

# On the Meaning of “Patented Invention”

By James W. Dabney<sup>1</sup>

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## On the Meaning of “Patented Invention”: Tab 1

Statement of the Case.

that plaintiff, by riding in the stock car while the train was in motion, was guilty of contributory negligence, or even to go to the jury on that point. The real question was whether the train was actually in motion when the injury was received, and, if there was any error at all in submitting that question to the jury, it was not one of which the defendant was entitled to complain.

There was no error in the action of the Court of Appeals, and its judgment is, therefore,

*Affirmed.*

MR. JUSTICE WHITE dissented.

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WESTINGHOUSE v. BOYDEN POWER BRAKE  
COMPANY.

BOYDEN POWER BRAKE COMPANY v. WEST-  
INGHOUSE.

CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE FOURTH  
CIRCUIT.

Nos. 116, 99. Argued March 10, 11, 1898. — Decided May 9, 1898.

The Boyden device for a fluid-pressure break is not an infringement of patent No. 360,070 issued to George Westinghouse, Jr., March 29, 1887, for a fluid-pressure automatic-brake mechanism.

THIS was a writ of certiorari to review a decree of the Circuit Court of Appeals, reversing a decree of the Circuit Court for the District of Maryland, which had sustained, in part, a bill filed by Westinghouse against the Boyden Power Brake Company for the infringement of patent No. 360,070, and from which decree both parties had taken an appeal to the Circuit Court of Appeals.

The patent in suit, which was issued March 29, 1887, to George Westinghouse, Jr., is for a fluid-pressure automatic-brake mechanism, the object of which is said in the speci-

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fication to be "to enable the application of brake-shoes to car-wheels by fluid pressure to be effected with greater rapidity and effectiveness than heretofore, more particularly in trains of considerable length, as well as to economize compressed air in the operation of braking, by utilizing in the brake-cylinders the greater portion of the volume of air which in former practice was directly discharged into the atmosphere."

"To this end my invention, generally stated, consists in a novel combination of a brake-pipe, an auxiliary reservoir, a brake-cylinder and a 'triple-valve' device, governing, primarily, communication between the auxiliary reservoir and the brake-cylinder, and, secondarily, communication directly from the brake-pipe to the brake-cylinder."

There follows here a description of the Westinghouse automatic brake as theretofore used, its mode of operation, and the defects or insufficiencies which attended its application to long trains, in the following language:

"In the application of the Westinghouse automatic brake as heretofore and at present commonly in use, each car is provided with a main air-pipe, an auxiliary reservoir, a brake-cylinder and a triple-valve, the triple-valve having three connections, to wit, one to the main air-brake pipe, one to the auxiliary reservoir and one to the brake-cylinder. The main air-pipe has a stop-cock at or near each of its ends, to be opened or closed as required, and is fitted with flexible connections and couplings for connecting the pipes from car to car of a train, so as to form a continuous line for the transmission of compressed air from a main reservoir supplied by an air-pump on the engine. When the brakes are off or released, but in readiness for action upon the wheels of the train, the air which fills the main reservoir and main air-pipes has a pressure of from sixty-five to seventy-five pounds to the square inch, and by reason of the connections referred to the same pressure is exerted in the casings of the triple-valves on both sides of their pistons and in the auxiliary reservoirs connected therewith. At the same time passages called 'release-ports' are open from the brake-cylinders to the atmosphere. When it is desired to apply the brakes, air is

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allowed to escape from the main air-pipes through the engineer's valve, thereby reducing the pressure in the main air-pipes, whereupon the then higher pressure in the auxiliary reservoirs moves the pistons of the triple-valves, so as to first close the passages from the triple-valves to the brake-pipe and at the same time close the release-ports of all the brake-cylinders, and then open the passages from the auxiliary reservoirs to the brake-cylinders, the pistons of which are forced out by the compressed air thereby admitted to the brake-cylinders, applying the brakes by means of suitable levers and connections, all of which mechanism is fully shown in various letters patent granted to me."

"The application of the brakes with their full force has heretofore required a discharge of air from the main pipe sufficient to reduce the pressure in said pipe below that remaining in the auxiliary reservoir after the brakes have been fully applied, and it has been found that, while the brakes are sufficiently quick in action on comparatively short trains, their action on long trains of from thirty to fifty cars, which are common in freight service under present practice, is in a measure slow, particularly by reason of the fact that all the air required to be discharged from the main pipe to set the brakes must travel from the rear of the train to a single discharge opening on the engine. This discharge of air at the engine has not only involved a serious loss of time in braking, but also a waste of air. Under my present invention a quicker and more efficient action of the brakes is obtained, and air which has been heretofore wasted in the application of the brakes is almost wholly utilized to act upon the brake-pistons."

After a detailed description of the invention, an important feature of which is a triple-valve, (hereinafter more fully explained in the opinion,) with references to the accompanying drawings, the specification proceeds to state that, "so far as the performance of its preliminary function in ordinary braking is concerned—that is to say, effecting the closure of communication between the main-air pipe and the auxiliary reservoir, and the opening of communication between the aux-

## Statement of the Case.

iliary reservoir and the brake-cylinder in applying the brakes, and the reverse operations in releasing the brakes—the triple-valve 10 accords substantially with that set forth in letters patent of the United States No. 220,556, granted and issued to me October 14, 1879, and is not, therefore, saving as to the structural features by which it performs the further function of effecting the direct admission of air from the main air-pipe to the brake-cylinder, as presently to be described, claimed as of my present invention. Certain of its elements devised and employed by me prior thereto will, however, be herein specified, in order to render its construction and operative relation to other members of the brake mechanism fully intelligible.”

After a further reference to the drawings he again states that “so far as hereinbefore described, the triple-valve accords in all substantial particulars with and is adapted to operate similarly to those of my letters patent Nos. 168,359, 172,064 and 220,556, and, in order that it may perform the further functions requisite in the practice of my present invention, it is provided with certain additional members, which will now be described.” These additional members, which are said to be for the purpose of effecting the admission of air directly from the main air-pipe to the brake-cylinder when it is desired to apply the brakes with great rapidity and full force, consist of (1) a passageway through which air can be admitted directly from the main air (or train) pipe to the brake-cylinder, without passing through the auxiliary reservoir; and, (2) an auxiliary valve in connection with such passage, that, when the triple-valve piston makes a short or preliminary movement, the passageway direct from the train-pipe to brake-cylinder, controlled by said valve, will not be opened, while, in the event of a long or full movement of the piston, or “further traverse,” as it is called, such direct passageway will be thrown wide open to the admission of train-pipe air, and the brake-cylinder will be rapidly filled thereby.

After describing the auxiliary sliding valve 41 and its connections, as well as the operation of the device in ordinary (non-emergency) cases of checking the speed of or stopping trains, already fully provided for in previous patents, he pro-

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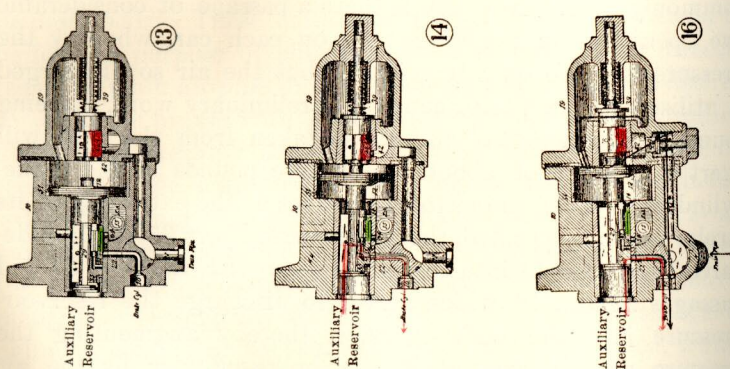
ceeds to state its operation in cases of emergency which the patent was specially designed to cover, as follows:

“In the event, however, of its becoming necessary to apply the brakes with great rapidity and with their greatest available force, the engineer, by means of the valve at his command, instantly discharges sufficient air from the front end of the main air-pipe to effect a sudden reduction of pressure of about twenty pounds per square inch therein, whereupon the piston 12 of the triple-valve is forced to the extreme limit of its stroke in the direction of the drain-cup 19, carrying with it the stem 36 and auxiliary slide-valve 41, which instantly uncovers the port 42 and discharges air from the main air-pipe through the opening of the check-valve 49 and the passages 46 and 48 to the brake-cylinder, and, each car being provided with one of these devices, it will be seen that they are successively moved with great rapidity, there being practically on a train of fifty cars fifty openings for discharging compressed air from the main pipe instead of the single opening heretofore commonly used. Not only is there a passage of considerable size opened from the brake-pipe on each car, whereby the pressure is more quickly reduced, but the air so discharged is utilized in the performance of preliminary work, it being found in practice that the air so taken from the pipe will exert a pressure of about twenty-five pounds in the brake-cylinders. When the piston 12 arrives at the extremity of its stroke as above specified, the supplemental port 35 of the slide-valve 14 is brought into communication with the port 33 and passages 22 and 16, which serves to discharge the reservoir-pressure into the brake-cylinder, thereby augmenting the pressure already exerted in the brake-cylinder by the air admitted from the main air-pipe. Upon the reduction of the pressure in the main air-pipe below that in the brake-cylinders, as by the breaking in two of the train, the check-valve 49 closes communication between the passages 46 and 18, thereby preventing the return of the air from the brake-cylinder to the main air-pipe. The feed-opening for the admission of air from the auxiliary reservoir to the brake-cylinder is purposely made of comparatively small diameter, it having been determined

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by experiment that the initial application of the brakes should not be made with maximum force, and this opening may be made of such size as to apply the brakes exactly in accord with the requirements of the most efficient work."

"In using the terms 'triple-valve' and 'triple-valve device' I refer to a valve device, however specifically constructed, having a connection with the main air or brake-pipe, another with an auxiliary reservoir or chamber for the storage of power, and another with a brake-cylinder or its equivalent for the utilization of the stored power, and with a release or discharge passage for releasing the operative power from the brake-cylinder, whether the valves governing these passages or connections are arranged in one or more cases and are moved by a piston or its equivalent or by a series of pistons or their equivalents, there being numerous examples in the art of constructions varying materially in appearance whereby these functions are performed, both in plenum and vacuum brake mechanisms."



The above drawings are somewhat clearer than those annexed to the patent, and exhibit the triple-valve and its connections in three positions, viz., No. 13, Released or "Brakes Off;" No. 14, Ordinary Service Application, and No. 16, "Quick Action" Position.

The only claims of the patent alleged to have been infringed are the first, second and fourth, which read as follows:

"1. In a brake mechanism, the combination of a main air-

pipe, an auxiliary reservoir, a triple-valve device, and an auxiliary-valve device, the triple-valve and independent of admitting air in the application of the main air-pipe to the brake cylinder."

"2. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, and a piston having a piston rod extending through the auxiliary reservoir to the brake-cylinder, the piston rod further traverse admits air directly into the brake-cylinder, substantially as set forth."

"4. The combination, in a triple-valve mechanism, of a piston fixed upon a stem in a valve chest, a valve moving with the piston, and a valve stem therein, a valve moving with the piston, the valve stem and ports and passages in the case leading to an auxiliary reservoir and a brake-cylinder, respectively, and an auxiliary valve stem and controlling communication to connections with a main air-pipe, respectively, substantially as set forth."

The joint and several answer of the defendants and the individual defendants admitted that they were engaged in manufacturing and selling the triple-valve, but denied that the same was an infringement of the plaintiffs' patent, and also denied that they were the original inventors of the mechanism. The plaintiffs alleged that an apparatus, substantially similar to that claimed, had been previously granted Westinghouse (No. 124,404,) and that a like apparatus was described in the following patents issued to Westinghouse: No. 138,827, May 13, 1873; No. 168,359, October 5, 1875; No. 220,556, October 14, 1879, and others.

The answer further denied any infringement of the fourth and fifth claims of the patent, and, with respect to the second claim,



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pipe, an auxiliary reservoir, a brake-cylinder, a triple-valve and an auxiliary-valve device, actuated by the piston of the triple-valve and independent of the main valve thereof, for admitting air in the application of the brake directly from the main air-pipe to the brake cylinder, substantially as set forth."

"2. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, and a triple-valve having a piston whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder, substantially as set forth."

"4. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a stem and working in a chamber therein, a valve moving with the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, and an auxiliary valve actuated by the piston-stem and controlling communication between passages leading to connections with a main air-pipe and with the brake-cylinder, respectively, substantially as set forth."

The joint and several answer of the Boyden Brake Company and the individual defendants admitted that such company was engaged in manufacturing and selling a fluid-pressure brake, but denied that the same was an infringement upon complainants' patent, and also denied that Westinghouse was the original inventor of the mechanism covered by the patent, and alleged that an apparatus, substantially identical in character, had been previously granted Westinghouse, March 5, 1872, (No. 124,404,) and that a like apparatus was previously described in the following patents issued to Westinghouse, viz.: No. 138,827, May 13, 1873; No. 144,006, October 28, 1873; No. 168,359, October 5, 1875; No. 172,064, January 11, 1876; No. 220,556, October 14, 1879, and also in three patents to other parties, not necessary here to be specifically mentioned.

The answer further denied any infringement of the first, fourth and fifth claims of the patent sued upon, (No. 360,070,) and, with respect to the second claim, averred the same to be

Counsel for Westinghouse.

invalid because the combination of parts therein named is inoperative to perform and incapable of performing the function set forth in said claim; and that, if the said claim be considered merely as the combination of parts therein set forth, and without reference to the function described as performed by it, it is invalid for the reason that the same combination of parts is shown in most of the prior patents above cited, and has been publicly used by the complainants for a long time prior to the date of the said letters patent No. 360,070.

The answer further averred the claim to be uncertain and ambiguous, and if the functions recited by it are construed as amplifying the description of the combination to distinguish this combination from that shown in the prior patents, "then the defendants say that the said claim is anticipated by the prior letters patent issued to George A. Boyden on June 26, 1883, for the reason that air-brake valves made in accordance with the last mentioned patent embody the same combination of parts, and will perform the same functions, and operate in substantially the same manner as stated in said second claim."

Upon a hearing in the Circuit Court upon the pleadings and proofs, that court was of opinion that the second claim was valid, and had been infringed, but that defendants had not infringed claims one and four, and as to those the bill was dismissed. 66 Fed. Rep. 997. From the decree entered in pursuance of this opinion both parties appealed to the Court of Appeals for the Fourth Circuit, which affirmed the action of the Circuit Court with respect to the first and fourth claims, but reversed it with respect to the second claim, and dismissed the bill. 25 U. S. App. 475. Whereupon complainants applied for and were granted a writ of certiorari.

Full copies of the principal Westinghouse patents are printed in *Westinghouse Brake Co. v. N. Y. Brake Co.*, 26 U. S. App. 248, and of the Boyden patents in the report of this case in 25 U. S. App. 475.

*Mr. George H. Christy* and *Mr. Frederic H. Betts* for Westinghouse. *Mr. J. Snowden Bell* and *Mr. Bernard Carter* were on their brief.

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*Mr. Philip Mauro* and *Mr. Lysander Hill* for the Boyden Power Brake Company. *Mr. Hector T. Fenton*, *Mr. Melville Church* and *Mr. Anthony Pollok* were on their brief.

MR. JUSTICE BROWN, after stating the case, delivered the opinion of the court.

The history of arresting the speed of railway trains by the application of compressed air is one to which the records of the Patent Office bear frequent witness, of a gradual progress from rude and imperfect beginnings, step by step, to a final consummation, which, in respect to this invention, had not been reached when the patent in suit was taken out, and which, it is quite possible, has not been reached to this day. It is not disputed that the most important steps in this direction have been taken by Westinghouse himself.

The original substitution of the air-brake for the old hand-brake was itself almost a revolution, but the main difficulty seems to have arisen in the subsequent extension of that system to long trains of freight cars, in securing a simultaneous application of brakes to each of perhaps forty or fifty cars in such a train, and finally in bringing about the instantaneous as well as simultaneous application of such brakes in cases of emergency, when the speediest possible stoppage of the train is desired to avoid a catastrophe.

Patent No. 88,929, issued April 13, 1869, appears to have been the earliest of the Westinghouse series. This brake, known as the *straight-air brake*, consisted of an air-compressing pump, operated by steam from the locomotive boiler, by which air was compressed into a reservoir, located under the locomotive, to a pressure of about eighty pounds to the square inch. This reservoir, being still in use, is now known as the main reservoir. From this reservoir an air-pipe, usually called the train-pipe, led into the cab, where the supply of air was regulated by an "engineer's valve," thence down and back under the tender and cars, being united between the cars by a flexible hose with metal couplings, rendering the train-pipe continuous. These couplings were automatically

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detachable; that is, while they kept their grip upon each other under the ordinary strains incident to the running of the train, they would readily pull apart under unusual strains, as when the car coupling broke and the train pulled in two.

From the train-pipe of each car, a branch pipe connected with the forward end of a cylinder, called the "brake-cylinder," which contained a piston, the stem of which was connected with the brake levers of the car. This piston was moved, and the brakes applied, by means of compressed air admitted through the train-pipe and its branches, into the forward end of the brake-cylinder. When the brakes were to be applied, the engineer opened his valve, admitted the compressed air into the train-pipes and brake-cylinders, whereby the levers were operated and the brakes applied. To release the brakes, he reversed the valve, whereby the compressed air escaped from the brake-cylinders, flowed forward along the train-pipe to the escape port of the engineer's valve, thence into the atmosphere. Upon the release of the compressed air, the pistons of the brake-cylinders were forced forward again by means of springs, and the brake-shoes removed from the wheels. By means of this apparatus, the train might be wholly stopped or slowed down by a full or partial application of the brakes. As between a full stop and a partial stop, or slow speed, there was only a question of the amount of air to be released from the main reservoir. The validity of this patent was sustained by the Circuit Court for the Northern District of Ohio, Mr. Justice Swayne and Judge Welker sitting, in *Westinghouse v. The Air Brake Company*, 9 Official Gazette, 538. The court said, in its opinion, that while Westinghouse was not the first to conceive the idea of operating railway brakes by air pressure, such fact did not detract at all from his merits or rights as a successful inventor; that the new elements introduced by him "fully substantiated his pretensions as an original and meritorious inventor, and entitled him as such to the amplest protection of the law;" and that it appeared from the record and briefs that he was the first to put an air-brake into successful actual use.

While the application of this brake to short trains was

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reasonably successful, the time required for the air to pass from the locomotive to the rear cars of a long train (about one second per car) rendered it impossible to stop the train with the requisite celerity, since in a train of ten cars it would be ten seconds before the brakes could be applied to the rear car, and to a freight train of fifty cars nearly a minute. While the speed of the foremost car would be checked at once, those in the rear would proceed at unabated speed, and in their sudden contact with the forward cars would produce such shocks as to often cause damage. As a train moving at the rate of fifty miles an hour makes over seventy feet per second, a train of fifty cars would run half a mile before the brakes could be applied to the rear car. So, too, if the rear end of the train became detached from the forward end by the rupture of the train-pipe or couplings, the brakes could not be applied at all, since the compressed air admitted to the train-pipe by opening the engineer's valve would escape into the atmosphere without operating the brakes, or if the brakes were already applied, they would be instantly released when such rupture occurred.

The first step taken toward the removal of these defects resulted in what is known as "the *automatic brake*," described first in patent No. 124,404 in a crude form, and, after several improvements, finally culminating in patent No. 220,556 of 1880. The salient features of this brake were an auxiliary reservoir beneath each car for the reception and storage of compressed air from the main reservoir, and a triple-valve, so called, automatically controlling the flow of compressed air in three directions, by opening and closing, at the proper times, three ports or valve openings, viz.: 1. A port or valve known as the "feeding-in valve" from the train-pipe to the auxiliary reservoir, allowing the auxiliary reservoir to fill so as to be ready when the brakes were applied; 2. A port or valve from the auxiliary reservoir to the brake-cylinder, which allowed a flow of compressed air to apply the brakes, and was called the "main valve;" 3. A port or valve from the brake-cylinder to the open air, denominated the "release-valve," to be opened when it was desired to release the brakes.

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The operation of these valves was as follows: Before the train starts, compressed air from the main reservoir is permitted to flow back through the train-pipe, and through valve No. 1, for the purpose of charging the auxiliary reservoir beneath each car with a full working pressure of air. When it is desired to apply the brakes, the engineer's valve is shifted, and the air in the train-pipe is allowed to escape into the atmosphere at the engine. Thereupon the compressed air in the auxiliary reservoir closes valve No. 1, leading to the train-pipe, and opens the main valve No. 2, from the auxiliary reservoir to the brake-cylinder, whereby the piston of that cylinder operates upon the brake-levers and applies the brakes. By this use of the auxiliary reservoirs a practically simultaneous application of the brakes is secured for each car. This application of the brakes is secured, not by direct application of compressed air from the engine through the train-pipe, but by a reverse action, whereby the air is allowed to escape from the train-pipe toward the engine, the pressure being applied by the air escaping from the auxiliary reservoirs. It also results that, if a train should pull in two, or a car become detached, the same escape of air occurs, the same action takes place automatically at the broken part, and the same result follows by the escape of the compressed air through the separated couplings. When it is desired to release the brakes, the engineer's valve is again shifted, and the compressed air not only opens valve No. 1 from the train-pipe to the auxiliary reservoir, but valve No. 3 from the brake-cylinder to the open air, which allows the air from the brake-cylinder to escape and thus release the brake.

From this description it will be seen that the action of the automatic brake was, in fact, the converse of that of the straight air-brake, and that the result was to obviate the most serious defects which had attended the employment of the former.

This automatic brake appears, in its perfected form, in patent No. 220,556, although this patent was but the culmination of a series of experiments, each successive step in which appears in the prior patents. Thus in patent No. 124,404, (1872,)

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is introduced the auxiliary reservoir beneath each car in connection with a double line of brake-pipes and a single cock with suitable ports for charging the reservoir and for operating the brakes — a device which was obviously the foundation of the triple-valve which first made its appearance in patent No. 141,685, (1873,) in which the main valve, which admitted air from the auxiliary reservoir to the brake-cylinder, was of the poppet form; and as a poppet-valve can govern only one port, separate valves had to be provided for feeding in the air from the train-pipe to the auxiliary reservoir, and for discharging the air from the brake-cylinder to release the brakes. In subsequent patents, No. 144,006, (1873,) and No. 163,242, (issued in 1875 to C. H. Perkins and assigned to Westinghouse,) Mr. Westinghouse improved upon his prior devices by substituting a sliding-piston valve for the poppet form of main valve previously used by him. This enabled the piston to perform the feed-valve function of admitting air from the train-pipe to the auxiliary reservoir; the main-valve function of admitting air from the auxiliary reservoir to the brake-cylinder to apply the brakes, and the release-valve function of discharging the air from the cylinder to release the brakes. In patent No. 168,359, (1875,) a piston actuating a slide-valve was substituted for the piston-valve, and, after a series of experiments, which did not seem to have been successful, he introduced into patent No. 217,838 the idea of venting the train-pipe, not only at the locomotive, but also under each car, in order to quicken the application of the brakes. Prior to this time, “when the engineer desired to apply his brakes with full force he operated the valve at the engine and opened the port wide, letting the compressed air out of the train-pipe at the locomotive, then its only vent. The air, as before said, had to travel from the rear cars along the cars forward to the engine before it could lessen the pressure of the train-pipe air, . . . and before the brake-cylinder could be operated with air from the auxiliary reservoirs. In a train of fifty cars it would have to travel nearly half a mile to get out at the engine.” He embodied in patent No. 220,556, (1879,) the most complete form of the automatic brake, and as stated by the

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court below, "the ordinary work of braking was performed by a partial traverse of its chamber by the triple-valve piston, graduated according to the purpose desired, at the will of the engineer, and emergency work was done by an extreme traverse of the piston to the end of its chamber."

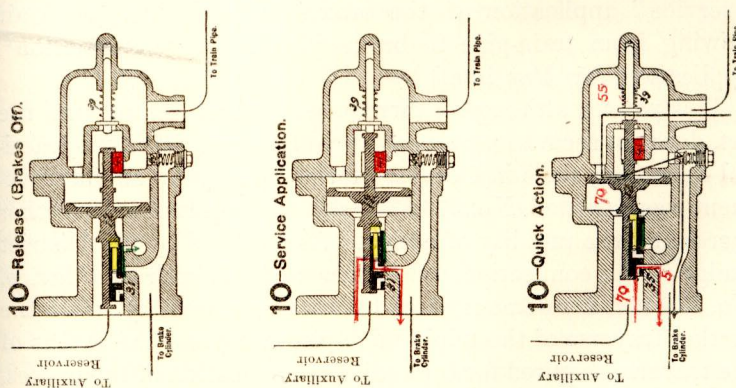
While the automatic brake had thus obviated the most important defects of the old or straight air-brake, and come into general use upon passenger trains throughout the country, it was found, in practice upon long freight trains, that the air from the auxiliary reservoirs did not act with sufficient promptness upon the brakes of the rear cars, where a particularly speedy action was required, and that it would be necessary to devise some other means for cases of special emergency. In the business of transporting freight over long distances, the tendency has been in the direction of increasing the load by using stronger and heavier cars and larger locomotives. Upon a long train of this kind, composed of thirty to fifty cars, a demand was made for quicker action in cases of emergency than had yet been contemplated, although for ordinary work, such as checking the speed of a train while running, holding it at a slow speed on a down grade, and also for making the ordinary station stops, the automatic brake was still sufficient, and produced satisfactory results even in the equipment of long and heavy trains. But however effective for ordinary purposes, the automatic brake did not sufficiently provide for certain emergencies, requiring prompt action, and, therefore, failed in a single important particular.

Upon examination of these defects it was found that they could only be remedied by securing, (1) in cases of emergency, a more abundant discharge of compressed air into the brake-cylinder; and (2) an escape of air near to each triple-valve without requiring the escaping air to travel all the way back to the engine. The latter device having been already embodied in patent No. 217,838, these features Mr. Westinghouse introduced into the patent in suit, by which a passage was opened directly from the train-pipe filled from the main reservoir on the engine, to the brake-cylinder through which, in cases of emergency, the train-pipe air, instead of being dis-



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charged into the atmosphere, could pour directly from the train-pipe into the brake-cylinder. This operation resulted in charging the brake-cylinder and applying the brakes more quickly than before, and also, by reason of the fact that the filling of the brake-cylinder from the train-pipe on one car made what was, in effect, a local vent for the release of pressure sufficient to operate the valve on the next car behind, each successive valve operated more quickly than when a diminution of pressure was caused by an escape of air only at the locomotive. The direct passage of the air from the train-pipe to the brake-cylinder was effected by a valve (41), colored red in the above diagrams, which is never opened except in cases of emergency. In ordinary cases, when the brakes are desired to be applied, sufficient air is released from the train-pipe to open the passage from the auxiliary reservoir to the brake-cylinder by what is called a preliminary traverse of the piston (12), but when a quick action is required sufficient air is drawn from the train-pipe, not only to open this passage, but by a further traverse of the piston, to shove valve 41 off its port, and introduce air directly from the train-pipe to the brake-cylinder, as shown in the following drawings.



In the foregoing skeleton drawings, from which all details of construction, and all figures of reference, not necessary for a clear understanding of the structure, are omitted, the

TERM, 1897.

the Court.

rk of braking was performed  
ber by the triple-valve piston,  
pose desired, at the will of the  
was done by an extreme trav-  
its chamber."

ad thus obviated the most im-  
aight air-brake, and come into  
ns throughout the country, it  
g freight trains, that the air  
did not act with sufficient  
the rear cars, where a par-  
quired, and that it would be  
r means for cases of special  
transporting freight over long  
in the direction of increasing  
heavier cars and larger loco-  
this kind, composed of thirty  
le for quicker action in cases  
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essential parts are colored, so that their changes of position in the different stages of action can be easily followed.

The access of train-pipe air is shown located at the right end of the structure, instead of the left, (as in the patent drawings,) simply for greater clearness. Its course from the train-pipe to the auxiliary cylinder is through the small port above the upper arm of the piston 12.

The "main valve" of the triple is *black*. Its office is to admit auxiliary reservoir air to brake-cylinder.

The "quick-action" valve is colored *red*. Its office is to admit *train-pipe air* to brake-cylinder.

The release port is colored *green*. Its office is to discharge air from brake-cylinder, in releasing the brakes.

There is also shown in *yellow* what is known as the graduating valve, the function of which will be hereafter explained. As at present used, the triple-valve is in reality a quadruple-valve.

The flow or movement of air, in the several positions of the structure is also shown by colored lines and arrows, viz. :

Air released from brake-cylinder to open air by *green* arrow.

Air flowing from auxiliary reservoir to brake-cylinder, in "service" application of the brakes, by *red* line. And air flowing from train-pipe to brake-cylinder in "quick-action" application, by *blue* line.

This patent, although it introduced a novel feature into the art, does not seem to have been entirely successful in its practical operation, since in October of the same year an improvement was patented, No. 376,837, with the object of still further increasing the rapidity of action. As observed by the District Judge in this connection, "the success of this improved device, No. 376,837, has demonstrated that the invention, by which the further traverse of the triple-valve piston beyond the extent of the traverse required for the ordinary application of the brakes, is made to admit a large volume of train-pipe air directly to the brake-cylinder, was one of great importance. The proofs show that a quick-action automatic brake, which would give the results which this brake has accomplished, was eagerly

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sought after by inventors and car builders, and all had failed until Westinghouse discovered that it could be done by this mode of operation.”

We are now in position to take up the several claims of the patent in suit, and their defences thereto. It may be stated generally that the position of complainants in this connection is, that the novel feature of this patent, in respect to which they are entitled to be protected, is the opening of a passage directly from the train-pipe to the brake-cylinder, without passing through the auxiliary reservoir and without reference to the means by which such passageway is controlled. Defendant's theory is that they are limited to such passageway when governed by the auxiliary valve 41, a device which, although of no utility as arranged in the patent in suit, became afterwards exceedingly useful when further combined with the supplementary piston shown in patent No. 376,837. The further inference is that, as they do not use the auxiliary valve of this patent, they cannot be held liable as infringers.

Complainants' case must rest either upon the theory that the admission of compressed air directly from the train-pipe to the brake-cylinder is patentable as a function, or that the means employed by the defendants for that purpose are a mechanical equivalent for the auxiliary valve 41, described in the patent.

1. The first theory is based upon the second claim, which is “in a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder and a triple-valve having a piston, whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder, substantially as set forth.”

In the construction of this claim, the District Judge was of opinion that it was broad enough to cover other devices in which air was admitted directly from the train-pipe to the brake-cylinder by the further traverse of the piston actuating a valve admitting such air, and that the defendants could not exculpate themselves from the charge of infringement, from the fact that in their device the train-pipe air was admitted

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through the triple-valve chamber, and not through a by-passage, nor by the fact that in their device the further traverse of the piston opens the main valve in a special manner, which produces the same result, but does not make use of a separate auxiliary valve.

Upon the other hand, the Circuit Court of Appeals held that "the transmission of train-pipe air and auxiliary reservoir air simultaneously to the brake-cylinder is a result of [or] function, and is not patentable;" that "the means by which this or any other result or function is accomplished may be many and various, and if these several means are not mechanical equivalents, each of them is patentable." It was of opinion that when the second claim, "in its language describing the action of that device, failed to describe any means by which the extreme traverse of the piston produced it, declaring merely that the piston, 'by a further traverse, admits air directly from the main air-pipe to the brake-cylinder,' it was fatally defective, claiming only a result which is public property, and not identifying the specific means (his own property) by which the result is achieved."

It is true, as observed by the Court of Appeals, that the further traverse of the piston for use in cases of emergency had been shown in prior patents, but it had never been employed for the purpose of admitting air directly from the main air-pipe to the brake-cylinder until the patent in suit was taken out.

The claim in question is, to a certain extent, for a function, viz., the admission of air directly from the train-pipe to the brake-cylinder, and is only limited to such function when performed by the further traverse of the piston of the triple-valve. This limitation, however, does not obviate the objection that the means are not fully and specifically set forth for the performance of the function in question.

The difficulty we have found with this claim is this: That, if it be interpreted simply as a claim for the function of admitting air to the brake-cylinder directly from the train-pipe, it is open to the objection, held in several cases to be fatal, that the mere function of a machine cannot be patented.

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This rule was clearly laid down in the leading case of *Corn- ing v. Burden*, 15 How. 252, in which Mr. Justice Grier, delivering the opinion of the court, drew the distinction between such processes as were the result or effect of "chemical action, by the operation or application of some element or power of nature, or of one substance to another," and the mere result of the operation of a machine, with regard to which he says:

"It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect that a patent is granted, and not for the result or effect itself. It is when the term 'process' is used to represent the means or method of producing a result that it is patentable, and it will include all methods or means which are not effected by mechanism or mechanical combinations.

"But the term 'process' is often used in a more vague sense, in which it cannot be the subject of a patent. Thus we say that a board is undergoing the process of being planed, grain of being ground, iron of being hammered or rolled. Here the term is used subjectively or passively as applied to the material operated on, and not to the method or mode of producing that operation, which is by mechanical means, or the use of a machine, as distinguished from a process."

"In this use of the term it represents the function of a machine, or the effect produced by it on the material subjected to the action of the machine. But it is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it."

In the subsequent case of *Burr v. Duryee*, 1 Wall. 531, 570, Mr. Justice Grier laid down the same principle as follows:

"The patent act grants a monopoly 'to any one who may have discovered or invented any new and useful art, machine, manufacture or composition of matter.' . . . The law requires that the specification 'should set forth the principle and the several modes in which he has contemplated the application of that principle, or character by which it may be distinguished from other inventions, and shall particularly point out the part, improvement or combination which he claims as

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his own invention or discovery.' We find here no authority to grant a patent for a 'principle' or 'a mode of operation,' or an *idea*, or any other abstraction. A machine is a concrete thing, consisting of parts, or of certain devices and combination of devices. The principle of a machine is properly defined to be its mode of operation, or that peculiar combination of devices which distinguishes it from other machines. A machine is not a principle or an idea. The use of ill defined abstract phraseology is the frequent source of error. It requires no great ingenuity to mystify a subject by the use of abstract terms of indefinite or equivocal meaning. Because the law requires a patentee to explain the mode of operation of his peculiar machine, which distinguishes it from others, it does not authorize a patent for 'a mode of operation as exhibited in the machine.' Much less can any inference be drawn from the statute, that an inventor who has made an improvement in a machine, and thus effects the desired result in a better or cheaper manner than before can include all previous inventions and have a claim to the whole art, discovery or machine which he has improved. All others have an equal right to make improved machines, provided they do not embody the same, or substantially the same devices, or combination of devices, which constitute the peculiar characteristics of the previous invention."

So also in *Fuller v. Yentzer*, 94 U. S. 288, this court, speaking through Mr. Justice Clifford, said:

"Patents for a machine will not be sustained if the claim is for a result, the established rule being that the invention, if any, within the meaning of the Patent Act, consists in the means or apparatus by which the result is obtained, and not merely in the mode of operation independent of the mechanical devices employed; nor will a patent be held valid for a principle or for an idea, or any other mere abstraction."

Most of the prior authorities upon this subject are reviewed in the recent case of *Risdon Locomotive Works v. Medart*, 158 U. S. 68, in which it was also held that a valid patent could not be obtained for a process which involved nothing more than the operation of a piece of mechanism, or the func-

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tion of a machine. See also to the same effect *Wicke v. Ostrum*, 103 U. S. 461, 469. These cases assume, although they do not expressly decide, that a process to be patentable must involve a chemical or other similar elemental action, and it may be still regarded as an open question whether the patentability of processes extends beyond this class of inventions. Where the process is simply the function or operative effect of a machine, the above cases are conclusive against its patentability; but where it is one which, though ordinarily and most successfully performed by machinery, may also be performed by simple manipulation, such, for instance, as the folding of paper in a peculiar way for the manufacture of paper bags, or a new method of weaving a hammock, there are cases to the effect that such a process is patentable, though none of the powers of nature be invoked to aid in producing the result. *Eastern Paper Bag Co. v. Standard Paper Bag Co.*, 30 Fed. Rep. 63; *Union Paper Bag Machine Co. v. Waterbury*, 39 Fed. Rep. 389; *Travers v. Am. Cordage Co.*, 64 Fed. Rep. 771. This case, however, does not call for an expression of our opinion upon this point, nor even upon the question whether the function of admitting air directly from the train-pipe to the brake-cylinder be patentable or not, since there is no claim made for an independent process in this patent, and the whole theory of the specification and claims is based upon the novelty of the mechanism.

But if the second claim be not susceptible of the interpretation that it is simply for a function, then the performance of that function must be limited to the particular means described in the specification for the admission of air from the train-pipe to the brake-cylinder. This we understand to be the theory of the defendants, and this raises the same question which is raised under the first and fourth claims, whether defendants' device contains the auxiliary valve of the Westinghouse patent, or its mechanical equivalent.

In this view, it becomes unnecessary to express an opinion whether the second claim be valid or not, since in the aspect of the case most favorable to the complainants, it is necessary to read into it something which is not found there, or, in the

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language of complainants' brief, "to refer back to the specification; not, it is true, for a slavish adoption of the identical instrumentalities therein described, but for the understanding of the essential and substantial features of the means therein illustrated." In thus reading the specification into the claim, we can adopt no other construction than to consider it as if the auxiliary valve were inserted in the claim in so many words, and then to inquire whether the defendants make use of such valve, or its mechanical equivalent.

There are two other facts which have a strong bearing in the same connection, and preclude the idea that this can be interpreted as a claim for a function, without reading into it the particular device described in the specification.

One of these is that the claim is for a triple-valve device, etc., for admitting air from the main air-pipe to the brake-cylinder, "substantially as set forth." These words have been uniformly held by us to import into the claim the particulars of the specification, or, as was said in *Seymour v. Osborne*, 11 Wall. 516, 547, "where the claim immediately follows the description of the invention, it may be construed in connection with the explanations contained in the specifications, and where it contains words referring back to the specifications, it cannot be properly construed in any other way." In that case it was held that a claim which might otherwise be bad, as covering a function or result, when containing the words "substantially as described," should be construed in connection with the specification, and when so construed was held to be valid. To the same effect is *The Corn Planter Patent*, 23 Wall. 181, 218.

Again, it appears from the file-wrapper and contents, that in his original application Mr. Westinghouse made a broad claim for the admission of air directly from the main air-pipe to the brake-cylinder, which was rejected upon reference to a prior patent to Boyden, No. 280,285, and that on January 19, 1887, his attorney wrote the Patent Office in the following terms:

"It is respectfully submitted that while the Boyden patent No. 280,285 referred to, shows that what the inventor terms



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'an always-open one-way passage,' by which communication may be established under certain conditions, between the main air-pipe or train-pipe, and hence might be held to meet the terms of the claim as originally broadly drawn, yet it fails to embody a device which in structure or function corresponds with the auxiliary valve of applicant, which in no sense relates to 'an always-open one-way passage.' This amended claim, above submitted, prescribes a valve device actuated by the piston of the triple-valve for admitting air to the brake-cylinder in the application of the brake, while Boyden's check-valve *d* is not actuated by the piston, and is designed to recharge the auxiliary reservoir and brake-cylinder while the brakes are on. It is submitted, as to claim 2, that a piston, which by its preliminary traverse, admits air from the auxiliary reservoir to the brake-cylinder and by its further traverse admits air directly from the main air-pipe to the brake-cylinder, as set forth in said claim, is not found in the Boyden patent, the check-valve *d* of which is described as actuated by the manipulation of the cock *g* on the locomotive to 'recharge and continue charging the reservoir and brake-cylinder while the brakes are applied.' . . . It is to be understood that applicant *does not seek to broadly claim a device for admitting air directly from the main air-pipe to the brake-cylinder*, as the four-way cock long heretofore employed by him (similar to the cock *K* of the Boyden patent) would be a structure of such character. When, however, the triple-valve is provided with an *auxiliary valve, operated by its piston which performs a new function* additional to that of the triple-valve as previously employed, it is believed that such *combination* is wholly novel."

So, too, in the specification it is stated:

"So far as the performance of its preliminary function in ordinary braking is concerned — that is to say, effecting the closure of communication between the main air-pipe and the auxiliary reservoir, and the opening of communication between the auxiliary reservoir and the brake-cylinder in applying the brakes, and the reverse operations in releasing the brakes — the triple-valve 10 accords substantially with that set forth in letters patent of the United States No. 220,556, granted and

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issued to me October 14, 1879, and is not, therefore, saving as to the *structural features* by which it performs the further function of effecting the direct admission of air from the main air-pipe to the brake-cylinder, as presently to be described, claimed as of my present invention.”

Apparently, too, in consequence of the above letter of January 19, 1887, the patentee erased from his original specification the following sentence: “Further, while in the specific construction described and shown, the function of admitting air from the main pipe is performed by a valve separate from that which effects the preliminary admission of reservoir pressure to the cylinder, a modification in which the same office is performed by a valve integral with the main valve and formed by an extension thereof, would be included in and embody the essential operative features of my invention,” and inserted in its place the following: “I am aware that a construction in which ‘an always-open one-way passage’ from the main air-pipe to the brake-cylinder is uncovered by the piston of the triple-valve simultaneously with the opening of the passage from the auxiliary reservoir to the brake-cylinder, has been heretofore proposed, and such construction, which involves an operation different from that of my invention, I therefore hereby disclaim.”

We agree with the defendant that this correspondence, and the specification as so amended, should be construed as reading the auxiliary valve into the claim, and as repelling the idea that this claim should be construed as one for a method or process. Language more explicit upon this subject could hardly have been employed.

While it is true that no claim is formally made for the admission of train-pipe air directly to the brake-cylinder as a method or process, a construction is given by the complainants and the Circuit Court to the second claim which eliminates the mechanical features described, and one which could only be supported upon the theory that the claim was for a method or process. If the mechanism described by Westinghouse, and particularly the auxiliary valve, be not essential to the validity of the second claim, then it could only be supported

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upon the theory that it was for the process of admitting train-pipe air directly to the brake-cylinder.

2. The first and fourth claims of this patent are as follows :

“ 1. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple-valve and an auxiliary valve device, actuated by the piston of the triple-valve and independent of the main valve thereof, for admitting air in the application of the brake directly from the main air-pipe to the brake-cylinder, substantially as set forth.”

“ 4. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a stem and working in a chamber therein, a valve moving with the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, and an auxiliary valve actuated by the piston-stem and controlling communication between passages leading to connections with a main air-pipe and with the brake-cylinder, respectively, substantially as set forth.”

These two claims are practically little more than different expressions of one and the same invention. In both of them there is a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple-valve and piston, described in the fourth claim as “fixed upon a stem and working in a chamber” in a case or chest, and an auxiliary valve; and in the fourth claim also a case or chest, which contains the whole device and is immaterial.

In both of these claims an auxiliary valve is named as an element. In the first it is described as “actuated by the piston of the triple-valve and independent of the main valve thereof;” and in the fourth as “actuated by the piston-stem and controlling communication between passages leading to connections with the main air-pipe and with the brake-cylinder.”

To what liberality of construction these claims are entitled depends to a certain extent upon the character of the invention, and whether it is what is termed in ordinary parlance a “pioneer.” This word, although used somewhat loosely, is commonly understood to denote a patent covering a function

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never before performed, a wholly novel device, or one of such novelty and importance as to mark a distinct step in the progress of the art, as distinguished from a mere improvement or perfection of what had gone before. Most conspicuous examples of such patents are: The one to Howe of the sewing machine; to Morse of the electrical telegraph; and to Bell of the telephone. The record in this case would indicate that the same honorable appellation might be safely bestowed upon the original air-brake of Westinghouse, and perhaps also upon his automatic brake. In view of the fact that the invention in this case was never put into successful operation, and was to a limited extent anticipated by the Boyden patent of 1883, it is perhaps an unwarrantable extension of the term to speak of it as a "pioneer," although the principle involved subsequently and through improvements upon this invention became one of great value to the public. The fact that this invention was first in the line of those which resulted in placing it within the power of an engineer, running a long train, to stop in about half the time and half the distance within which any similar train had stopped, is certainly deserving of recognition, and entitles the patent to a liberality of construction which would not be accorded to an ordinary improvement upon prior devices. At the same time, as hereinafter observed, this liberality must be exercised in subordination to the general principle above stated: that the function of a machine cannot be patented, and, hence, that the fact that the defendants' machine performs the same function is not conclusive that it is an infringement.

The device made use of by the defendants is exhibited in patents No. 481,134 and No. 481,135, both dated August 16, 1892, and both of which were granted after the commencement of this suit. There are two forms of this patent, one of which, illustrated in patent No. 481,135, is here given on the opposite page in its three positions of release (20), service application (21), and quick action (22).

In this device there is found a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple, or rather a quadruple, valve and piston (29) with three ports; first, for the admission

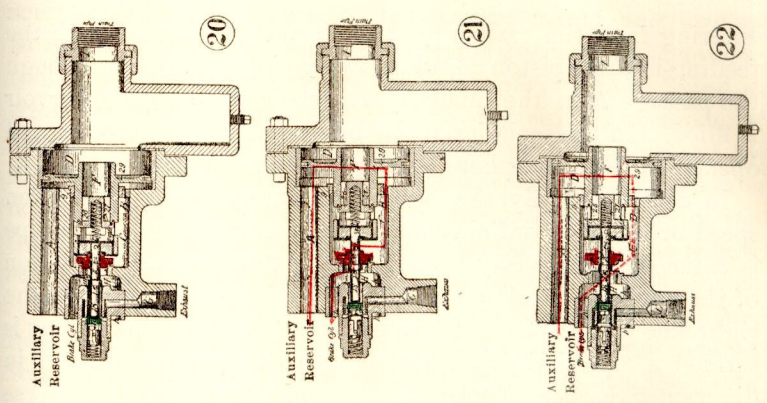
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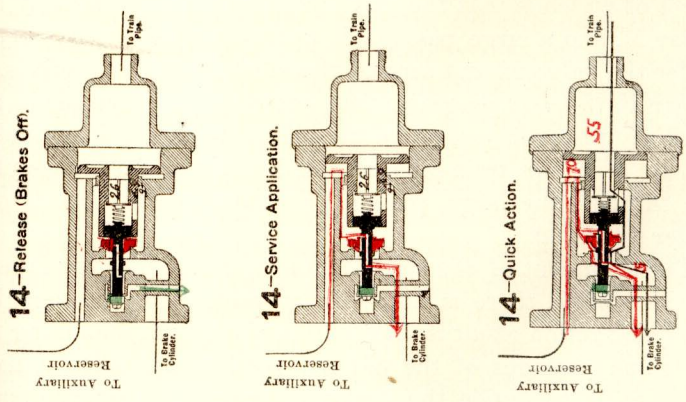
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of air from the train-pipe to the brake-cylinder through the feeding-in valve 26; second, for the passage of air from the auxiliary reservoir to the brake-cylinder through the apertures *i, j, k* in the stem slide-valve 18; and, third, for the release of air from the brake-cylinder to the exhaust port by means of valve 17, colored green. Whether this device has an auxiliary valve or not is one of the main questions in the case, complainants' theory being that poppet-valve 22 is an auxiliary valve, while defendants' claim is that it is in reality the main valve.



The operation of this device is best shown by the foregoing skeleton drawings.  
 The auxiliary reservoirs are charged by air under pressure,

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entering from the train-pipe, raising and passing through the feeding-in valve piston 26, and flowing slowly into and through the passage A to the auxiliary reservoir, until such reservoir is filled. In this condition the brake-cylinder is emptied and opened to the atmosphere through the exhaust passage G.

In order to apply the brakes gradually, so as to slacken speed or make an ordinary stop, air pressure in the train-pipe is reduced slightly (say from three to five pounds) by action of the engineer's valve, and the reduction of pressure on the right side of the piston 29 causes the piston to make what is termed a "preliminary traverse" to the position shown in diagram "Service Application." Such preliminary traverse pulls the stem slide-valve 18 to the right, and opens the apertures *i, j* and *k*, (one of these apertures being to the right and the other to the left of valve 22,) and through these apertures air rushes from the auxiliary reservoir to the brake-cylinder; but the poppet-valve 22 still remains upon its seat.

If quick action be required, the pressure in the train-pipe is suddenly lowered to the extent of fifteen or twenty pounds, and the travelling piston 29, instead of making a preliminary traverse to the intermediate position shown in the "Service Application," makes a full traverse to the extreme right, the effect of which is that the valve 22 is pulled off its seat by the collar M, and a large passage is opened to the brake-cylinder under the valve 22 and around the stem 18. The result is, as shown in the last diagram, that not only does the air in the auxiliary reservoir escape in full volume to the brake-cylinder, but air from the train-pipe rushes directly to the brake-cylinder through the large passage F into the chamber C and under valve 22.

The argument of the defendants in this connection is that, in this device, there is no auxiliary valve or by-passage, but the quick-action result is effected simply by proportioning the ports and passages of the old triple-valve, and using a fixed partition, 9, to divide the piston chamber D from the main-valve chamber C; that it is this partition which produces the quick action, and that such partition is not a valve, nor the mechanical equivalent of a valve, but merely a metal ring

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screwed immovably into the triple-valve casing, and serving to divide the piston-chamber from the main-valve chamber; that this partition was a new element, never before found in triple valves, and introduced a new principle and mode of operation, totally different from anything ever invented by Mr. Westinghouse or any other inventor, and that its effect is to make valve 22, termed by them the main valve, admit the train-pipe air to the brake-cylinder at the same time that it admits the auxiliary air thereto.

It is claimed that, in embodying this new principle, Mr. Boyden adopted the form of triple-valve shown in the expired Westinghouse patent No. 141,685, (1873,) in which the main valve, 22, is of the poppet form, and the separate valve 17, controlled by a rod sliding through the main valve, is employed for releasing the brakes. For charging the auxiliary reservoir he adopted, from the expired Westinghouse patent No. 144,006, (1873,) a check-valved feed passage through the triple-valve piston, but arranged the feed passage and its check-valve, 26, in a tubular extension, F, of the piston, and substantially in the form shown in Boyden patent No. 280,285, (1883). He also provided a sensitive graduating valve, similar in results to the graduating valve *e'* of the Westinghouse patent No. 220,556, (1879,) by so arranging a small passage, 40, in the sliding stem, which actuates the release valve, that such passage will be opened and closed by the sliding of such stem through the main valve 22. As thus constructed, the triple-valve operates much the same as that of patent No. 220,556, and, like the latter, is incapable of quick action.

In both the complainants' and defendants' devices there is (1) a feeding-in valve to charge the auxiliary reservoir; (2) a valve which complainants call their "main valve," and which the defendants denominate a "graduating valve," which is opened by the preliminary traverse of the piston to admit reservoir air to the brake-cylinder; (3) a release valve which discharges air from the brake-cylinder to the atmosphere; and (4) a quick-action valve — 41 in the complainants' patent, and 22 in the defendants' — which is opened by the further traverse of the piston to admit train-pipe air to the brake-

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cylinder. In defendants' patent, it may also be used to admit auxiliary reservoir air to the brake-cylinder.

One of the main controversies in the case turns upon the construction and operation of the poppet-valve 22, called by the defendants their "main-valve." Complainants insist that the office of *their* main valve is performed by the stem slide-valve 18 of defendants' patent, and by its apertures *i*, *j* and *k*, through which air passes from the auxiliary reservoir to the brake-cylinder, and that the poppet-valve 22 is only called into action in emergency cases, when a large quantity of air is suddenly withdrawn from the train-pipe, and the valve is unseated by the traverse of the piston to the extreme right.

There is no doubt that the function of admitting air from the auxiliary reservoir to the brake-cylinder, which is performed in the Westinghouse patent by what the complainants term the main-valve, (aided, however, by the graduating-valve,) is, in ordinary cases, performed principally, if not altogether, by the stem slide-valve 18 and its three ports *i*, *j*, *k*, of the Boyden patent, which defendants term their graduating-valve. It is equally clear that, in emergencies, where quick action is required, air, which in the Westinghouse patent passes through auxiliary valve 41, (opened by the further traverse of the piston,) in the Boyden patent finds its way through the poppet-valve 22, which has also been lifted from its seat by the further traverse of the piston.

One of the main differences between the two devices is this: That in the preliminary traverse of the piston of the Westinghouse patent, there is a movement, first, of the graduating-valve to open its port from the auxiliary reservoir, and then of the main valve, carrying the graduating-valve also with it, to open a passage to the brake-cylinder, while in the Boyden patent it is only the graduating-valve which is opened by the preliminary traverse of the piston. In doing this, the graduating-valve moves *through* the poppet-valve, but does not lift it from its seat. In emergency cases not only do the graduating-valve and the main-valve of the Westinghouse patent move as before, but, by the extreme traverse of the piston, the auxiliary-valve 41 is shoved from its seat, and a separate



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passage is opened for the air from the train-pipe to the brake-cylinder. In the Boyden patent, however, the extreme traverse of the piston lifts the poppet-valve from its seat, and opens a wide passage to the brake-cylinder, not only for the air from the auxiliary reservoir, but, through the peculiar operation of the partition 9 and its aperture B, directly from the train-pipe. As the graduating-valve of the Boyden patent practically does all the work in ordinary cases, and the poppet-valve is only called into action in emergency cases, the latter is practically an auxiliary valve, by which, we understand, not necessarily an independent valve, nor one of a particular construction, but simply a valve which in emergency cases is called into the assistance of the graduating-valve. In this particular, the poppet-valve of the Boyden device performs practically the same function as the slide-valve 41 of the Westinghouse. It is not material in this connection that it is a poppet-valve while the other is a slide-valve, since there is no invention in substituting one valve or spring of familiar shape for another; *Imhaeuser v. Buerk*, 101 U. S. 647, 656; nor, that in one case the piston *pushes* the valve off its seat, and in the other *pulls* it off; nor is it material that this poppet-valve may have been used in prior patents to perform the function of a main-valve, so long as it is used for a different purpose here. Indeed, this valve seems to have been taken bodily from Westinghouse patent No. 141,685, where it was used as a main-valve, and the stem-valve 18 with its ports *i*, *j*, *k*, added for ordinary uses, and the poppet-valve thus converted from a main-valve to an auxiliary valve.

We have not overlooked in this connection the argument that the poppet-valve 22 is also sometimes used for graduating purposes, but it is not commonly so used, and appears to be entirely unnecessary for that purpose. It seems to be possible to move the piston 29 to its extreme traverse so slowly, and hence to open valve 22 so gradually, that the pressure in the chamber C will be reduced so slightly, that the train-pipe air will not have sufficient force to throw open the check-valve 26, and hence, in such case no train-pipe air will be admitted directly to the brake-cylinder, which will be filled with auxil-

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inary reservoir air only. But, as a matter of fact, this seldom or never takes place in the practical operation of the device, and is an unnecessary and wholly unimportant incident, and for all practical purposes valve 22 is solely a quick-action valve. As this valve is actuated by the piston of the triple-valve, and in such action is independent of the main valve, it meets the demand of the first claim of the patent, and as it is actuated by the piston-stem, and controls communication between passages leading to connections with the main air-pipe and with the brake-cylinder, it seems also to be covered by the fourth claim.

But even if it be conceded that the Boyden device corresponds with the letter of the Westinghouse claims, that does not settle conclusively the question of infringement. We have repeatedly held that a charge of infringement is sometimes made out, though the letter of the claims be avoided. *Machine Co. v. Murphy*, 97 U. S. 120; *Ives v. Hamilton*, 92 U. S. 426, 431; *Morey v. Lockwood*, 8 Wall. 230; *Elizabeth v. Pavement Company*, 97 U. S. 126, 137; *Sessions v. Romadka*, 145 U. S. 29; *Hoyt v. Horne*, 145 U. S. 302. The converse is equally true. The patentee may bring the defendant within the letter of his claims, but if the latter has so far changed the principle of the device that the claims of the patent, literally construed, have ceased to represent his actual invention, he is as little subject to be adjudged an infringer as one who has violated the letter of a statute has to be convicted, when he has done nothing in conflict with its spirit and intent. "An infringement," says Mr. Justice Grier in *Burr v. Duryee*, 1 Wall. 531, 572, "involves substantial identity, whether that identity be described by the terms, 'same principle,' same '*modus operandi*,' or any other. . . . The argument used to show infringement assumes that every combination of devices in a machine which is used to produce the same effect, is necessarily an equivalent for any other combination used for the same purpose. This is a flagrant abuse of the term 'equivalent.'"

We have no desire to qualify the repeated expressions of this court to the effect that, where the invention is functional, and the defendant's device differs from that of the patentee

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only in form, or in a rearrangement of the same elements of a combination, he would be adjudged an infringer, even if, in certain particulars, his device be an improvement upon that of the patentee. But, after all, even if the patent for a machine be a pioneer, the alleged infringer must have done something more than reach the same result. He must have reached it by substantially the same or similar means, or the rule that the function of a machine cannot be patented is of no practical value. To say that the patentee of a pioneer invention for a new mechanism is entitled to every mechanical device which produces the same result is to hold, in other language, that he is entitled to patent his function. Mere variations of form may be disregarded, but the substance of the invention must be there. As was said in *Burr v. Duryee*, 1 Wall. 531, 573, an infringement "is a copy of the thing described in the specification of the patentee, either without variation, or with such variations as are consistent with its being in substance the same thing. If the invention of the patentee be a machine, it will be infringed by a machine which incorporates in its structure and operation the substance of the invention; that is, by an arrangement of mechanism which performs the same service or produces the same effect in the same way, or substantially the same way. . . . That two machines produce the same effect will not justify the assertion that they are substantially the same, or that the devices used are, therefore, mere equivalents for those of the other."

Not only is this sound as a general principle of law, but it is peculiarly appropriate to this case. Under the very terms of the first and fourth claims of the Westinghouse patent, the infringing device must not only contain an auxiliary valve, or its mechanical equivalent, but it must contain the elements of the combination "substantially as set forth." In other words, there must not only be an auxiliary valve, but substantially such a one as is described in the patent, *i.e.* independent of the triple-valve. Not only has the Boyden patent a poppet instead of a slide-valve — a matter of minor importance — but it performs a somewhat different function. In the Westinghouse patent the valve is not in the line of travel between the

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auxiliary reservoir and the brake-cylinder, and admits train-pipe air only. In the Boyden patent, it is in the line of travel, both from the auxiliary reservoir and from the train-pipe, and admits both currents of air to the brake-cylinder. The by-passage, to which the auxiliary reservoir is merely an adit, is wholly wanting in the Boyden device, both currents of air uniting in chamber C and passing to the brake-cylinder together, through the poppet-valve.

But a much more radical departure from the Westinghouse patent is found in the partition 9, separating the valve-chamber C from the piston-chamber D. This partition has an aperture, B, the capacity of which is less than that of the large passage A, and intermediate in size between that of the graduating passage 40, and that of the port covered by the valve 22. The office of this partition is thus explained by the defendants in their briefs: When the engineer's valve is thrown wide open, the poppet-valve is lifted from its seat by the extreme traverse of the piston, and a new action takes place. "The port of the main valve 22 is so much larger than the passage B, that the pressure in the main valve-chamber C is instantly emptied into the brake-cylinder, and, as the passage B cannot supply air so fast as the main-valve port can exhaust it, the pressure in the main valve-chamber suddenly drops to about five pounds. Meanwhile the passage A, leading from the auxiliary reservoir to the inner end of the piston-chamber, is so much larger than the passage B, leading from the piston-chamber to the main valve-chamber, that full reservoir pressure is maintained in the piston-chamber between the partition 9 and the inner side of the piston, thereby holding the piston back firmly at its extreme traverse. But the feed-valve 26 is now exposed on the one side to a train-pipe pressure of about fifty-five pounds, and on the other side to a main valve-chamber pressure of only about five pounds, and therefore valve 26 is instantly forced open by the greater train-pipe pressure, which then vents freely through the said feed valve-port into the main valve-chamber C where it commingles with the auxiliary reservoir air passing through said chamber, and both airs pass together through the port opened by the main valve 22

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to the brake-cylinder. The whole operation is substantially instantaneous, and the result is that the train-pipe is freely vented at each car, the time of serially or successively applying the brakes of the several cars from one end of the train to the other is reduced to a minimum, and the train is quickly stopped without shock, a result which Mr. Westinghouse did not attain with the device of patent No. 360,070, nor did he attain it until he had invented his later apparatus of patent No. 376,837, not here in suit."

In a word, this partition maintains upon the outside of valve 26 a much higher pressure than upon the inside, the effect of which is to open feed-valve 26 and admit a full volume of train-pipe air upon the brake-cylinder.

Conceding that the functions of the two devices are practically the same, the means used in accomplishing this function are so different that we find it impossible to say, even in favor of a primary patent, that they are mechanical equivalents. While the poppet-valve, which for the purposes of this case, we may term the auxiliary valve, is in its operation independent of the main valve, the word "independent" in the claims of the Westinghouse patent evidently refers to a valve auxiliary to the triple-valve, and independently located as well as operated. The difference is that in one case the air from the train-pipe is introduced into the brake-cylinder separately and independently from the air from the auxiliary reservoir; while in the other case they unite in the chamber C and pass through the same valve to the brake-cylinder. In the Westinghouse patent there is one valve operated by the direct thrust of the piston, opening a by-passage; in the other, there is a poppet-valve also opened by the piston, and another valve, 26, opened by the pressure maintained upon the outside of the partition 9.

It is claimed, however, by the complainants that Boyden was not the inventor of the differential pressure theory; that there is such a differential pressure in their own patent, caused by the fact that the air from the auxiliary reservoir in passing to the brake-cylinder travels through a restricted port, 35, and, as the entrance to the brake-cylinder is through a much larger port, the air is taken up by it much more rapidly than it is

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supplied by the restricted port, which reduces the pressure in the by-passage so much that when the quick-action valve 41 is opened, the pressure from the train-pipe air is sufficient to open the valve 49 and admit a full volume of train-pipe air, at a pressure of fifty-five pounds, to the brake-cylinder. The fact, however, that no suggestion is made in the patent of such a function of the restricted port 35, indicates either that none such had been discovered, or that it was not considered of sufficient importance to mention it. Indeed, it seems to have been an afterthought, suggested by the necessity of an answer to defendants' argument, based upon their partition 9. That when the auxiliary valve is opened there must be a difference in pressure above and below the check-valve 49, in order to open it, is manifest; yet, this is rather an incident to the Westinghouse device than the controlling feature that it is made in the Boyden patent. There is no partition in the proper sense of the word—certainly none located as in the Boyden device—between the chambers D and C, and no aperture in such partition opened for the express purpose of maintaining this differential pressure. If such differential pressure existed to the extent claimed in the Westinghouse patent, it certainly was not productive of the results flowing from the same device in the Boyden patent.

We are induced to look with more favor upon this device, not only because it is a novel one and a manifest departure from the principle of the Westinghouse patent, but because it solved at once in the simplest manner the problem of quick action, whereas the Westinghouse patent did not prove to be a success until certain additional members had been incorporated into it. The underlying distinction between the two devices is that in one, a separate valve and separate by-passage are provided for the train-pipe air, while in the other, the patentee has taken the old triple (or quadruple) valve, and by a slight change in the functions of two of its valves and the incorporation of a new element, (partition 9,) has made a more perfect brake than the one described in the Westinghouse patent. If credit be due to Mr. Westinghouse for having invented the function, Mr. Boyden has certainly exhibited

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great ingenuity in the discovery of a new and more perfect method of performing such function. If his patent be compared with the later Westinghouse patent No. 376,837, which appears to have been the first completely successful one, the difference between the two, both in form and principle, becomes still more apparent, and the greater simplicity of the Boyden patent certainly entitles it to a favorable consideration. If the method pursued by the patentee for the performance of the function discovered by him would naturally have suggested the device adopted by the defendants, that is in itself evidence of an intended infringement; but, although Mr. Boyden may have intended to accomplish the same results, the Westinghouse patent, if he had had it before him, would scarcely have suggested the method he adopted to accomplish these results. Under such circumstances, the law entitles him to the rights of an independent inventor.

Upon a careful consideration of the testimony we have come to the conclusion that the Boyden device is not an infringement of the complainants' patent, and the decree of the Circuit Court of Appeals is, therefore,

*Affirmed.*

MR. JUSTICE SHIRAS, with whom concurred MR. JUSTICE BREWER, dissenting.

I am unable to concur in the reasoning and conclusion of the court, and shall briefly state my views.

The history of the art discloses that the patent in suit was what is called a "pioneer invention." In it, for the first time, was brought to light a method or process which, by the co-operation of the air from the train-pipe with that from the car reservoir, created the "quick action" brake. The patent, in its specification and claims, clearly described a machine or mechanical combination whereby the invention was exemplified or rendered operative.

It is not an unwarrantable extension of the term to speak of this invention in suit as a pioneer, since it is practically conceded in this case, and justly observed by the court below,

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“one of the highest value to the public,” and conspicuously one “which entitles the proprietor to a liberal protection from the courts in construing the claim.” The very fact that this invention resulted in placing it within the power of an engineer, running a long train, to stop in about half the time and half the distance within which any similar train had been stopped, is certainly deserving of recognition. The claims of such patents have from time out of mind been allowed a liberal construction, and considered as entitled to the fullest benefit of the doctrine of mechanical equivalents.

It in nowise detracts from the merit of this invention that later devices have been adopted which render its practical operation more efficient. The very term, “pioneer patent,” signifies that the invention has been followed by others. A pioneer patent does not shut, but opens the door for subsequent invention.

The particular patent in suit was, as I understand it to be admitted, an entire success in supplying passenger trains and short freight trains with a “quick action” brake; but while it enabled even the longest freight trains to stop in half the time and half the distance previously occupied, there remained difficulties which required further devices to give to the invention the perfect success which it has now attained.

Being of the character so described as a pioneer, the patent in suit is entitled to a broad or liberal construction. In other words, the invention is not to be restricted narrowly to the mere details of the mechanism described as a means of carrying the invention into practicable operation.

I cannot assent to what is, perhaps, rather intimated than decided in the opinion of the court that what is called a “process in order to be patentable must involve a chemical or other similar elemental action.” The term “process” or “method,” as describing the subject of a patent, is not found in the statutes. No reason is given in the authorities, and I can think of none in the nature of things, why a new process or method may not be patentable, even though a mechanical device or a mechanical combination may be necessary to render the new process practicable. It seems to be used by the courts



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as descriptive of an invention which, from its novelty and priority in the art to which it belongs, is not to be construed as inhering only in the particular means described, in the letters patent, as sufficient to exemplify the invention and bring it into practical use.

Thus in the case of *Winans v. Dormead*, 15 How. 330, 341, the patent was for a new form of the body of a car for the transportation of coal, thus avoiding certain practical difficulties or disadvantages in such cars as previously made. To the argument on behalf of the infringer, that the claim of the patent was confined to a single form, and only through and by that form to the principle which it embodies, this court said, per Mr. Justice Curtis :

“It is generally true that when a patentee describes a machine, and then claims it as described, he is understood to intend to claim, and does by law actually cover, not only the precise form he has described, but all other forms which embody his invention ; it being a familiar rule that to copy the principle or mode of operation described is an infringement, although such copy should be totally unlike the original in form or proportions. . . . It is not sufficient to distinguish this case to say that here the invention consists in a change of form, and the patentee has claimed one form only. Patentable improvements in machinery are almost always made by changing some one or more forms of one or more parts, and thereby introducing some mechanical principle or mode of action not previously existing in the machine, and so securing a new or improved result. And in the numerous cases in which it has been held that to copy the patentee's mode of operation was an infringement, the infringer had got forms and proportions not described, and not in terms claimed. If it were not so, no question of infringement could arise. If the machine complained of were a copy, in form, of the machine described in the specification, of course, it would be at once seen to be an infringement. It could be nothing else. It is only ingenious diversities of form and proportion, presenting the appearance of something unlike the thing patented, which give rise to questions ; and the property of inventors would be valueless

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if it were enough for the defendant to say: Your improvement consisted in a change of form; you describe and claim but one form; I have not taken that, and so have not infringed.

“The answer is: My infringement did not consist in a change of form, but in the new employment of principles or powers, in a new mode of operation, embodied in a form by means of which a new or better result is produced; it was this which constituted my invention; this you have copied, changing only the form. . . . Where form and substance are inseparable it is enough to look at the form only. Where they are separable—where the whole substance of the invention may be copied in a different form, it is the duty of courts and juries to look through the form for the substance of the invention—for that which entitled the inventor to his patent, and which the patent was designed to secure; where that is found there is an infringement; and it is not a defence that it is embodied in a form not described and in terms claimed by the patentee. Patentees sometimes add to their claims an express declaration to the effect that the claim extends to the thing patented, however its form or proportions may be varied. But this is unnecessary. The law so interprets the claim without the addition of these words.”

*McCormick v. Talcott*, 20 How. 402, 405, was also a case of a mechanical patent, and it was said by Mr. Justice Grier, who delivered the opinion of the court: If the patentee “be the original inventor of the device or machine, called the divider, he will have a right to treat as infringers all who make dividers operating on the same principle and performing the same functions by analogous means or equivalent combination, even though the infringing machine may be an improvement of the original and patentable as such.”

In *Morley Sewing Machine Co. v. Lancaster*, 129 U. S. 263, there was also a question of an alleged invention of a primary character, and wherein the invention was embodied in a mechanical combination; and it was held that, in a pioneer patent, such as that of Morley, the patentee, the special devices set forth by Morley were not necessary constituents

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of the claims; that his patent was to receive a liberal construction, in view of the fact that he was a pioneer in the construction of an automatic button sewing machine, and that his patent was not to be limited to the particular devices or instrumentalities described by him.

In that case extended and approving reference was made to the case of *Proctor v. Bennis*, 36 Ch. Div. 740, which was a case of an invention embodied in a mechanical contrivance, and the following language of Lord Justice Bowen was quoted:

“Now I think it goes to the root of this case to remember that this is, as was described by one of the counsel, really a pioneer invention, and it is by the light of that, as it seems to me, that we ought to consider the question whether there have been variations, or omissions, and additions, which prevent the machine which is complained of from being an infringement of the plaintiff's. . . . With regard to the additions and omissions, it is obvious that additions may be an improvement, and that omissions may be an improvement, but the mere fact that there is an addition, or the mere fact that there is an omission, does not enable you to take the substance of the plaintiff's patent. The question is not whether the addition is material, or whether the omission is material, but whether what has been taken is the substance and essence of the invention.”

These were cases wherein the discovery or invention was made effective through machines or mechanical combinations, and wherein it was held that the merit of the process or method was not to be confined, in the case of a pioneer patent, to the mere form described in the specification as sufficient to make the invention practically operative.

*Neilson's patent*, Web. P. C. 275, was a noted case, in which the true distinction was drawn between a mere principle, as the subject of a patent, and a process by which a principle is applied to effect a new and useful result. The Court of Exchequer, in answering the objection that Neilson's patent was for a principle, said:

“It is very difficult to distinguish it from the specification

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of a patent for a principle, and this at first created in the minds of some of the court much difficulty; but after full consideration, we think the plaintiff does not merely claim a principle, but a machine embodying a principle, and a very valuable one. We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it by a mechanical apparatus to furnaces; and his invention consists in this — by interposing a receptacle for heated air between the blowing apparatus and the furnace. In this receptacle he directs the air to be heated by the application of heat externally to the receptacle, and thus he accomplishes the object of applying the blast, which was before of cold air, in a heated state to the furnace.”

And when the case came before the House of Lords, Lord Campbell said:

“After the construction first put upon the patent by the learned judges of the Exchequer, . . . I think the patent must be taken to extend to all machines, of whatever construction, whereby the air is heated intermediately between the blowing apparatus and the blast furnace. That being so, the learned judge was perfectly justified in telling the jury that it was unnecessary for them to compare one apparatus with another, because, confessedly, that system of conduit pipes was a mode of heating air by an intermediate vessel between the blowing apparatus and the blast furnace, and, therefore, it was an infringement of the patent.” Web. Pat. Cas. 715.

Very applicable to the present case is the doctrine of *Tilghman v. Procter*, 102 U. S. 707. It was there held, overruling the case of *Mitchell v. Tilghman*, 19 Wall. 287, that a patent may be validly granted for carrying a principle into effect; and if the patentee suggests and discovers not only the principle, but suggests and invents how it may be applied to a practical result by mechanical contrivances and apparatus, and shows that he is aware that no particular sort or modification of form of apparatus is essential to obtain benefit from the principle, then he may take his patent for the mode

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of carrying it into effect, and is not under the necessity of confining himself to one form of apparatus.

Having discussed the previous cases, particularly that of *Neilson* and of *O'Reilly v. Morse*, 15 How. 62, Mr. Justice Bradley said:

“Whoever discovers that a certain useful result will be produced in any art by the use of certain means is entitled to a patent for it, provided he specifies the means.’ But everything turns on the force and meaning of the word ‘means.’ It is very certain that the means need not be a machine, or an apparatus; it may, as the court says, be a process. A machine is a thing. A process is an act, or a mode of acting. The one is visible to the eye — an object of perpetual observation. The other is a conception of the mind, seen only by its effects when being executed or performed. Either may be the means of producing a useful result. . . . Perhaps the process is susceptible of being applied in many modes and by the use of many forms of apparatus. The inventor is not bound to describe them all in order to secure to himself the exclusive right to the process, if he is really its inventor or discoverer. But he must describe some particular mode, or some apparatus, by which the process can be applied with at least some beneficial result, in order to show that it is capable of being exhibited and performed in actual experience.”

*The Telephone cases*, 126 U. S. 1, 532, 533, 535, contain an apt illustration of these principles. Mr. Chief Justice Waite in discussing the case, said:

“In this art, or, what is the same thing under the patent law, this process, this way of transmitting speech, electricity, one of the forces of nature, is employed; but electricity, left to itself, will not do what is wanted. The art consists in so controlling the force as to make it accomplish the purpose. It had long been believed that if the vibrations of air caused by the voice in speaking could be reproduced at a distance by means of electricity, the speech itself would be reproduced and understood. How to do it was the question. Bell discovered that it could be done by gradually changing the intensity of a continuous electric current, so as to make it

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correspond exactly to the changes in the density of the air caused by the sound of the voice. This was his art. He then devised a way in which these changes of density could be made and speech actually transmitted. Thus his art was put in a condition for practical use. In doing this, both discovery and invention, in the popular sense of those terms, were involved; discovery in finding the art, and invention in devising the means of making it useful. For such discoveries and such inventions the law has given the discoverer and inventor the right to a patent—as discoverer, for the useful art, process, method of doing a thing he has found; and as inventor, for the means he has devised to make the discovery one of actual value. . . . The patent for the art does not necessarily involve a patent for the particular means employed for using it. Indeed, the mention of any means, in the specification or descriptive portion of the patent, is only necessary to show that the art can be used; for it is only useful arts—arts which may be used to advantage—that can be made the subject of a patent. The language of the statute is that ‘any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter,’ may obtain a patent therefor. Rev. Stat. § 4886. Thus, an art—a process—which is useful, is as much the subject of a patent, as a machine, manufacture or composition of matter. . . . But it is insisted that the claim cannot be sustained, because when the patent was issued Bell had not in fact completed his discovery. While it is conceded that he was acting on the right principles, and had adopted the true theory, it is claimed that the discovery lacked that practical development which was necessary to make it patentable. In the language of counsel, ‘there was still work to be done, and work calling for the exercise of the utmost ingenuity, and calling for the very highest degree of practical invention.’ It is quite true that when Bell applied for his patent he had never actually transmitted telegraphically spoken words so that they could be distinctly heard and understood at the receiving end of his line, but in his specification he did describe, accurately and with admirable clearness, his process, that is to say, the

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exact electrical condition that must be created to accomplish his purpose, and he also described with sufficient precision to enable one of ordinary skill in such matters to make a form of apparatus which, if used in the way pointed out, would produce the required effect, receive the words, and carry them to and deliver them at the appointed place. The particular instrument which he had and which he used in his experiments did not, under the circumstances in which it was tried, reproduce the words spoken so that they could be clearly understood, but the proof is abundant and of the most convincing character that other instruments, carefully constructed and made exactly in accordance with the specification, without any additions whatever, have operated and will operate successfully. . . . The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation. . . . Surely a patent for such a discovery is not to be confined to the mere means he improvised to prove the reality of his conception.”

The conclusion justified by the authorities is that whether you call Westinghouse’s discovery, that “quick action” may be accomplished by the coöperation of the main pipe air and that from the car reservoir, a process, or a mode of operation, yet if he was the first to disclose it and to describe a mechanical means to give practical effect to the invention, he must be regarded as a pioneer inventor, and as entitled to protection against those who, availing themselves of the discovery, seek to justify themselves by pointing to mere differences in form in the mechanical devices used.

Much stress was laid in the argument on an alleged disclaimer by the patentee while the application was pending in the Patent Office, whereby it is said Westinghouse must be understood to have abandoned the second claim, or, at any rate, to have consented that that claim should be interpreted

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by the courts as if it contained an auxiliary valve as a material element in the claim.

There are cases, no doubt, in which it has been held that when a claimant has, under objection in the Patent Office, withdrawn certain claims, or has modified them by adding or striking out terms or phrases, and accepts a patent which does not grant the abandoned or unmodified claims, he cannot be heard to insist upon such a construction of the allowed claims as would cover what had been previously rejected. *Shepard v. Carrigan*, 116 U. S. 593; *Roemer v. Peddie*, 132 U. S. 313; *Corbin Cabinet Lock Co. v. Eagle Lock Co.*, 150 U. S. 38.

An examination of the cited cases, however, will disclose, as I think, that they turned upon matters of construction. In other words, were cases where it was questionable what the patent, as actually granted, meant. In such cases, as in other cases of ambiguity, it may be allowable to consult the application and file wrapper, and possibly written communications, which may throw light upon claims that are ambiguous or capable of different constructions.

But where the claims allowed are not uncertain or ambiguous, the courts should be slow to permit their construction of a patent, actually granted and delivered, to be affected or controlled by alleged interlocutions between the officers in the Patent Office and the claimant. No doubt, in proceedings to revoke or cancel a patent granted by inadvertence or by fraudulent representations, it would be competent to show what had taken place in the Patent Office pending the application. But when we consider that often the employes in the Patent Office are inexperienced persons, and that the mass of the business is so vast that it is impossible for the Commissioner or the Chief Examiner to review it, except in a perfunctory way, it can be readily seen how dangerous it would be to modify or invalidate a patent, clear and definite in its terms, by resorting to such uncertain sources of information.

However this may be, I do not perceive that the matters alleged in the present case are entitled to any weight in the construction of the patent. Even if the letter of the claimant's attorney, written on January-19, 1887, can be looked to



Dissenting Opinion: Shiras, Brewer, JJ.

as helping us to understand the meaning of a patent granted on March 29, 1887, it only appears to be an argument as to the meaning or legal effect of the language used in the claims, and does not amount to a withdrawal or modification of them.

Accordingly the second claim of the patent is before us for construction on its own terms, and, to avoid protracting this discussion, the opinion of Judge Morris in the Circuit Court is referred to and adopted as a sound construction of that claim. 66 Fed. Rep. 997. This claim is not, as I read it, open to the objection that it aims to patent a principle. It sets forth the discovery that by a coöperation of the air from the auxiliary reservoir and that from the main air-pipe, the action of the brakes is quickened and the air vented from the main air-pipe directly to the brake-cylinder.

But, even if the second claim must, as argued in the opinion of the court, be read, by reason of the letter of the claimant's attorney, as if it called for the auxiliary valve described in the first and fourth claims, and even if, when not so read, it can be regarded as void because simply for a function or principle, nevertheless the invention, as described in the other claims and specifications, is clearly set forth, and, under the evidence as to the state of the art, is entitled to be regarded as a pioneer. Regarding the second claim as a mere statement of the idea or invention and the other claims as describing a form or combination of mechanism which embodies the invention and renders it operative, all the requisites of the law are sufficiently complied with.

The only remaining question is that of the infringement, and that is readily disposed of. For it is conceded in the opinion of the majority of the court that, if the patent in suit is entitled to a broad construction as a pioneer, embodying a new mode of operation, not limited to the particular means described in the specification, then the defendant's device is an adoption of the idea or principle of the Westinghouse patent with a mechanical equivalent or substitute for the auxiliary valve.

Upon the whole I am of the opinion that the decree of the

Opinion of the Court.

Circuit Court of Appeals should be reversed and that the cause should be remanded with directions to restore the decree of the Circuit Court.

MR. JUSTICE GRAY and MR. JUSTICE MCKENNA also dissented from the opinion and from the decision of the court.

---

FINK *v.* UNITED STATES.

CERTIFICATE FROM THE CIRCUIT COURT OF APPEALS FOR THE  
SECOND CIRCUIT.

No. 120. Argued April 23, 1893. — Decided May 23, 1893.

Muriate of cocaine is properly dutiable under paragraph 74 of the tariff act of October 1, 1890, and not under paragraph 76 of that act.

THE case is stated in the opinion.

*Mr. Albert Comstock* for appellants.

*Mr. Assistant Attorney General Hoyt* for appellees.

MR. JUSTICE WHITE delivered the opinion of the court.

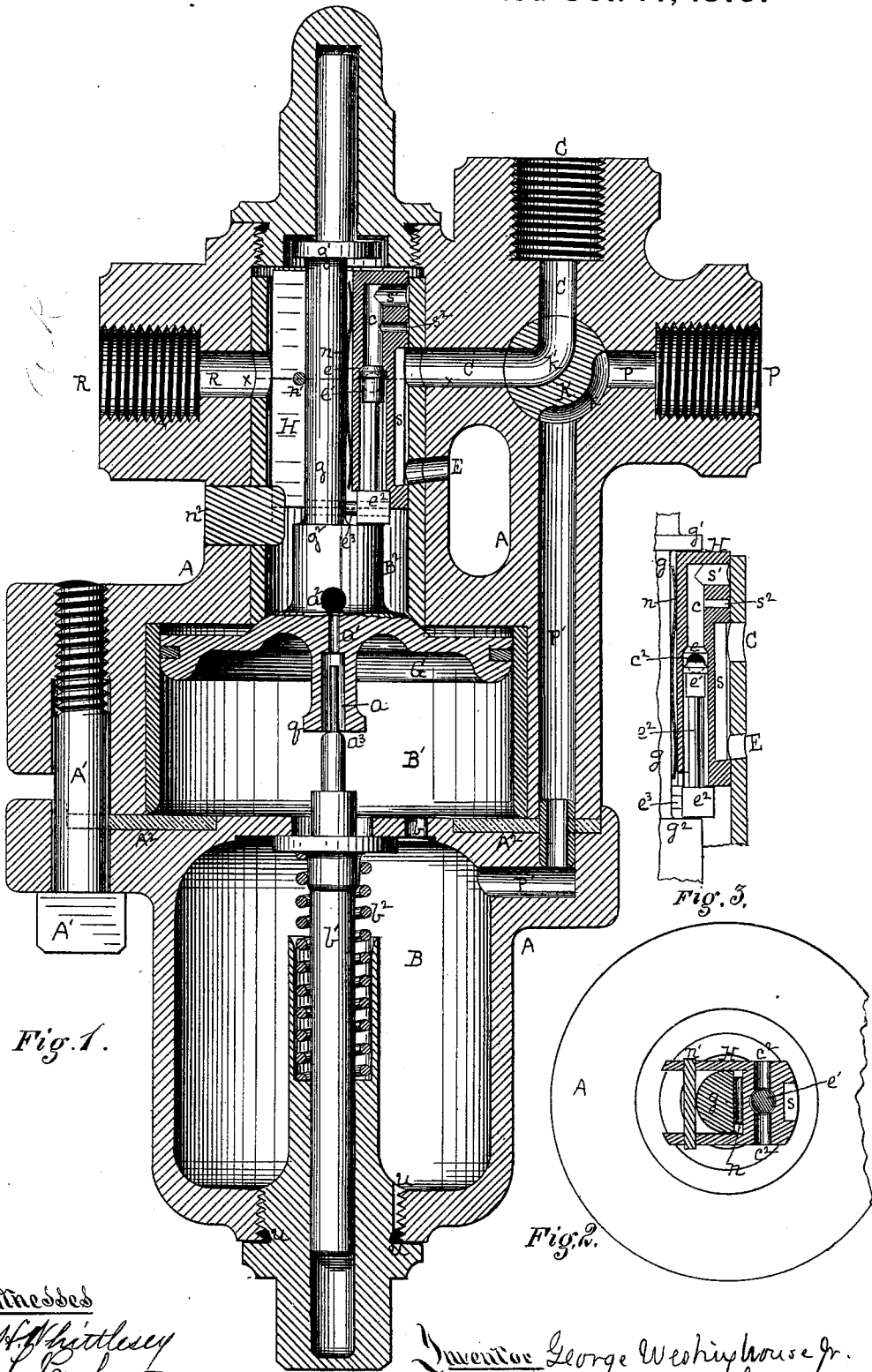
This record presents for consideration certain questions of law certified to this court by the Court of Appeals for the Second Circuit. The certificate and questions therein stated are as follows:

“A judgment or decree of the Circuit Court of the United States for the Southern District of New York having been made and entered February 4, 1895, by which it was ordered, adjudged and decreed that there was no error in certain proceedings herein before the board of United States general appraisers, and that their decisions herein be, and the same are hereby, in all things affirmed, and an appeal having been taken from said judgment or decree to this court by the above-named appellants, and the cause having come on for



## On the Meaning of “Patented Invention”: Tab 2

G. WESTINGHOUSE, Jr.  
Regulating-Valve for Automatic-Brakes.  
No. 220,556. Patented Oct. 14, 1879.



*Witnesses*  
*R. N. Whittlesey*  
*O. L. Parker*

*Inventor* George Westinghouse Jr.  
*By Attorney* George H. Christy

G. WESTINGHOUSE, Jr.  
Regulating-Valve for Automatic-Brakes.  
No. 220,556.      Patented Oct. 14, 1879.

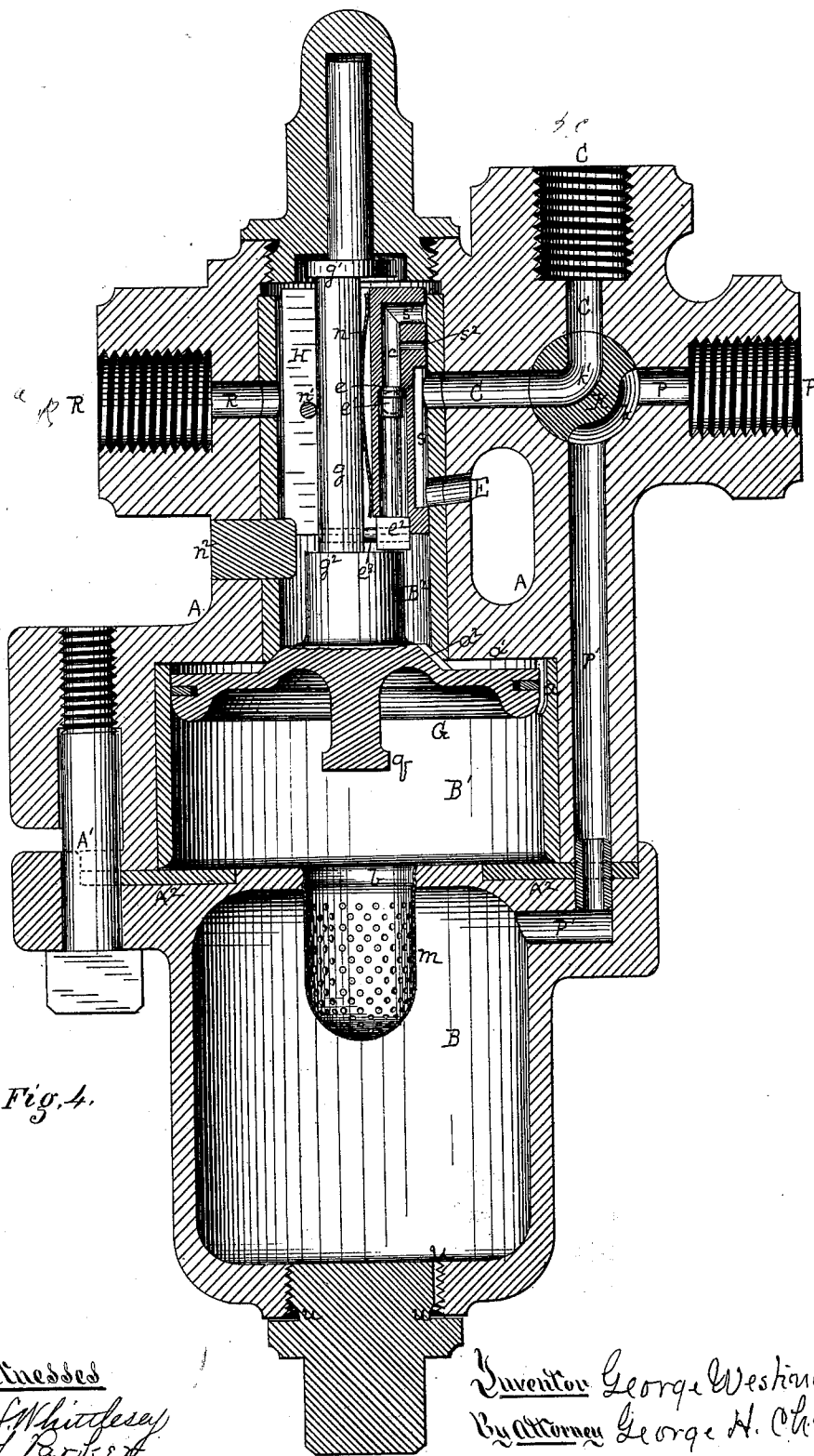


Fig. 4.

*Witnessed*  
*R. N. Whitelsey*  
*Chas. Parker*

*Inventor* George Westinghouse, Jr.  
*By Attorney* George H. Christy

# UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN REGULATING-VALVES FOR AUTOMATIC BRAKES.

Specification forming part of Letters Patent No. **220,556**, dated October 14, 1879; application filed September 17, 1879.

*To all whom it may concern:*

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Regulating-Valves for Automatic Brakes; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a vertical sectional view of the triple-valve device illustrative of my improvements. Fig. 2 is a transverse horizontal section in the line *xx* of Fig. 1. Fig. 3 is a detached sectional view of the slide and auxiliary valves, valve-seats, and stems, as shown in Fig. 1, but with the auxiliary valve in a different position; and Fig. 4, Sheet 2, by a view similar to Fig. 1, illustrates some modified features of construction.

In the class of fluid-pressure brakes for railway-trains commonly known in this country as "automatic brakes," a device usually termed a "triple valve" is extensively used. This device, in two of the many forms in which it has been patented, is shown and described in United States Patents granted to me October 5, 1875, No. 168,359, and January 11, 1876, No. 172,064, as well as in various other earlier and later patents.

It is important in such device that the valve (lettered H in said two patents and herein) which governs the flow of air or other fluid shall move not only with great certainty to any desired position, but also shall move with slight variations of pressure on the piston, (lettered G,) so that the application of the brakes with any desired power, and their ready release, may be quickly and easily effected at the pleasure of the engineer.

To this end I combine with the said valve H, giving it a slight range of motion on its stem, an auxiliary valve operated by the same stem, in such manner that a portion of the functions performed in said patents by the valve H may now be performed by such auxiliary valve, the latter moving with practically no resistance, and hence moving more quickly and with less pressure than the valve H itself. The same auxiliary valve is also de-

signed for use, under certain circumstances, as a leakage-valve. In the drawings I have shown it as applied to or embodied in a triple valve having the graduating-stem and spring of said patents, and also as used without them. The former will be first described with reference to Figs. 1 to 3.

A represents the valve-case, made preferably in two parts, united by the necessary number of screw-bolts  $A^1$ , with interposed packing  $A^2$ .

B is a drip-chamber;  $B^1$ , the cylinder in which the piston G is operated, and  $B^2$  is an upper chamber, through which the fluid passes under pressure to the auxiliary reservoir by the port R, or to the brake-cylinder by the port C. It is also a valve-chamber for the slide-valve H, which is secured on the stem, in any suitable way, by a pin,  $n^1$ , going through the back U-shaped wings of the valve, and is held to its seat by any suitable spring, as at  $n$ , and rotation on the stem is prevented by a stud,  $n^2$ .

A cock, K, with ports  $k k'$ , is arranged in the line of fluid-pressure communication, substantially as represented, and for purposes which will be understood by reference to said patents.

From the port P connection is made with the brake-pipe, and from the port C with the cylinders. With the devices in the position shown in Fig. 1 the brake apparatus is in the normal condition for the running of the train. The fluid-pressure then enters the port P, passes by  $k P'$  into chamber B, through port  $b$  into  $B^1$  beneath the piston G, and holds the latter up in the position shown. It then passes through ports  $a a^1 a^2$  into chamber  $B^2$ , and thence to the auxiliary reservoir through port R.

The details of construction and the functions of these parts will be readily understood from the drawings and the patents above named.

The graduating-stem  $b^1$  and spring  $b^2$ , including the reduced upper end of the stem, have also the construction and operation described in the second of said patents.

The piston-stem  $g$  operates the valve H; but the collar  $g^1$  and shoulder  $g^2$ , which bear on the opposite ends of the valve or its con-

nections and give it its motion, are a little farther apart—say about one-eighth ( $\frac{1}{8}$ ) of an inch, more or less—than the distance between the end bearings of the valve H.

The distance between the open end of the port  $a$  and the shoulder  $a^3$  on the stem  $b^1$ , when the piston G is at the highest point of its stroke, is by preference somewhat less—say one-sixteenth ( $\frac{1}{16}$ ) of an inch, more or less.

The valve H has a cavity,  $s$ , long enough to uncover the port C and the exhaust-port E and put them in communication. It has also two additional ports,  $s^1$   $s^2$ , the former having a diameter, by preference, of about three-sixteenths ( $\frac{3}{16}$ ) of an inch, and the latter of about five-sixty-fourths ( $\frac{5}{64}$ ) of an inch, in a device of the proportions shown; but I do not confine myself in my invention to these exact figures or proportions, but include all such variations therefrom as give substantially a like construction and operation.

The distance between the ports  $s$  and  $s^1$  is equal to or slightly in excess of the diameter of the port C at the valve-seat. The port  $s^1$  communicates by a passage,  $c$ , with the open end of the valve H. Transverse to this passage, and opening therein, is a cross-port,  $c^2$ , Fig. 3, extending to the exterior of the valve H on one or both sides. Between the point of junction of this port with the passage  $c$  and the port  $s^1$ , I make a valve-seat,  $e$ , and seat thereon a valve,  $e^1$ , the stem  $e^2$  of which is connected by a pin,  $e^3$ , with the stem  $g$ .

It will now be seen that any motion imparted to the piston G, Fig. 1, will, through the stem  $g$ , be first operative in unseating the valve  $e^1$ , the valve H being held by frictional contact with its seat, so that the stem  $g$  will slide through it until the collar  $g'$  engages the upper end thereof. Also, after any portion of an up or down stroke is made by the piston G, the first motion thereof in an opposite direction will first shift the auxiliary valve  $e^1$  to or from its seat, as the case may be, before any motion is imparted to the valve H.

In order now to apply the brakes fluid-pressure is allowed to escape from below the piston G by the manipulation of the cock on the locomotive or other escape-cock. Fluid-pressure then acts back from the auxiliary reservoir on top of G, and forces it down, first closing the port  $a$ , and at the same time unseating the valve  $e^1$ , and bringing the latter and the devices immediately connected therewith into the relative positions shown in Fig. 3. But a very slight reduction of pressure below G is required in order to do this. The downstroke of G is continued, shifting the valve H downward rapidly or slowly, until the port  $s^1$  comes partly or fully into line with C.

The escape at E is then closed, and the ports and passages are open for fluid-pressure to pass from the auxiliary reservoir by R,  $c^2$ ,  $c$ ,  $s^1$ , and C to the brake-cylinder and cause the application of the brakes. In this motion of H, however, it should be noted that the small port  $s^2$  is, while passing the open end of C, in

communication with the exhaust E; but the amount of air thus escaping through a port so small is practically inappreciable, and does not interfere with the action described. When now the valve H is thus shifted, so that the port  $s$ , shall, to the extent of one-quarter or one-half its capacity, more or less, as is usual when less than a maximum braking force is desired, be thus brought into communication with the port C, and held there until the limited or desired amount of fluid-pressure shall have passed into the brake-cylinder, the auxiliary valve  $e^1$  becomes available as a quick and ready means of closing the supply-port with certainty, without danger of opening the exhaust. To this end a very slight increase or excess of pressure below the piston G—much less in, fact, than is necessary to shift the valve H—will suffice to move the piston G and stem  $g$  far enough to close the valve  $e^1$  on its seat  $e$ . All ports are thus closed by an almost instantaneous motion, and the brakes remain on with a force corresponding to the amount of pressure previously charged into the brake-cylinder.

In case a slight addition to the operative braking force is desired, either to compensate for loss by leakage or for any other reason, it may be secured by a slight downward motion of the piston G, such as will unseat the auxiliary valve  $e^1$ . In this manner the graduating friction may be more advantageously performed than heretofore. But the use of this auxiliary valve enables me to dispense entirely with the graduating stem and spring, and in this combination it is illustrated in Fig. 4, Sheet 2.

With the valve H of the patents above named, if the graduating spring and stem were omitted it would be found that after the slide-valve H had been so far shifted in applying the brakes as to permit a moderate or limited quantity of fluid-pressure to pass from the auxiliary reservoir to the brake-cylinder, in such case the amount of power of fluid-pressure necessary to shift such valve part way back, and thus close the port leading to the brake-cylinder, and thereby hold or retain the limited amount or degree of pressure in the brake-cylinder, would frequently give such valve its entire throw and result in the release of the brakes. The important function of graduating would thus be to some extent interfered with, since it is desirable in the handling of a train to be able to admit into the brake-cylinders any desired amount or degree of fluid-pressure less than the maximum, and to retain or hold it there without material increase or diminution. This tendency of the valve referred to, to complete its back stroke under the circumstances named, results, in part, from the fact that the amount of force necessary to start the valve upward when the graduating-spring is not employed is frequently found to be more than enough to carry it to the end of its stroke after it is started. But with the explanation already given, it will be seen that the necessity of giving a back stroke

to the valve H is wholly obviated, so far as relates to closing the ports and holding in the brake-cylinder any predetermined or limited amount of fluid-pressure, or to increase such pressure at pleasure, since, after the slide-valve H has been brought to the desired position, as set forth, a slight motion imparted to the piston G, and much less than would be necessary to start the valve H, will suffice to seat and unseat the auxiliary valve  $e^1$ , and so hold or retain in the brake-cylinder any desired pressure previously charged therein, or permit the increase thereof at pleasure.

Another part of my invention relates to the use of the auxiliary valve  $e^1$  as a leakage-valve. When a car is disconnected from the train and run onto a siding, the auxiliary reservoir and brake-pipes are still charged with fluid-pressure. Leakage from the pipes, where it is greatest, results in the depression of the piston G until the port  $s^2$  comes wholly or in part opposite the port C. As the intermediate full face of the valve is insufficient to cover entirely the port C, (the auxiliary valve  $e^1$  being now unseated,) the fluid-pressure from the auxiliary reservoir will pass out slowly through  $s^2$ ,  $s$ , and E, but about as fast as it will leak from the brake-pipes. Were it not for this port  $s^2$ , or some other leakage device, the port  $s^1$  would be brought into communication with the port C so as to apply the brakes slowly at first, but eventually with maximum force, and hold them on for a considerable time. This would be highly objectionable, as it would interfere with the shifting of cars and other like operations, or even the running of a car, in case the brake apparatus of such car were disconnected, which it is sometimes necessary to do.

By the same device I provide for unexpected or accidental fluctuations of pressure slight in amount, such as are liable to occur while the pipes are connected and the train running, without danger of the brakes being applied thereto.

In Fig. 4 I have shown a strainer,  $m$ , arranged over the port leading from B to  $B^1$ , as a device to exclude or aid in excluding dust; also, in this figure, the ports from  $B^1$  to  $B^2$  are shown past the piston G instead of through it.

In both forms of the device I have shown a knob,  $q$ , projecting from the lower side of the

piston G, as a device by which to get hold of the piston and pull it out, when necessary, for purposes of renewal, cleaning, or repairs. The necessity for this results from the fact that heretofore careless workmen have often used the graduating-stem for this purpose, and in doing so have bent the stem and caused trouble in the working of the valve.

The function of the large chamber B is chiefly that of a drip-cup, and to discharge the drip a hole and groove are made at  $u$ .

While in order to make my improvements clearly understood I have described and specified the devices with some minuteness, I still include herein known mechanical equivalents, or such substitutes for devices specified as involve a substantially like operation and result.

I claim herein as my invention—

1. In combination with the piston and stem of a triple valve, a valve, H, arranged on such stem, and having a short range of motion independent of such stem, in combination with an auxiliary valve operated by the same stem to close or open a port through the main valve without necessarily moving the main valve, substantially as set forth.

2. In a valve-case having a fluid-pressure-supply port, an auxiliary reservoir-port, a brake-cylinder port, and an exhaust-port, a valve, H, for governing the flow of air, provided with ports or passages  $s$   $s^2$ , and a fluid-pressure-supply port communicating with  $s^2$ , in combination with piston G, substantially as set forth with reference to the exhaustion without application of the brakes of the contained fluid-pressure.

3. The valve H, having cavity  $s$ , ports  $s^1$ ,  $s^2$ ,  $e$ , and  $e^2$ , in combination with valve  $e^1$ , substantially as set forth.

4. In combination with a triple valve of the class described, a strainer,  $m$ , arranged inside the valve-case and over or across the port leading to the piston-chamber, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:

R. H. WHITTLESEY,  
GEORGE H. CHRISTY.





## On the Meaning of “Patented Invention”: Tab 3

(Model.)

3 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

FLUID PRESSURE AUTOMATIC BRAKE MECHANISM.

No. 360,070.

Patented Mar. 29, 1887.

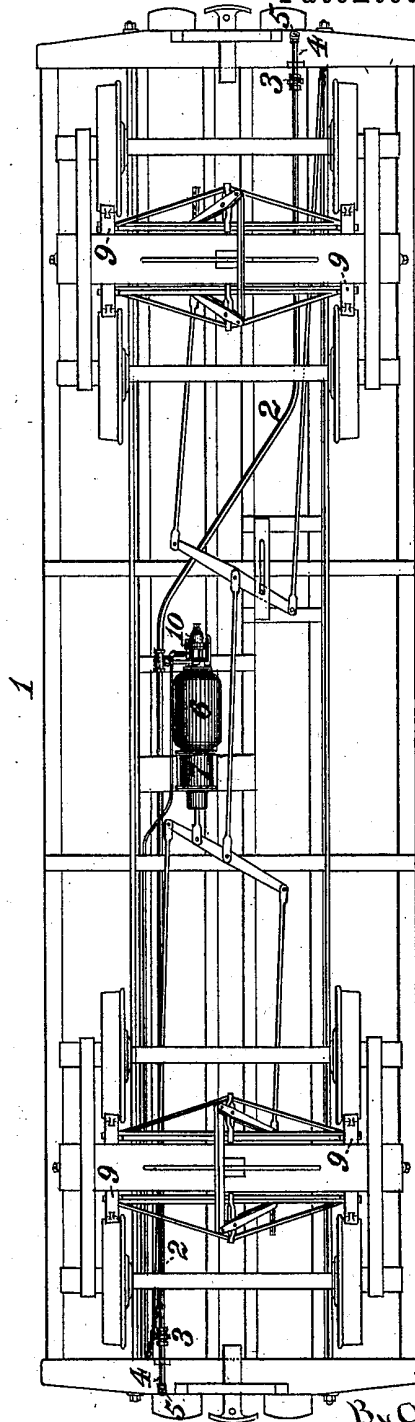


Fig. 1.

*Witnesses*  
*R. M. Whittlesay*  
*L. M. Clarke*

*Inventor*  
*George Westinghouse, Jr.*  
*By Attorney*  
*J. Thomson Bell*

(Model.)

3 Sheets—Sheet 2.

G. WESTINGHOUSE, Jr.

FLUID PRESSURE AUTOMATIC BRAKE MECHANISM.

No. 360,070.

Patented Mar. 29, 1887.

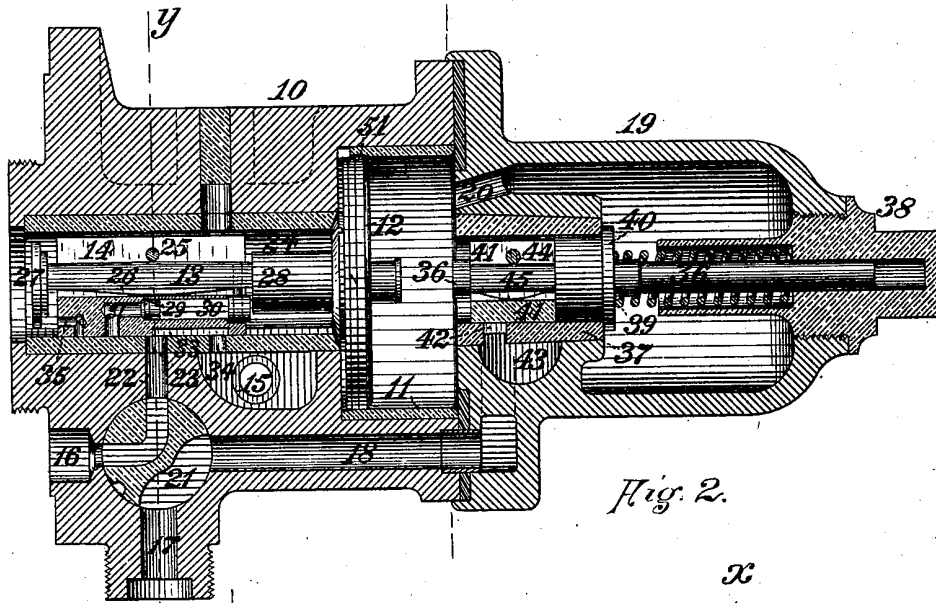


Fig. 2.

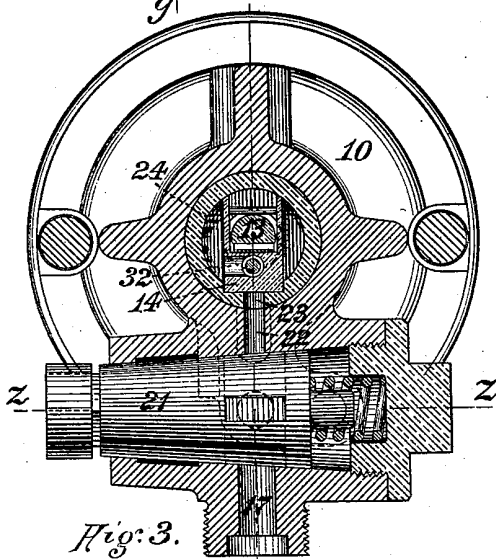


Fig. 3.

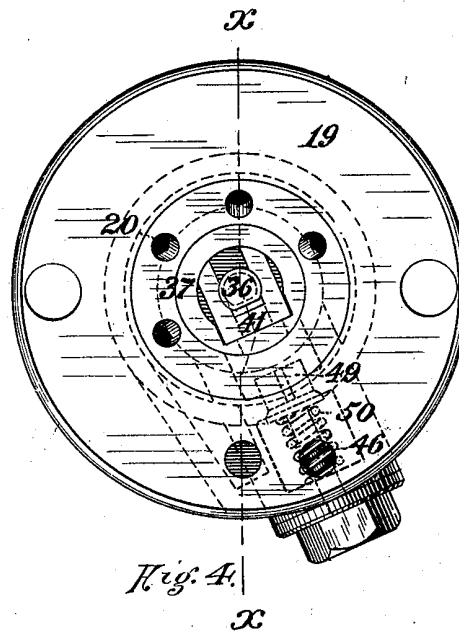


Fig. 4.

Witnesses  
 R. A. Whittlesey  
 C. M. Clarke.

Inventor  
 George Westinghouse Jr.  
 By Attorney  
 J. Thorden Bell.

(Model.)

3 Sheets—Sheet 3.

G. WESTINGHOUSE, Jr.

FLUID PRESSURE AUTOMATIC BRAKE MECHANISM.

No. 360,070.

Patented Mar. 29, 1887.

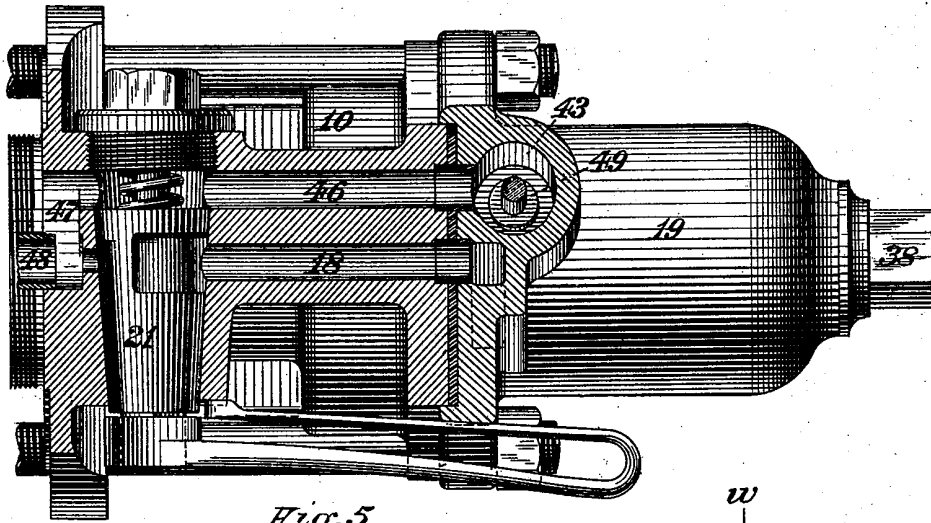


Fig. 5.

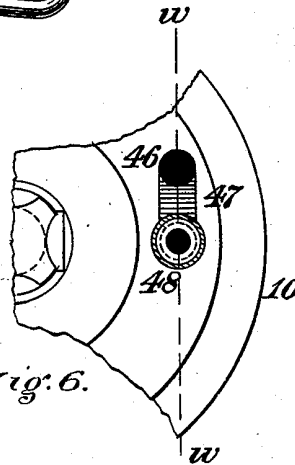


Fig. 6.

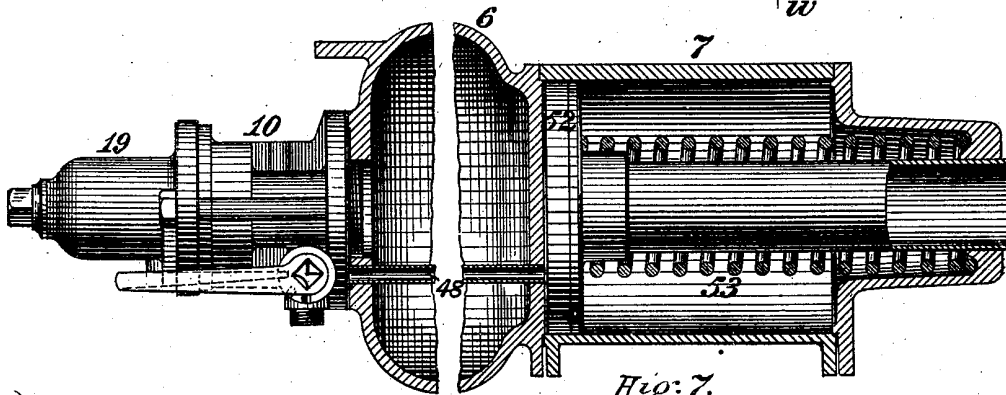


Fig. 7.

Witnesses  
 R. H. Whittlesey  
 C. M. Clark

Inventor George Westinghouse Jr.  
 By Attorney J. Snowden Bell

# UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

## FLUID-PRESSURE AUTOMATIC-BRAKE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 360,070, dated March 29, 1887.

Application filed November 19, 1886. Serial No. 219,353. (M. del.)

*To all whom it may concern:*

Be it known that I, GEORGE WESTINGHOUSE, Jr., residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Fluid-Pressure Automatic-Brake Mechanism, of which improvements the following is a specification.

The object of my invention is to enable the application of brake-shoes to car-wheels by fluid pressure to be effected with greater rapidity and effectiveness than heretofore, more particularly in trains of considerable length, as well as to economize compressed air in the operation of braking by utilizing in the brake-cylinders the greater portion of the volume of air which in former practice was directly discharged into the atmosphere.

To this end my invention, generally stated, consists in a novel combination of a brake-pipe, an auxiliary reservoir, a brake-cylinder, and a "triple-valve" device governing, primarily, communication between the auxiliary reservoir and the brake cylinder, and, secondarily, communication directly from the brake-pipe to the brake-cylinder.

The improvements claimed are hereinafter fully set forth.

In the application of the Westinghouse automatic brake as heretofore and at present commonly in use, each car is provided with a main air-pipe, an auxiliary reservoir, a brake-cylinder, and a triple valve, the triple valve having three connections—to wit, one to the main air-brake pipe, one to the auxiliary reservoir, and one to the brake-cylinder. The main air-pipe has a stop-cock at or near each of its ends, to be opened or closed as required, and is fitted with flexible connections and couplings for connecting the pipes from car to car of a train, so as to form a continuous line for the transmission of compressed air from a main reservoir supplied by an air-pump on the engine. When the brakes are off or released, but in readiness for action upon the wheels of the train, the air which fills the main reservoir and main air-pipes has a pressure of from sixty-five to seventy-five pounds to the square inch, and by reason of the connections referred to the same pressure is exerted in the casings of the triple valves on both sides of their pis-

tons and in the auxiliary reservoirs connected therewith. At the same time passages called "release-ports" are open from the brake-cylinders to the atmosphere. When it is desired to apply the brakes, air is allowed to escape from the main air-pipes through the engineer's valve, thereby reducing the pressure in the main air-pipes, whereupon the then higher pressure in the auxiliary reservoirs moves the pistons of the triple valves, so as to first close the passages from the triple valves to the brake-pipe and at the same time close the release-ports of all the brake-cylinders, and then open the passages from the auxiliary reservoirs to the brake-cylinders, the pistons of which are forced out by the compressed air thereby admitted to the brake-cylinders, applying the brakes by means of suitable levers and connections, all of which mechanism is fully shown in various Letters Patent granted to me.

The application of the brakes with their full force has heretofore required a discharge of air from the main pipe sufficient to reduce the pressure in said pipe below that remaining in the auxiliary reservoir after the brakes have been fully applied, and it has been found that, while the brakes are sufficiently quick in action on comparatively short trains, their action on long trains of from thirty to fifty cars, which are common in freight service under present practice, is in a measure slow, particularly by reason of the fact that all the air required to be discharged from the main pipe to set the brakes must travel from the rear of the train to a single discharge-opening on the engine. This discharge of air at the engine has not only involved a serious loss of time in braking, but also a waste of air. Under my present invention a quicker and more efficient action of the brakes is obtained, and air which has been heretofore wasted in the application of the brakes is almost wholly utilized to act upon the brake-pistons.

In the accompanying drawings, Figure 1 is an inverted plan view of a railroad-car, illustrating the application of my invention; Fig. 2, a longitudinal section, on an enlarged scale, through the triple valve at the line *x x* of Fig. 4; Fig. 3, a transverse section through the same at the line *y y* of Fig. 2; Fig. 4, a bottom plan view of the cap or drain-cup of the triple valve; Fig. 5, a longitudinal section

through the triple valve at the lines *z z* of Fig. 3 and *w w* of Fig. 6; Fig. 6, a partial bottom plan view of the triple valve; and Fig. 7, a longitudinal central section through the brake-cylinder and auxiliary reservoir, with the triple valve in elevation.

In the practice of my invention each railroad car 1 on which it is applied is, as heretofore, provided with a main air-pipe, 2, governed by stop-cocks 3, adjacent to its ends, and having a flexible connection, 4, and coupling 5 at each end, to admit of being coupled to the main air-pipe of the tender or the adjacent car or cars of a train. An auxiliary reservoir, 6, and brake cylinder 7 are secured in convenient position below the sills of the car, the brake-cylinder having a piston, 52, by the movement of which, through a system of lever-connections, which do not form part of my present invention, the brake-shoes 9 are applied to and released from the wheels of the car, compressed air being supplied to and released from the brake-cylinder 7 as the pressure in the main air-pipe is reduced or reinstated, respectively, by means of a triple valve, 10, the casing or chest of which communicates with the main air-pipe, the auxiliary reservoir, and the brake-cylinder.

So far as the performance of its preliminary function in ordinary braking is concerned—that is to say, effecting the closure of communication between the main air-pipe and the auxiliary reservoir, and the opening of communication between the auxiliary reservoir and the brake-cylinder in applying the brakes, and the reverse operations in releasing the brakes—the triple valve 10 accords substantially with that set forth in Letters Patent of the United States No. 220,556, granted and issued to me October 14, 1879, and is not, therefore, saving as to the structural features by which it performs the further function of effecting the direct admission of air from the main air-pipe to the brake-cylinder, as presently to be described, claimed as of my present invention. Certain of its elements devised and employed by me prior thereto will, however, be herein specified, in order to render its construction and operative relation to other members of the brake mechanism fully intelligible.

The case or chest in which the operative mechanism of the triple valve proper, 10, is mounted is fixed under or on the car-body in any convenient position relatively to the auxiliary reservoir 6 and brake-cylinder 7, being in this instance shown as secured directly to one end of the auxiliary reservoir, in line axially therewith and with the brake-cylinder, which is secured to its opposite end. The triple-valve case is fitted at one end with a cylindrical sleeve or bushing, 11, which is bored out truly and forms the chamber of a piston, 12, which is fixed upon a stem, 13, carrying, as in my Letters Patent No. 220,556, before mentioned, a slide-valve, 14, which con-

trols communication between the auxiliary reservoir and the brake-cylinder, and between the brake-cylinder and release-port 15, respectively. The auxiliary reservoir 6 is continuously in communication with the chamber 11, on one side of the piston 12, through the longitudinal chamber 24 of the case in which the slide-valve 14 moves, and the triple-valve case communicates, by a passage, 16, with the brake cylinder, and, by a passage, 17, with the main air-pipe 2. The passage 17, leading from the main air-pipe, communicates, by a passage, 18, with the cap or, as it is ordinarily termed, the "drain-cup" 19 of the triple valve, from which passages 20 lead into the piston-chamber 11. A four-way cock, 21, controls the passages 16, 17, 18, and a passage, 22, leading to a port, 23, in the face or seat of the slide-valve 14. When in the position shown in the drawings, communication is continuously maintained between the main air-pipe 2 and piston-chamber 11 through the passages 17 and 18, drain-cup 19, and passages 20, and by turning the cock 21, so as to establish communication between the passages 16 and 17, the triple valve and auxiliary reservoir will be cut out from the main air-pipe, and the mechanism can be operated as a non automatic brake, the admission of air under pressure to the main air-pipe and brake-cylinder effecting, in such case, the application of the brakes.

The entire brake mechanism of the car other than the main air-pipe may be put out of action, when for any reason required, by turning the cock 21 into position to cover the passages 16 and 18, the main air-pipe then serving only for the transmission of air between the portions of the train-line made up by the main air-pipes of the remaining vehicles.

The slide-valve 14 is loosely connected with the stem 13 of the piston 12, and by a pin, 25, extending across the stem and fixed in the side plates of the valve, is prevented from being separated from the stem when removed for examination. It is held up to its seat in the chamber 24 by a spring, 26. The valve partakes in the reciprocating movements of the stem 13, being moved in one or the other direction by a collar, 27, and a shoulder, 28, respectively, on the stem. Said collar and shoulder are located at a distance apart slightly greater than the length of the valve 14, so that a limited degree of traverse of the stem 13 and piston 12 in each direction is effected without imparting movement to the valve. A graduating-valve, 29, secured upon a stem, 30, which is moved by the piston-stem 13, governs a passage, 31, in the slide-valve 14, said passage communicating by a lateral port, 32, with the valve-chamber 24, and consequently with the auxiliary reservoir. A cavity or passage, 33, is formed on the face of the slide-valve 14, of such length as to establish communication during a portion of the traverse of the valve between the port 23 of the valve-chamber 24,

which is open to the passage 16, leading to the brake cylinder, and a port, 34, communicating with the relief-port 15.

The construction and relative arrangement of the piston-stem 13, slide-valve 14, and graduating-valve 29 are substantially similar to those of the corresponding parts as heretofore employed by me and exemplified in my Letters Patent No. 220,556; but under my present invention these are supplemented by a port, 35, leading from the end of the valve adjacent to the opening of the chamber 24, which communicates with the auxiliary reservoir, to the face of the valve, so as, at the limit of traverse of the piston-stem in the application of the brakes, to establish communication directly through said passage between the auxiliary reservoir and the port 23 and passages 22 and 16, leading to the brake-cylinder.

The piston-stem 13 abuts when the stem 13 and piston 12 are moved for the major portion of their traverse toward the drain-cup 19 against a stem, 36, which is fitted to slide freely in line axially with the stem 13 in an open-ended bushing, 37, in the end of the drain-cup 19 adjoining the piston-chamber 11, and in a guide formed in a screw-cap, 38, closing the opposite end of the drain-cup. A spring, 39, surrounding the stem 36 and bearing against the inside of the cap 38 and against a collar, 40, on the stem 36, maintains the latter in the position shown in Fig. 2, except when a sufficient pressure of air is admitted from the auxiliary reservoir to the piston-chamber to overcome the resistance of the spring and effect movement of the piston 12 beyond the point at which its stem 13 comes in contact with the stem 36.

So far as hereinbefore described, the triple valve accords in all substantial particulars with and is adapted to operate similarly to those of my Letters Patent Nos. 168,359, 172,064, and 220,556, and, in order that it may perform the further functions requisite in the practice of my present invention, it is provided with certain additional members, which will now be described. For the purpose of effecting the admission of air directly from the main air-pipe 2 to the brake-cylinder 7 when it is desired to apply the brakes with great rapidity and full force, an auxiliary slide-valve, 41, is connected to and moves with the stem 36, said valve working over a face in the bushing 37 between the piston-chamber 11 and drain-cup 19, and governing a port, 42, in said face leading into a chamber, 43, adjoining the same. The valve 41 has lateral wings or plates fitting on each side of the stem 36, between shoulders or collars thereon, and is held thereto, when the stem is removed, between collars or shoulders thereon abutting against its ends, by a pin, 44, in its wings, a spring, 45, acting to hold it to its seat in the bushing 37 when in position. The chamber 43 communicates by a passage, 46, Fig. 5, with a chamber, 47, in the end of the case of the triple valve adjacent to the auxiliary reservoir, from which

chamber a passage, 48, leads through the auxiliary reservoir into the brake-cylinder 7. The chamber 43 is further provided with a check-valve, 49, which opens outwardly into and controls the passage of air into the passage 46, said valve being held to its seat by a light spring, 50, and serving to prevent the return of air from the brake-cylinder when the pressure in the main air-pipe is reduced below that in the brake-cylinder, as in the case of the separation of the cars of the train by the breaking of a coupling.

In the operation of the brake mechanism as above described, air from the main reservoir and main air-pipe passes through the passages 17 18, drain-cup 19, and passages 20 into the piston-chamber 11, forcing the piston 12 to the left-hand extremity of its stroke and uncovering a small feeding-groove, 51, in the piston-chamber, through which air passes into the auxiliary reservoir 6 until the pressure in the latter is equal to that in the main air-pipe, the brake-cylinder being meanwhile in communication with the atmosphere through the passages 16 and 22, valve-cavity 33, and ports 23 34, and release-port 15. To apply the brakes in making ordinary stops, a portion of the air is discharged from the main air-pipe by the engineer's valve, thereby correspondingly reducing the pressure in the main air-pipe, whereupon the higher pressure in the auxiliary reservoir moves the piston 12 to the right, covering the feeding-groove 51, and thus preventing the return of air from the auxiliary reservoir to the main air-pipe, the movement of the piston continuing until arrested by the decrease of pressure in the auxiliary reservoir or by the stem 36 and its spring 39. The movement of the slide-valve 14 then closes the port 23, preventing escape of air from the brake-cylinder, and places the passage 31 partly or wholly in communication with the port 33. The small auxiliary valve 29 having been meanwhile unseated by the movement of the piston-stem, compressed air from the auxiliary reservoir passes through the lateral port 32 and passage 31 of the slide-valve 14 and the passages 22 and 16 of the triple-valve case to the brake-cylinder, forcing out the piston, and, through an appropriate system of levers and connections, applying the brakes. When the pressure in the auxiliary reservoir has in this operation been reduced by expansion into the brake-cylinder until it is slightly below the pressure in the main air-pipe, the pressure on the air-pipe side of the piston 12 forces the piston 12 in the opposite direction until the auxiliary valve 29 closes the passage 31, thereby arresting the further flow of air from the reservoir to the brake-cylinder and holding the brakes with a force proportionate to the reduction of pressure in the brake-pipe. To release the brakes, the pressure in the main air-pipe is increased by admitting air from the main reservoir, whereupon the resultant increase of pressure in the piston-chamber 11 forces the piston 12 back to its original or normal posi-

tion, permitting the escape of air from the brake-cylinder 7, the piston 52 of which is returned to its position by a spring, 53, releasing in its backward movement the brake-shoes 9 from the wheels, and at the same time the auxiliary reservoir is recharged. The admission of air to the brake-cylinder through the passage 31, which is opened just before the piston stem comes in contact with the graduating-stem, and which corresponds to the feed-passage heretofore employed, suffices for the ordinary requirements of braking in regular service. In the event, however, of its becoming necessary to apply the brakes with great rapidity and with their greatest available force, the engineer, by means of the valve at his command, instantly discharges sufficient air from the front end of the main air-pipe to effect a sudden reduction of pressure of about twenty pounds per square inch therein, whereupon the piston 12 of the triple valve is forced to the extreme limit of its stroke in the direction of the drain-cup 19, carrying with it the stem 36 and auxiliary slide valve 41, which instantly uncovers the port 42 and discharges air from the main air-pipe through the opening of the check-valve 49 and the passages 46 and 48 to the brake-cylinder, and, each car being provided with one of these devices, it will be seen that they are successively moved with great rapidity, there being practically on a train of fifty cars fifty openings for discharging compressed air from the main pipe, instead of the single opening heretofore commonly used. Not only is there a passage of considerable size opened from the brake-pipe on each car, whereby the pressure is more quickly reduced, but the air so discharged is utilized in the performance of preliminary work, it being found in practice that the air so taken from the pipe will exert a pressure of about twenty-five pounds in the brake-cylinders. When the piston 12 arrives at the extremity of its stroke, as above specified, the supplemental port 35 of the slide-valve 14 is brought into communication with the port 33 and passages 22 and 16, which serves to discharge the reservoir-pressure into the brake-cylinder, thereby augmenting the pressure already exerted in the brake-cylinder by the air admitted from the main air-pipe. Upon the reduction of the pressure in the main air-pipe below that in the brake-cylinders, as by the breaking in two of the train, the check-valve 49 closes communication between the passages 46 and 18, thereby preventing the return of the air from the brake-cylinder to the main air-pipe. The feed-opening for the admission of air from the auxiliary reservoir to the brake-cylinder is purposely made of comparatively small diameter, it having been determined by experiment that the initial application of the brakes should not be made with maximum force, and this opening may be made of such size as to apply the brakes exactly in accord with the requirements of the most efficient work.

In using the terms "triple valve" and "triple-valve device" I refer to a valve device, however specifically constructed, having a connection with the main air or brake pipe, another with an auxiliary reservoir or chamber for the storage of power, and another with a brake-cylinder or its equivalent for the utilization of the stored power and with a release or discharge passage for releasing the operative power from the brake-cylinder, whether the valves governing these passages or connections are arranged in one or more cases and are moved by a piston or its equivalent or by a series of pistons or their equivalents, there being numerous examples in the art of constructions varying materially in appearance whereby these functions are performed, both in plenum and vacuum brake mechanisms.

While I have herein described my invention as applied in a brake mechanism utilizing air under pressure, such as is in general and approved use, I do not desire to limit myself to brakes so operated, as my improvements are likewise susceptible of application, without variation of principle, in connection with brakes worked by atmospheric pressure.

I am aware that a construction in which "an always-open one-way passage" from the main air-pipe to the brake-cylinder is uncovered by the piston of the triple valve simultaneously with the opening of the passage from the auxiliary reservoir to the brake-cylinder has been heretofore proposed, and such construction, which involves an operation different from that of my invention, I therefore hereby disclaim.

I claim as my invention and desire to secure by Letters Patent—

1. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple valve, and an auxiliary-valve device, actuated by the piston of the triple valve and independent of the main valve thereof, for admitting air in the application of the brake directly from the main air-pipe to the brake-cylinder, substantially as set forth.

2. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, and a triple valve having a piston whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder, substantially as set forth.

3. In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, and a triple valve having a piston whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder and effects a second admission of air from the auxiliary reservoir to the brake-cylinder, substantially as set forth.

4. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a



stem and working in a chamber therein, a valve moving with the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, and an auxiliary valve actuated by the piston-stem and controlling communication between passages leading to connections with a main air-pipe and with the brake-cylinder, respectively, substantially as set forth.

5. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a stem and working in a chamber therein, a valve moving with the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, an auxiliary valve actuated by the piston-stem and controlling communication between passages leading to connections with a main air-pipe and with the brake-cylinder, respectively, and a check or non-return valve interposed between the auxiliary valve and the passage leading therefrom to the brake-cylinder, substantially as set forth.

6. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a stem and working in a chamber therein, a valve moving with the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, an auxiliary stem mounted in the cap of the case in position to be moved longi-

tudinally by the piston-stem in the latter portion of its traverse in the direction required for the application of the brakes, a spring bearing against a collar on the auxiliary stem and against a fixed abutment, and an auxiliary valve connected to the auxiliary stem and controlling communication between passages leading to connections with a main air-pipe and with the brake-cylinder, respectively, substantially as set forth.

7. The combination, in a triple-valve device, of a case or chest, a piston fixed upon a stem and working in a chamber therein, an auxiliary valve actuated by the piston-stem and controlling communication between passages leading to connections with a main air-pipe and with a brake-cylinder, respectively, and a main valve connected to the piston-stem and governing ports and passages in the case leading to connections with an auxiliary reservoir and a brake-cylinder and to the atmosphere, respectively, said main valve having a supplemental port or passage which establishes communication between the auxiliary reservoir and brake-cylinder connections at or near the limit of the traverse of the main valve in effecting the application of the brake under maximum pressure, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEO. WESTINGHOUSE, JR.

Witnesses:

J. SNOWDEN BELL,  
R. H. WHITTLESEY.



On the Meaning of “Patented Invention”: Tab 4

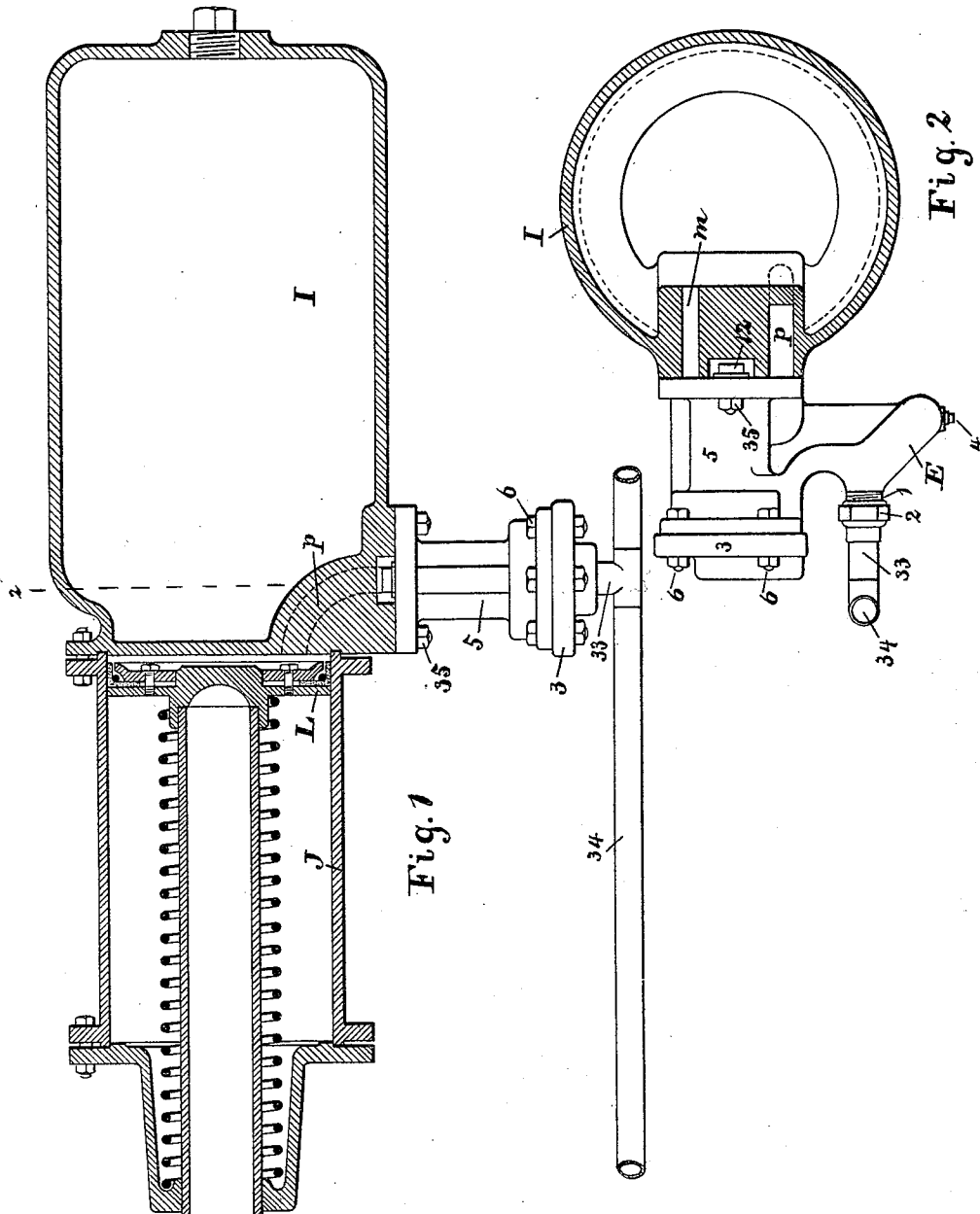
(No Model.)

2 Sheets—Sheet 1.

G. A. BOYDEN.  
FLUID PRESSURE BRAKE.

No. 481,135.

Patented Aug. 16, 1892.



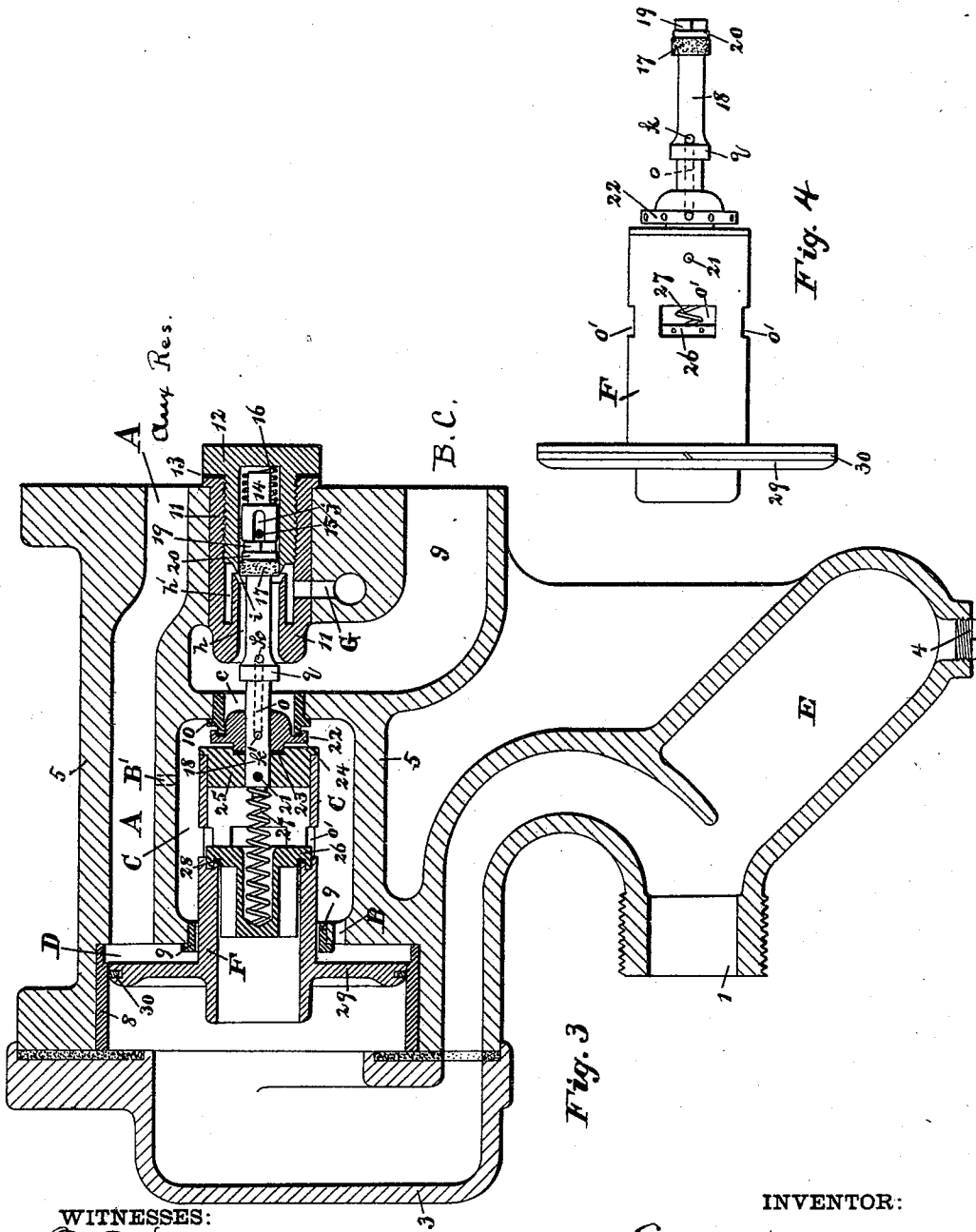
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INVENTOR:  
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# UNITED STATES PATENT OFFICE.

GEORGE A. BOYDEN, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE BOYDEN BRAKE COMPANY OF BALTIMORE CITY, OF MARYLAND.

## FLUID-PRESSURE BRAKE.

SPECIFICATION forming part of Letters Patent No. 481,135, dated August 16, 1892.

Application filed March 6, 1891. Serial No. 384,012. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE A. BOYDEN, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Fluid-Pressure Brakes, of which the following is a specification.

This invention relates to the construction of valves for automatic air-brakes, and has for its object to provide for admitting air-pressure to the brake-cylinder from both the train-brake pipe and the auxiliary reservoir, thereby effecting a more powerful and also a quicker application of each brake and at the same time so quickly reducing the air-pressure in the train-brake pipe adjacent to the said valves that all the brakes of a train will be applied at nearly the same time.

Referring to the drawings, Figure 1 is a section of the auxiliary reservoir and brake-cylinder, with a side view of the valve and train-pipe. Fig. 2 is a cross-section of the reservoir, with a side view of the valve attached thereto, showing the passages by which communication is established between the reservoir and the valve and brake-cylinder. Fig. 3 is a longitudinal section of the valve. Fig. 4 is a side view of the valve-piston and its attached parts.

In my patent of June 26, 1883, No. 280,285, I brought out an improved triple-valve mechanism having a check-valve passage leading from the train-pipe through or around the piston to the main-valve chamber, with a communication to the auxiliary reservoir and a communication to the brake-cylinder, the latter communication being normally covered by the main valve of the triple-valve device and uncovered by the movement thereof, thus utilizing both auxiliary-reservoir air and train-pipe air when the brakes are applied. Subsequently George Westinghouse, Jr., for the purpose of utilizing train-pipe air, in addition to auxiliary-reservoir air for applying the brakes in quick action, adopted a check-valved passage leading from the train-pipe around or past the triple valve directly to the brake-cylinder without passing through the main-valve chamber and covered said passage with a valve additional and "auxiliary" to the triple-valve mechanism, said auxiliary valve

performing none of the three ordinary functions of the latter, but adapted and used solely for producing a "quick action" of the brakes in applying for emergency. The United States Patent for the Westinghouse invention here referred to is dated March 29, 1887, and numbered 360,070.

In my present invention I use the check-valved feed-passage of my 1883 patent, leading from the train-pipe through the triple-valve piston to the main-valve chamber, and thence both to the auxiliary reservoir and the brake-cylinder for the double purpose of supplying the auxiliary reservoir, and also enabling train-pipe air to be vented directly through the main-valve chamber into the brake-cylinder to aid in applying the brakes for emergency stops, and this is done without interfering with the usual operation or functions of the "triple valve" and also without the aid of the "auxiliary valve," heretofore required for the purpose. It will be seen that the means I have thus provided for introducing train-pipe air into the brake-cylinder for "emergency stops" differs, essentially, from that shown in said Patent No. 360,070, and that said means involves a new mode of operation.

The branch pipe 33 from the train-pipe 34 is connected to the valve by its nozzle 1 and union-nut 2, which screws thereon, the intervening joint between being made tight by a washer. The valve-case is provided with a drip-chamber E, extending below to drain the water therefrom and from which it is drawn off by removing the plug 4. The cap 3 is secured to the body 5 by suitable bolts 6 and the joint between is made tight by a washer. The body-piece 5 of the valve is provided with a cylinder D, lined with a brass bushing 8, a large passage A communicating between the auxiliary reservoir and said piston-cylinder a valve-chamber C, having at one end an opening lined with a brass bushing 9, which serves in part as a partition and separates the piston-chamber D from the valve-chamber C. A small passage B opens in the present instance between the piston-chamber D and the valve-chamber C and forms a communication through which air from the auxiliary reservoir is admitted to the valve-chamber C, and

vice versa. At the opposite end of the valve-chamber is a bushing 10, forming a port *c*, which is closed by the main valve 22. At this end of the body-piece is a passage *g*, leading to the brake-cylinder, and a bushing 11, having an exhaust-passage *G* opening to the atmosphere. It is obvious the restricted communication by which auxiliary-reservoir air flows to the valve-chamber may open directly between the auxiliary-reservoir passage *A* and the valve-chamber, as at *B'* in dotted lines. However located, this passage is much smaller than the passage *A* between the piston-cylinder *D* and the auxiliary reservoir. The piston 29 is provided with a packing-ring 30 and moves in the cylinder *D*, according to the changes in the preponderance of the pressure. Integral with the piston is the sleeve *F*, which fits and moves in the bushing 9. A cap 25 is secured to the sleeve *F* by the screw 21, which passes crosswise through the cap and also through a stem 18 and has each end resting in the piston-sleeve *F*.

A bushing 11 is fitted in an opening at the end of the body-piece 5. This bushing has a central passage *h* and an annular passage *h'*. A release-port *i* connects said two passages, and the annular passage has a connection with the exhaust-passage *G*. A cap 12 fits into the bushing, and a washer 13 makes a tight joint between the cap and bushing. The cap has a central passage, conforming in size to the central passage *h* of the bushing, and is practically a continuation thereof. The release-port *i*, before mentioned, is formed where the inner end of the cap adjoins the annular passage *h'*. In this cap is arranged an abutting piece 14, which has a limited movement by means of a slot *j* and the pin 15. A spring 16 presses against the abutting piece 14 and forms a resistance in graduating to the end of the stem 18 and to the movement of the piston 29 and its attached parts. The release-valve is formed by a leather cup 17, secured to the valve-stem 18 by a screw 19, which extends into the stem, and a washer 20, that binds the said cup. The release-valve is movable like a piston in the central passage *h* of the bushing 11 and cap 12 and opens and closes the release-port *i*. The graduating-valve is formed by the valve-stem 18, having a passage *o*, with an opening *k* at one end, a port *k'* at the other, and with the main valve 22 loose on the said stem 18. The main valve 22 closes the large port *c*, which leads to the brake-cylinder, and this valve seats on the packing-rings 23 and 24. This valve 22 is loose on and is movable lengthwise of the stem 18, which wholly supports it. I term it a "floating" valve because it rides and may move freely on the stem and when unseated from the port *c* is not in contact with any other part. In the piston-sleeve *F* is arranged in a relation similar to my said 1883 patent the check-valve 26, which is held closed by the spring 27, the

seat of the check-valve being formed by the packing-ring 28. The piston-sleeve forms the train-pipe passage and has openings *o'*, which communicate with the valve-chamber *C*. The partition where the guide-bushing 9 is located isolates or separates the auxiliary-reservoir side of the piston-chamber *D* from the valve-chamber *C*, and this makes it possible when fully applying the brakes in an emergency for the piston 29 to be subjected on its auxiliary-reservoir side to a greater air-pressure than that contained in the valve-chamber.

As shown in Fig. 1, the auxiliary reservoir *I* is attached to the brake-cylinder *J*, in which it moves the piston *L*. The valve-body 5 is attached to the side of the auxiliary reservoir by the studs and nuts 35, and the large passage *A* communicates with the auxiliary reservoir *I* through the passage *m*. Communication between the valve and the brake-cylinder *J* is established through the curved passage *P*, connecting with the passage *g* in the valve.

Triple valves heretofore extensively in use, like that patented to George Westinghouse, Jr., October 14, 1879, No. 220,556, have been arranged to effect two grades of brake application by auxiliary-reservoir pressure. The first grade may be called "full pressure," and the second grade, which is partial pressure, is known as "graduation." For effecting these two grades of application a main valve and a graduating-valve have been employed corresponding generally, though embodied in a different form, with the main and graduating valves 22 and *k'*. (Here shown.) The graduation-valve *k' o k* in the stem 18 of the present valve mechanism performs the ordinary functions of such a device and is brought into useful action only in making graduation applications of the brakes. This graduation-valve does not affect the action of the release-valve or the main valve 22, which latter will allow the flow to the brake-cylinder of auxiliary-reservoir air alone, and also allow the flow of both auxiliary-reservoir air and train-pipe air. It will therefore be seen that the presence or absence of the graduation-valve is not essential to the performance by the other parts of all the functions of a triple valve.

The operation of the valve is as follows: To charge the auxiliary reservoir, the air from the train-pipe passes in through the nozzle 1 and moves the valve-piston 29 to the position shown in Fig. 3, where the graduating-valve port *k'* and the main-valve port *c* will be closed, and thus all communication with the brake-cylinder cut off. The air then opens the check-valve 26 and passes through the openings *o'* in the sleeve *F* to the valve-chamber *C*, from which it passes through the small passage *B* into the piston-cylinder *D*, and thence through the large passage *A* to the auxiliary reservoir. An equalization of air-pressure will thus be brought about in the

auxiliary reservoir I, valve-chamber C, and train-pipe, and the check-valve 26 will be seated.

To apply the brakes by graduation, a slight  
 5 reduction of the pressure in the train-pipe moves the piston 29 and its attached parts until the shoulder *q* on the stem 18 comes against the main valve 22, (the main valve remaining immovable on its seat, owing to the  
 10 air-pressure in the valve-chamber C holding it thereon.) This movement closes the release-valve port *i* and draws the graduating-stem 18 through the main valve 22 sufficiently far to expose the graduating-port *k'* in the  
 15 valve-stem to the air-pressure in the valve-chamber C. The air then passes from the auxiliary reservoir by way of the large passage A and small passage B into the valve-chamber C, and then through the graduating-  
 20 port *k'*, passage *o*, and opening *k* in the valve-stem and the passage *g* to the brake-cylinder, where it effects the partial application of the brakes. This operation, which does not  
 25 open the main-valve port, is due to the fact that the restricted communication B, through which the auxiliary-reservoir air enters the valve-chamber C, is larger than the graduating-  
 30 port *k'*, and therefore the pressure in the valve-chamber is kept substantially equal to that in the auxiliary reservoir. This retention of the pressure in the valve-chamber when graduating holds the main valve 22 and the check-valve 26 seated on their respective  
 35 ports. As the main valve 22 remains immovable on its port at the time the brakes are being applied by the graduation-valve, it serves to arrest the movement of the piston by means of the stop-shoulder *q* on the stem coming in contact with it. The piston 29 and  
 40 its attached parts will remain in the same position—to wit, with the stem-shoulder *q* in contact with the main valve 22—until the pressure has been reduced in the auxiliary reservoir below that in the train-pipe. The greater  
 45 train-pipe pressure will then cause the piston 29 to move to the right till the end of the valve-stem 18 comes in contact with the spring-held abutting-piece 14, which retards the movement. When in this last position,  
 50 the graduating-port *k'* in the valve-stem 18 is closed by having passed into the main valve 22, and thus prevents any further accumulation of pressure in the brake-cylinder. While in this position the cup-valve 17, which  
 55 controls the release of the air, has not moved sufficiently far to uncover the release-port *i*, that leads to the atmosphere, and thereby holds the pressure in the brake-cylinder, which exerts the desired braking force. If it is desired  
 60 to gradually increase the pressure in the brake-cylinder, the above operation may be repeated. To release the brakes, the engineer's valve is moved, and thereby the maximum pressure is restored in the train-pipe, which, acting on  
 65 the piston 29, overcomes the resistance of the abutting spring 16 and moves the piston and its attached parts to the right to the extreme

limit of its movement, as shown in Fig. 3, which causes the release-valve 17 to uncover the release-port *i* and allow the air to pass  
 70 from the brake-cylinder back through the passage *g*, then into the central passage *h*, around the stem 18, through the port *i*, and from thence to the annular passage *h'* in the bushing 11, from which it passes through the pas-  
 75 sage G to the atmosphere. At the same time that the brakes are released the restoration of the pressure in the train-pipe will recharge the auxiliary reservoir for future use. The brakes may be applied fully in two ways: 80  
 first, by the auxiliary-reservoir pressure alone, and, second, by the auxiliary-reservoir pressure in conjunction with the train-pipe pressure. The first mode is used when an ordinary gradual stop is required, such as at a  
 85 station. The second mode is used when an emergency stop is required, such as upon the occurrence of an accident. To apply the brakes fully for an ordinary stop, a limited amount of train-pipe air is continuously dis-  
 90 charged from the engineer's valve, which reduces the pressure in the train-pipe and slowly moves the piston 29 to the left and opens the main valve 22 sufficient to practi-  
 95 cally maintain the same air-pressure on both sides of the said piston. The piston and the said valve will be retained in the position just mentioned, or the piston will slightly vibrate back and forward, causing the valve 22  
 100 to repeatedly unseat and seat by the discharge of the auxiliary-reservoir air (through the valve-chamber C to the brake-cylinder) being about equal to the continuous discharge of air from the train-pipe at the engineer's valve. Under these conditions the  
 105 pressure in the brake-cylinder, valve-chamber C, and auxiliary reservoir will equalize, and thus the ordinary function of the triple valve in applying the brakes fully by the auxiliary-reservoir pressure alone is accomplished. If  
 110 the train-pipe pressure continues to lower slowly, the piston and its attached parts will be moved their full stroke to the left; but the air from the train-pipe will not pass to the brake-  
 115 cylinder, because by this continuous but limited discharge of train-pipe pressure the air-pressure in the valve-chamber C will not be suddenly reduced below that in the train-pipe, as in this operation the main valve will not be  
 120 opened sufficiently to discharge more air than the passage B supplies. To apply the brakes of a train quickly and with full power for an emergency stop, the engineer's valve will be moved to close communication between the  
 125 storage-tank on the locomotive and train-pipe and open the latter to the atmosphere and effect a sudden reduction of pressure of from ten to twenty pounds in the train-pipe. The effect of this sudden diminution of pressure in the train-pipe is immediately mani-  
 130 fested at the triple-valve mechanism on the first car, causing the valve-piston 29 to be moved by the higher pressure of auxiliary-reservoir air quickly to its full outward posi-

tion, thus moving the main valve 22 and opening the main port *c*, so that the air-pressure contained in the valve-chamber C may exhaust freely into the brake-cylinder. The supply of air from auxiliary reservoir to the valve-chamber is conducted through the restricted or small passage B. Hence when the main port *c* is fully opened and the air in valve-chamber C escapes through the larger passage thus provided, the pressure in said valve-chamber is quickly reduced below that in the piston-chamber D on the auxiliary-reservoir side, notwithstanding the fact that both the valve-chamber and the piston-chamber on said side receive air from the same source—*i. e.*, the auxiliary reservoir. The exhaustion of pressure from the valve-chamber C or the great reduction of pressure therein following the sudden opening of the main port *c* brings said air-pressure below that existing in the train-pipe, whereupon the check-valve 26 will be immediately unseated by said train-pipe pressure, and train-pipe air will then pass directly into the brake-cylinder J, thus effecting the quick application of the brakes and also further reduction of pressure in the train-pipe that will be sufficient to accelerate the action of the valve mechanism on the cars following. The piston 29 will in the meantime be held to its outward position by the relatively higher air-pressure from the auxiliary reservoir, which is delivered through the large passage A, while the transmission of auxiliary-reservoir air to the brake-cylinder is retarded by having to pass through the relatively smaller passage B. Thus a considerable volume of train-pipe air at lower pressure—say fifty to sixty pounds—will flow into the brake-cylinder, notwithstanding the admission of the auxiliary-reservoir air under a higher pressure, because the flow of auxiliary-reservoir air is so retarded by the smaller passage B that an appreciable period of time is required to raise the pressure in the brake-cylinder so that it and that in the auxiliary reservoir will be equal, and it is during this interval and before the pressure in the brake-cylinder is raised to equal that in the train-pipe that the air from the latter is free to enter the brake-cylinder. It will thus be seen that the sudden uncovering of the main port *c*, leading to the brake-cylinder, opens communication both between the train-pipe and brake-cylinder and also between the auxiliary reservoir and the brake-cylinder. As soon as the pressure above the check-valve, caused by the auxiliary-reservoir air plus the pressure of the spring 27, exceeds the pressure exerted by the train-pipe air on the other side the check-valve will close and the further ingress of train-pipe air to the brake-cylinder will be cut off, while the auxiliary-reservoir air will continue to flow, thus augmenting the pressure in the brake-cylinder. This valve mechanism belongs to the class of air-brake valves known as “triple valves,” of which there are numerous examples, differing some-

what in construction and embodying variations and modifications in the form and arrangement of parts; but all of them, however specially constructed, contemplate a valve structure having suitable connections for the train-pipe, the auxiliary reservoir, and the brake-cylinder, and they are provided with passages or ports leading, first, from the train-pipe to the auxiliary reservoir; second, from the said reservoir to the brake-cylinder, and, third, from the brake-cylinder to the atmosphere. Hence the name “triple valves.”

An examination of the particular embodiment of the present invention will disclose the fact that it is a triple valve *per se* without auxiliary or supplemental valve devices, and, further, that its conversion into a “quick-action” valve and its greater capacity for action over previous forms of triple valves is due to means here employed for transmitting train-pipe air direct to the brake-cylinder through the triple-valve chamber C and through the port *c* of the triple main valve, and at the same time retarding or restricting the flow of auxiliary-reservoir air to the said main port as compared with the more open or free delivery of train-pipe air to said main port. It will also be seen that a single valve 22, the main valve of the triple valve proper, here performs the office of opening a port *c* to the brake-cylinder, through which port both the train-pipe and the auxiliary-reservoir airs pass in the quick application of the brakes for emergency stops.

In my application for Letters Patent filed September 30, 1889, Serial No. 325,474, I have shown and described a valve for automatic air-brakes of the same type as that which constitutes the subject-matter of the present specification. In my said earlier application the fundamental features of the invention have been claimed. The present specification therefore relates to certain improvements in the construction of said valves.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a main valve 22, which closes and opens said port, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, and a stem having one end suitably connected with the piston and which passes loosely through the main valve and also through the said port leading to the brake-cylinder and imparts movement to the said release-valve.

2. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a main valve 22, which closes and opens said port, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the piston and which passes loosely through the main valve and also through the said port leading to the brake-



cylinder and imparts movement to the said release-valve, and a stop-shoulder on the said stem between the main valve and release-valve.

5 3. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the piston constructed to act as a gradu-  
10 ating-valve, a main valve 22, loose on said stem and which rides or floats lengthwise thereof and is wholly supported thereby and opens and closes the said port leading to the brake-cylinder, and a stop-shoulder on the  
15 stem to come in contact with the said main valve, whereby when the brakes are being applied by the graduating-valve the main valve remains immovable and the stop-shoulder coming in contact with it arrests the move-  
20 ment of the said piston.

4. A triple valve for automatic air-brakes, having, in combination, a passage from the train-pipe, a passage from the auxiliary reservoir, which is smaller or more restricted  
25 than said train-pipe passage, a main port co-acting with both of said passages and communicating between them and the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the  
30 piston, and a valve loose on said stem and which rides or floats lengthwise thereof and is wholly supported thereby and opens and closes the said main port communicating to the brake-cylinder.

35 5. A triple valve for automatic air-brakes, having, in combination, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, a main port *c*, leading to the

brake-cylinder and located between the said release-valve and piston, a stem having one  
40 end suitably connected with the piston and which passes through said port and imparts movement to the said release-valve, and said stem provided with a passage having a lat-  
45 eral port for the flow of a small volume of air to apply the brakes by graduation, and a main valve 22, which is free to ride or float lengthwise on said stem and opens and closes  
50 the said lateral graduation-port and which also opens and closes the main port leading to the brake-cylinder.

6. A triple valve for automatic air-brakes, having, in combination, a port communicating with the brake-cylinder from both the auxil-  
55 iary reservoir and the train-pipe, means for restricting the flow to the said port of auxiliary-reservoir air when applying the brakes for an emergency stop as compared with the  
60 flow of train-pipe air, a piston actuated by air-pressure, a stem having one end suitably connected with the piston and which is provided with a small passage for the flow of  
65 auxiliary-reservoir air to apply the brakes by graduation, and a main valve 22, which rides or floats loosely on said stem and is wholly supported thereby and opens and closes the  
said port communicating with the brake-cylinder and also controls the said small graduation-passage.

In testimony whereof I affix my signature in  
70 the presence of two witnesses.

GEORGE A. BOYDEN.

Witnesses:

JNO. T. MADDOX,  
F. P. DAVIS.



## On the Meaning of “Patented Invention”: Tab 5

institution of a proceeding will be in the public interest, while not strictly within the scope of that provision, will ordinarily be accepted by the courts. But the Commission's action in authorizing the filing of a complaint, like its action in making an order thereon, is subject to judicial review. The specific facts established may show, as a matter of law, that the proceeding which it authorized is not in the public interest, within the meaning of the Act. If this appears at any time during the course of the proceeding before it, the Commission should dismiss the complaint. If, instead, the Commission enters an order, and later brings suit to enforce it, the court should, without enquiry into the merits, dismiss the suit.

The undisputed facts, established before the Commission, at the hearings on the complaint, showed affirmatively the private character of the controversy. It then became clear (if it was not so earlier) that the proceeding was not one in the interest of the public; and that the resolution authorizing the complaint had been improvidently entered. Compare Gerard C. Henderson, *The Federal Trade Commission*, pp. 52-54, 174, 228-229, 337. It is on this ground that the judgment dismissing the suit is

*Affirmed.*

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SANITARY REFRIGERATOR COMPANY *v.* WINTERS ET AL.

WINTERS ET AL. *v.* DENT HARDWARE COMPANY.

CERTIORARI TO THE CIRCUIT COURTS OF APPEALS FOR THE SEVENTH AND THIRD CIRCUITS, RESPECTIVELY.

Nos. 4 and 14. Argued April 19, 22, 1929.—Decided October 14, 1929.

1. On writs of certiorari to review contrary decisions of two Circuit Courts of Appeals on whether a patent was infringed by a particular device, the plaintiff being the same in both cases and the

- defendant in one assuming defense of the other, this Court has no occasion to determine the validity of the patent claims involved, where, in the courts below, the defense conceded their validity if limited to the specific structure disclosed, and where their validity was upheld in one case, not denied in the other, and not questioned by the defense in its petition for certiorari. P. 34.
2. A decree of a Circuit Court of Appeals affirming an interlocutory order of the District Court adjudging the infringement of a patent and ordering an accounting, will not avail the patentee by way of *res judicata* or estoppel in a like suit pending before the Circuit Court of Appeals of another Circuit if not set up in the record of that case, but merely brought to the court's attention on argument. P. 35.
  3. In such case, the effect of the decree is, at most, that which it may have under the doctrine of comity; refusal to follow it is not in itself a ground for reversal. *Id.*
  4. Where there are concurrent findings of the two federal courts in one circuit that a patent has been infringed, and concurrent findings of those courts in another circuit, in a like case, that it has not, this Court, upon a review of both cases because of the conflict, will consider independently which of the decisions is correct. P. 35.
  5. Upon the undisputed evidence in these cases the question of infringement resolves itself into a question of law, depending upon a comparison between the structure disclosed on the face of the plaintiff's patent and the device complained of, and the correct application thereto of the law of equivalency. P. 36.
  6. Patent No. 1,385,102 (Claims 1-4, inclusive, and 7), issued to Winters and Crampton for an improved latch of the swinging lever type particularly adapted for use on doors of refrigerators, etc., is infringed by the defendants' latches, manufactured under Patent No 1,575,647, issued to Schrader. P. 41.
  7. A close copy which seeks to use the substance of the invention, and, although showing some changes in form and position, uses substantially the same devices, performing precisely the same offices with no change in principle, constitutes an infringement. P. 42.
  8. Even where, in view of the state of the art, the invention must be restricted to the form shown and described by the patentee and cannot be extended to embrace a new form which is a substantial departure therefrom, it is nevertheless infringed by a device in which there is no substantial departure from the description in the patent, but a mere colorable departure therefrom. P. 42.

9. Undisputed facts clearly showing infringement by a device made under a later patent, *held* not to be overcome by any presumption of the validity of that patent. P. 43.

24 F. (2d) 15, affirmed.

28 F. (2d) 583, reversed.

CERTIORARI, 278 U. S. 587, to review two decrees of different Circuit Courts of Appeals in suits for infringements of a patent. In No. 4 the court below sustained a District Court decree of injunction and for an accounting. In No. 14 the court below affirmed a District Court decree dismissing the bill because of non-infringement. See 20 F. (2d) 671.

*Mr. E. Hayward Fairbanks* for Sanitary Refrigerator Company and Dent Hardware Company.

*Messrs. Frank E. Liverance, Jr., and John Boyle, Jr.,* for Winters and Crampton.

MR. JUSTICE SANFORD delivered the opinion of the Court.

These are two suits in equity relating to letters patent No. 1,385,102 for improvements in latches, issued to Winters and Crampton July 19, 1921. They were heard together here. The invalidity of the two general claims of the patent, 5 and 6, has been conceded, and the issues here are limited to the five specific claims, 1, 2, 3, 4, and 7.

In No. 4—hereinafter referred to as the Sanitary case—Winters and Crampton brought suit in the Eastern District of Wisconsin against the Sanitary Refrigerator Co. for infringement of the patent by the latch which it used in the manufacture of refrigerators. The Dent Hardware Co., which had manufactured and sold the latches to the Refrigerator Co., although not itself a party to the suit, employed counsel and conducted the defense of the suit at its own expense. The District Court, after a

hearing on pleadings and proof, held that the patent was valid and infringed, enjoined further infringement and ordered an accounting. On appeal to the Circuit Court of Appeals for the Seventh Circuit, the defendant admitted the validity of the five specific claims, "accompanied by the statement that validity was recognized only in view of an asserted construction which gave to each so narrow a field that infringement was not disclosed." The court, finding that the sole issue remaining was one of the infringement of these claims, held that, while they were extremely narrow and were restricted to the particular structure disclosed, they had some range of equivalency and were infringed by the defendant's latch; and affirmed the decree of the District Court in respect to them. 24 F. (2d), 15.

In No. 14—hereinafter referred to as the Dent case—Winters and Crampton, after the decree of the District Court in the Sanitary case but before that of the Circuit Court of Appeals, brought a suit for infringement in the Eastern District of Pennsylvania against the Dent Hardware Co., the manufacturer of the refrigerator latches. The District Court, on final hearing, held that as to the five specific claims the question was not as to their validity but as to their scope, there being in effect no denial of the plaintiff's right to the specific construction described, and that these claims should be so read as to restrict their right to the specific construction and were not infringed by the defendant's latches; and dismissed the bill of complaint. On appeal to the Circuit Court of Appeals for the Third Circuit, the defendant again conceded that the five claims "were valid if limited to the specific structure disclosed," but claimed that, when so limited, it did not infringe. The court, while it had grave doubt as to the validity of these claims, finding that, if valid, their scope was clearly confined to the structural design dis-

closed and had only a narrow range of equivalency—and not agreeing with the opinion of the Circuit Court of Appeals in the Sanitary case, which meanwhile had been handed down—held that they were not infringed by the Dent latch; and affirmed “the decree of the District Court, dismissing the bill because of noninfringement.” 28 F. (2d) 583.

There being a conflict of opinion between the two Circuit Courts of Appeals on the question of infringement, writs of certiorari were thereafter granted in both cases.<sup>1</sup>

1. Since both courts in the Sanitary case held the five specific claims to be valid, and neither court in the Dent case held them to be invalid, and the Hardware Co. in defending for the Refrigerator Co. in the Sanitary case and for itself in the Dent case, admitted in both Circuit Courts of Appeals that these claims were valid if limited to the specific structure disclosed, we have no occasion here to determine the question as to the validity of these claims when thus limited; especially as the petition for certiorari in the Sanitary case did not question the decree of the Circuit Court of Appeals for the Seventh Circuit in respect to the validity of these claims, but assigned as error merely its holding in reference to the question of infringement and was based solely on the conflict between the two circuits in respect to that question.<sup>2</sup>

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<sup>1</sup> In the Sanitary case the petition for the writ of certiorari was filed before the decree of the Circuit Court of Appeals for the Third Circuit in the Dent case had been handed down; and was then denied. 278 U. S. 599. But after the handing down of that opinion, showing the conflict as to the question of infringement, was brought to our attention by a petition for rehearing, the certiorari was granted. 278 U. S. 587. However, the Refrigerator Co. did not challenge the correctness of the holding of the Circuit Court of Appeals for the Seventh Circuit that the five specific claims were valid; and the petition was based entirely on the conflict of opinion as to the question of infringement.

<sup>2</sup> See Note 1, *supra*.

2. Nor have we occasion here to consider at length whether, as urged by Winters and Crampton, the decree of the Circuit Court of Appeals for the Seventh Circuit affirming the interlocutory order of the District Court adjudging the infringement and ordering an accounting, finally and conclusively determined the question of infringement so as to become binding upon the Circuit Court of Appeals for the Third Circuit. The bill in the Dent case was filed before the judgment of the Circuit Court of Appeals for the Seventh Circuit had been rendered. This judgment was not set up by Winters and Crampton in the Dent case by any amendment to the pleadings; nor was it even introduced in evidence in that case. In short, there is nothing in the record in that case to raise the defense of *res judicata* or estoppel by judgment; and the only effect of the decree in the Seventh Circuit when called to the attention of the Circuit Court of Appeals for the Third Circuit in argument was, at most, that which it had under the doctrine of comity, constituting a rule, not of law, but of practice, convenience and expediency; and if we thought the action of the Circuit Court of Appeals for the Third Circuit "correct upon the merits, we should not reverse its action" though we were of opinion it had not given sufficient weight to that doctrine. See *Mast, Foos & Co. v. Stover Mfg. Co.*, 177 U. S. 485, 488.

3. This brings us to the question brought up for review by the writs of certiorari, as to whether the five specific claims of the Winters and Crampton patent were infringed by the refrigerator latches manufactured by the Dent Hardware Co. and used by the Refrigerator Co.

So far as this question is concerned there is no substantial difference in the evidence in the two cases. As there was a concurrent finding in the two lower courts in the Sanitary case that they were infringed, and a concurrent finding in the two lower courts in the Dent case that they



were not infringed, and the cases have been brought here because of the conflict of decision in the two Circuit Courts of Appeals, it is clear that under these circumstances, neither properly calls for the strict application of the general rule as to the acceptance by this Court of the concurrent findings of the lower courts on questions of fact, and we consider independently the question as to which of the decisions on this question is based upon the sounder reasoning and is correct. Compare *Thomson Co. v. Ford Motor Co.*, 265 U. S. 445, 447; *Concrete Appliances Co. v. Gomery*; 269 U. S. 177, 180. Furthermore upon the undisputed evidence the question of infringement resolves itself in each case into one of law, depending upon a comparison between the structure disclosed on the face of the patent and the device shown in the Dent latch, and the correct application thereto of the rule of equivalency. Compare *Singer Company v. Cramér*, 192 U. S. 265, 275.

4. In the application for their patent Winters and Crampton said: "This invention relates to a latch of the swinging lever type, particularly adapted for use on refrigerators though applicable in many other relations where a door is to be closed and held in closed position. The swinging lever latch . . . is pivotally connected at one end to the door jamb or casing, allowing the door to be opened when the latch is thrown to an upper vertical position, and coming down across the meeting edges of the casing and door when swung to horizontal position, engaging with a cam member on the door to wedge the door tightly shut. This latch is a very serviceable latch but . . . is liable to drop to horizontal position in which case the door cannot be closed without first raising the lever to upper vertical position while, many times, the door is inadvertently swung toward closed position and against the lever in its horizontal position with injury either to the lever or door or both. In the present inven-

tion, it is a primary object and purpose to provide a latch which may be pivotally connected to the door and which is automatically operated to engage with a retaining member or keeper fixed on the door casing when the door is closed irrespective of the vertical or horizontal position of the latch lever, working as well in the one case as the other. A further object of the invention is to construct a latch of few parts, whereby it may be economically made and which will be durable and efficient in service. . . . The ability to close the door and latch it automatically, irrespective of the position of the latch lever insures against injury to the latch or door and also insures that the door will be latched when it is swung shut."

Claims 1 and 7, which are typical, read as follows:

"1. In combination, a door and a casing therefor, a keeper attached to the casing comprising a base, an outstanding post and a head at the outer portion of the post, said head depending below the post and formed with upper and lower curved outer sides coming substantially to a point and with an inner upwardly and inwardly inclined side, a member attached to the door comprising a base, an integral outstanding post projecting from the base and a laterally extending arm at the upper end of the post paralleling the base, and a latch lever pivotally mounted between its ends between the said arm and base of said member, said lever having one arm formed with an under cam side extending from the pivot and adapted to be engaged under the depending portion of the keeper, a handle portion extending in the opposite direction from the pivot and another arm projecting from the handle portion a distance from the pivot and lying substantially at right angles to the first arm of the lever and likewise being formed with an inner cam side, substantially as and for the purposes described.

"7. In combination, a door and a casing therefor, a keeper attached to the casing, a latch lever pivotally

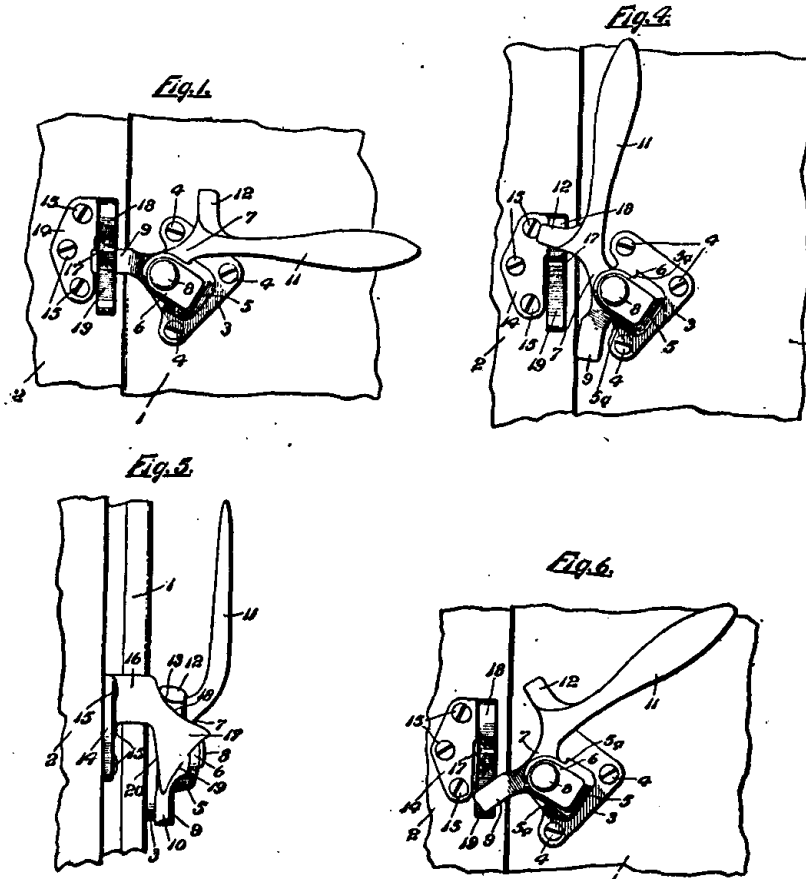
mounted on the door between its ends, one end of the lever being formed into an operating handle and the other into a keeper engaging arm, a second arm projecting from the handle portion of the lever a short distance from its pivot and at an angle to the first arm, said keeper being formed at its outer sides for engagement with the respective arms when the lever is in horizontal and vertical positions, respectively, as the door is closed, to automatically operate the lever so that it will engage under the keeper when the door is entirely closed, substantially as described."

We insert here reproductions (on a reduced scale) of Figure 4 of the drawings which is a front elevation showing the door approaching closed position with the swinging lever in vertical relation to the door; Figure 5, a side elevation thereof; Figure 6, a front elevation showing the action on the swinging lever as the door approaches closed position after the lever has been in horizontal position; and Figure 1, a front elevation showing the latch in closed position and holding a door closed. These show the patented device in detail.

The operation of closing and latching the door is thus described in the specification:

"When the door is moved toward closing position with the lever vertically located, the cam side 13 of arm 12 strikes against the curved upper side 18 of head 17, causing the lever to be automatically swung toward the horizontal, and bringing the arm 9 into place so as to pass under the lower point of the keeper head so that it may engage at its outer side against the wedging cam side 20 of the head. It is apparent that by giving the end of handle 11 a downward movement, the door will be wedged tightly shut as the arm 9 moves upwardly and against the incline 20. . . . If the lever has dropped to horizontal position while the door is open, the closure of the door and engagement of the lever with the keeper is accomplished by merely swinging the door shut, in which case, as shown in Figs. 6

and 7, the arm 9 strikes with its inclined cam side 10 against the lower curved side 19 of the head 17 of the keeper, causing the handle to be automatically turned toward vertical position. This movement continues until the arm 9 passes by the lower point of the keeper head 17 or, as usually occurs, the arm 12 comes into contact with the head at the upper side 18, whereupon the lever is actu-



ated so as to bring the arm 9 under the depending portion of the keeper, the same as before described when closing the door with the lever in vertical position. In any case, the latch lever engages with the latch keeper when the door is closed irrespective of the position of the lever."

While this patent came into a prior art crowded with various latch devices for holding a door in closed position

when it was shut and was not a pioneer patent entitled to a broad range of equivalents, the structure which it disclosed was meritorious and soon attained a large measure of commercial success.

5. The Dent latch is manufactured under letters patent No. 1,575,647 for lock devices for refrigerator doors issued March 9, 1926 to T. O. Schrader, assignor of the Hardware Co. In his application for this patent Schrader said: "I am aware of [Winters and Crampton] patent No. 1,385,102 dated July 19, 1921, and I disclaim the structure therein disclosed, as my invention is differentiated therefrom, since whereas the structure disclosed in said patent utilizes a pin 12 carried by the latch arm 11, which coacts with an upper cam edge 18 of the keeper member 17; in my novel construction the upper edge of my keeper plate *b*<sup>3</sup> has no function, but the pivotal latch *c*<sup>6</sup> carries a cam *c*<sup>2</sup> inclined to the pivot of said latch and adapted to coact with a pin *b*<sup>8</sup> carried by and laterally projecting from, the inner wall of the keeper plate *b*<sup>3</sup> thereby to swing the terminal tongue of the latch into the horizontal locking position; and to none of the constructions of the prior art do I herein make claim."

The latch manufactured by the Hardware Co. which is involved in both these cases, differs only slightly in form from that shown in the Schrader patent. It is in the main an exact reproduction of the structure disclosed in the Winters and Crampton patent. It has like it a keeper attached to the door casing, with a triangular head, and a lever latch with a handle and two arms whose functions are to trip or give a kick to the latch lever by their coaction with the keeper head, and wedge the lower arm under it, regardless of the position of the latch lever when the closing operation begins. The only differences are that in the Dent latch the keeper has on the inner or door side of the triangular head a lug projecting inwardly towards the latch lever; and the upper arm of the latch lever is a short

inclined cam placed at the pivot of the latch lever, and so constructed and at such an angle that it rides upon and contacts with the lug on the side of the keeper head, instead of with its upper curved side as in the Winters and Crampton structure. The coaction of this shortened arm with the lug operates, however, on the cam principle, just as the coaction of the longer upper arm with the curved upper surface of the keeper head in the Winters and Crampton structure, to trip or kick the lower arm of the latch lever into the wedged position under the keeper head.

6. Despite the changes in the Dent latch from the Winters and Crampton structure we find that the two devices are substantially identical, operating upon the same principle, and accomplishing the same result in substantially the same way, and that the slight change in the form of the Dent latch is merely a colorable departure from the Winters and Crampton structure.

In the Dent latch, as stated by the Circuit Court of Appeals for the Seventh Circuit, the lug on the inner side of the triangular head of the keeper is a part of the side of the head. And at the place where the shortened upper arm of the latch lever comes in contact with it, the surface of this lug forms in effect the upper side of the keeper head as a substitute for the upper side in the Winters and Crampton structure, which, while left in place, performs no function whatever, just as if it were cut away.

Although the claims of the Winters and Crampton patent are limited to the structure therein disclosed, we find that they are infringed by the device of the Dent latch. Both Circuit Courts of Appeals recognized that the Winters and Crampton patent, although thus limited had some range of equivalents; and we think that, though it be a narrow one, it is sufficient.

There is a substantial identity, constituting infringement, where a device is a copy of the thing described

by the patentee, "either without variation, or with such variations as are consistent with its being in substance the same thing." *Burr v. Duryee*, 1 Wall. 531, 573. Except where form is of the essence of the invention, it has little weight in the decision of such an issue; and, generally speaking, one device is an infringement of another "if it performs substantially the same function in substantially the same way to obtain the same result. . . . Authorities concur that the substantial equivalent of a thing, in the sense of the patent law, is the same as the thing itself; so that if two devices do the same work in substantially the same way, and accomplish substantially the same result, they are the same, even though they differ in name, form, or shape." *Machine Co. v. Murphy*, 97 U. S. 120, 125. And see *Elizabeth v. Pavement Co.*, 97 U. S. 126, 137. That mere colorable departures from the patented device do not avoid infringement, see *McCormick v. Talcott*, 20 How. 402, 405. A close copy which seeks to use the substance of the invention, and, although showing some change in form and position, uses substantially the same devices, performing precisely the same offices with no change in principle, constitutes an infringement. *Ives v. Hamilton*, 92 U. S. 426, 430. And even where, in view of the state of the art, the invention must be restricted to the form shown and described by the patentee and cannot be extended to embrace a new form which is a substantial departure therefrom, it is nevertheless infringed by a device in which there is no substantial departure from the description in the patent, but a mere colorable departure therefrom. Compare *Duff v. Sterling Pump Co.*, 107 U. S. 636, 639.

The fact that, as the Dent device makes two reciprocal changes in the form of the Winters and Crampton structure, one by the insertion of the lug on the keeper head, and the other in the shortened upper arm of the latch

lever, and one alone of these changes cannot be substituted in the Winters and Crampton structure without the other, so as to make it operative, is plainly insufficient to avoid the infringement.

Nor is the infringement avoided, under the controlling weight of the undisputed facts, by any presumptive validity that may attach to the Schrader patent by reason of its issuance after the Winters and Crampton patent.

The decree of the Circuit Court of Appeals for the Seventh Circuit in the Sanitary case is affirmed; and the decree of the Circuit Court of Appeals for the Third Circuit in the Dent case is reversed.

*No. 4 Affirmed.*

*No. 14 Reversed.*

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COLGATE, ADMINISTRATOR, *v.* UNITED STATES.

APPEAL FROM THE COURT OF CLAIMS.

No. 74. Jurisdictional Statement Submitted October 14, 1929.—  
Decided November 4, 1929.

Under a Special Jurisdictional Act approved March 3, 1927, (44 Stat. 1807,) which referred back to the Court of Claims for rendition of a judgment certain findings of fact theretofore made by it and reported to Congress, and provided for an "appeal" to this Court by either party "upon or from any conclusion of law or judgment, from which appeals now lie in other cases," the review intended was the usual method of review at the date of the Special Act, which was and is by application for a writ of certiorari, and not a technical appeal. P. 45.

APPEAL under a Special Jurisdictional Act from a judgment for the Government rendered by the Court of Claims on a claim against the United States for alleged patent infringement. A petition for certiorari had been denied. See *post*, p. 553.





On the Meaning of “Patented Invention”: Tab 6

A. F. WINTERS AND B. R. CRAMPTON.

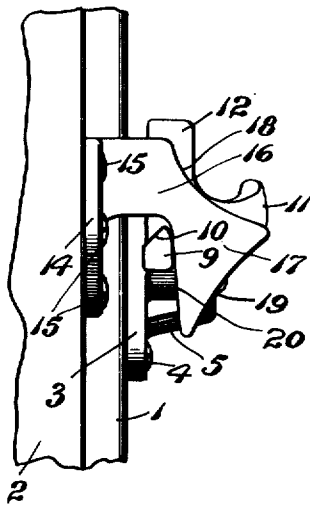
LATCH.

APPLICATION FILED DEC. 7, 1920.

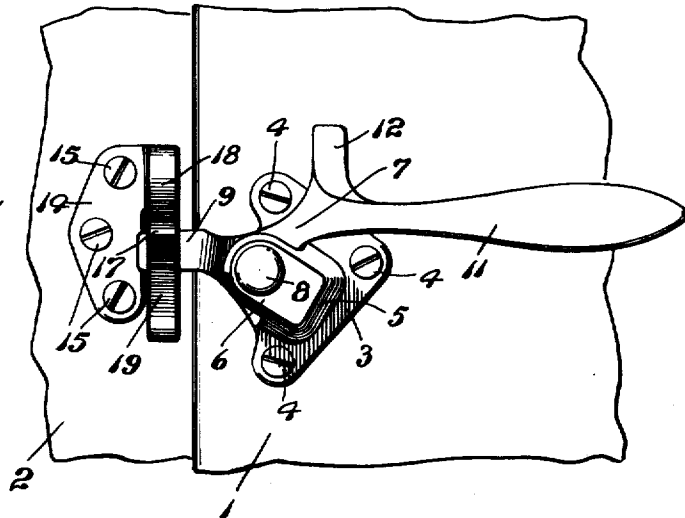
1,385,102.

Patented July 19, 1921.

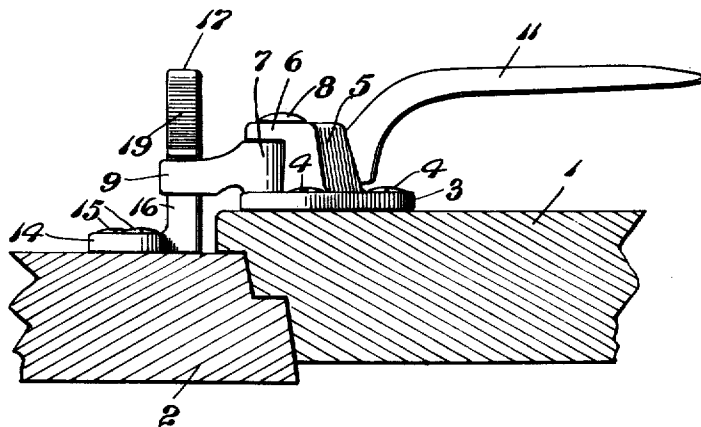
2 SHEETS—SHEET 1.



*Fig. 2.*



*Fig. 1.*



*Fig. 3.*

*Inventors*

*Alexander F. Winters*

*Basil R. Crampton*

*By*

*Frank E. Liverance, Jr.*

*Attorney*

A. F. WINTERS AND B. R. CRAMPTON.

LATCH.

APPLICATION FILED DEC. 7, 1920.

1,385,102.

Patented July 19, 1921.

2 SHEETS—SHEET 2.

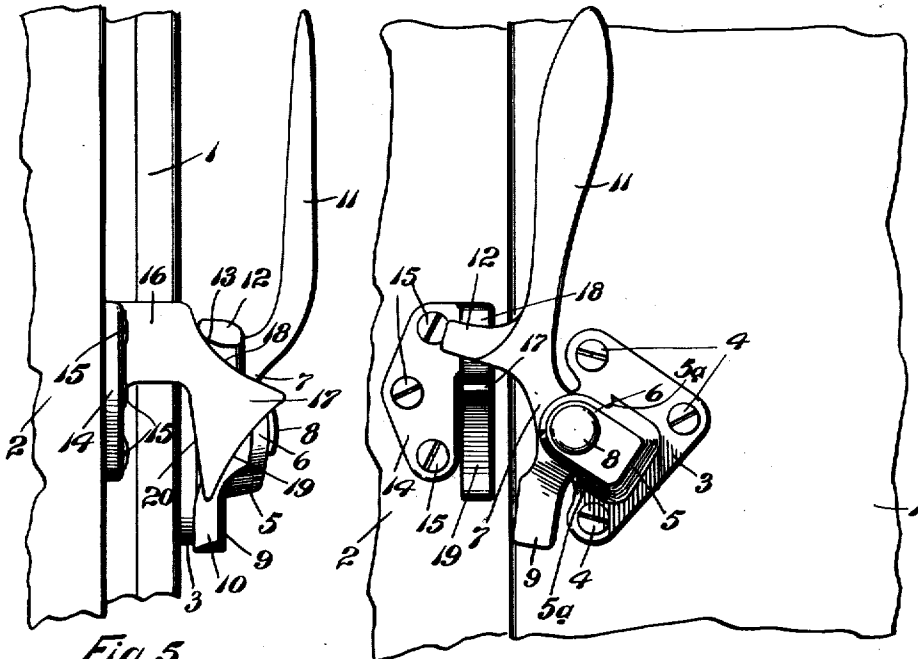


Fig. 5.

Fig. 4.

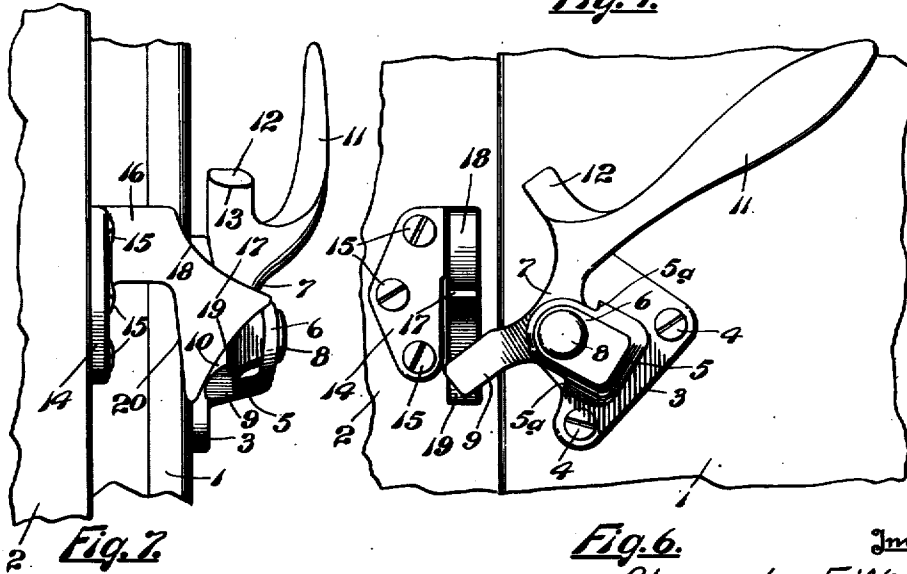


Fig. 7.

Fig. 6.

Inventors

Alexander F. Winters

Basil R. Crampton

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Attorney

# UNITED STATES PATENT OFFICE.

ALEXANDER F. WINTERS AND BASIL R. CRAMPTON, OF GRAND RAPIDS, MICHIGAN.

## LATCH.

1,385,102.

Specification of Letters Patent. Patented July 19, 1921.

Application filed December 7, 1920. Serial No. 428,891.

*To all whom it may concern:*

Be it known that we, ALEXANDER F. WINTERS and BASIL R. CRAMPTON, citizens of the United States of America, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Latches; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a latch of the swinging lever type, particularly adapted for use on refrigerators though applicable in many other relations where a door is to be closed and held in closed position. The swinging lever latch, or as it is better known, the Condit latch, is pivotally connected at one end to the door jamb or casing, allowing the door to be opened when the latch is thrown to an upper vertical position, and coming down across the meeting edges of the casing and door when swung to horizontal position, engaging with a cam member on the door to wedge the door tightly shut. This latch is a very serviceable latch but is relatively hard to operate due to its attachment to the casing instead of the door, and the same is liable to drop to horizontal position in which case the door cannot be closed without first raising the lever to upper vertical position while, many times, the door is inadvertently swung toward closed position and against the lever in its horizontal position with injury either to the lever or door or both. In the present invention, it is a primary object and purpose to provide a latch which may be pivotally connected to the door and which is automatically operated to engage with a retaining member or keeper fixed on the door casing when the door is closed irrespective of the vertical or horizontal position of the latch lever, working as well in the one case as the other. A further object of the invention is to construct a latch of few parts, whereby it may be economically made and which will be durable and efficient in service. Other objects and purposes will appear as understanding of the invention is had from the following description, taken in connection with the accompanying drawings, in which,

Figure 1 is a front elevation showing the latch in closed position and holding a door closed.

Fig. 2 is a side elevation thereof.

Fig. 3 is an under plan view of the latch, the door and adjacent portion of the casing therefor being in section.

Fig. 4 is a view similar to Fig. 1 showing the door approaching closed position with the swinging lever in vertical relation to the door.

Fig. 5 is a side elevation thereof.

Fig. 6 is a front elevation showing the action on the swinging lever as the door approaches closed position after said lever has been in horizontal position, and

Fig. 7 is a side view thereof.

Like reference characters refer to like parts in the different figures of the drawings.

The door 1 and the adjacent portion of the casing 2 against which the free vertical edge of the door comes in closing are shown fragmentarily, only enough being shown to disclose the attachment of the lever and keeper thereto. The lever is carried by the door. A base 3, attached to the door by screws 4 or equivalent connecting means has an integral outstanding post 5 from which, at the outer end an arm 6 extends over and paralleling the base. The lever 7 is placed between said arm and the base and a pivot pin 8 passed through the same, pivotally mounting the lever at a point between its ends. An arm 9 forming a part of the lever extends from the pivot and is adapted to cross the meeting edges of the door and casing when the door is closed and the lever in horizontal position, this arm passing under the keeper attached to the door casing. The under side of the arm 9 is formed at an angle as indicated at 10 the purpose of which will later appear.

In the opposite direction the lever extends from the pivot and is formed into a handle 11 set out a distance from the door to allow the passage of the fingers of the operator between it and the door. A short distance from the pivot an arm 12 is formed integral with the lever, being located substantially at right angles to the arm 9. The under side of arm 12 when the lever is vertically positioned is formed with a rounded cam surface 13, as shown, the purpose of which will also appear later.

The keeper comprises a base 14 attached to the casing 2 by screws 15 or like fastening means from which a post 16 extends outwardly for a short distance terminating in a

head 17 which is extended downwardly for a distance below the lower edge of the post. The head on its outer sides is formed with two curved surfaces 18 and 19 which come to a point substantially at the front and between the upper and lower ends of said head, while on its inner side it is cut upwardly and inwardly at a slight angle to the vertical, forming a wedging cam 20, as shown.

The latch lever may be thrown to upper position, as shown in Fig. 4, being stopped from going beyond such position by engagement of the arm 9 with the lower shoulder 5<sup>a</sup> made by post 5. It may also be carried to a horizontal position, being likewise stopped when it reaches such position by the upper shoulder 5<sup>a</sup>. When the door is moved toward closing position with the lever vertically located, the cam side 13 of arm 12 strikes against the curved upper side 18 of head 17, causing the lever to be automatically swung toward the horizontal, and bringing the arm 9 into place so as to pass under the lower point of the keeper head so that it may engage at its outer side against the wedging cam side 20 of the head. It is apparent that by giving the end of handle 11 a downward movement, the door will be wedged tightly shut as the arm 9 moves upwardly and against the incline 20. To open the door it is merely necessary to grasp handle 11 and turn it to upper position, thus releasing the door, and the door may be opened at the same time by pulling outwardly on the handle after arm 9 has disconnected from the keeper.

If the lever has dropped to horizontal position while the door is open, the closure of the door and engagement of the lever with the keeper is accomplished by merely swinging the door shut, in which case, as shown in Figs. 6 and 7, the arm 9 strikes with its inclined cam side 10 against the lower curved side 19 of the head 17 of the keeper, causing the handle to be automatically turned toward vertical position. This movement continues until the arm 9 passes by the lower point of the keeper head 17 or, as usually occurs, the arm 12 comes into contact with the head at the upper side 18, whereupon the lever is actuated so as to bring the arm 9 under the depending portion of the keeper, the same as before described when closing the door with the lever in vertical position. In any case, the latch lever engages with the latch keeper when the door is closed irrespective of the position of the lever. This is a feature of merit in the invention and one of particular value from a practical standpoint when the latch is used on refrigerators.

This latch construction is very simple, consisting of but three parts and a pivot pin, all of which may be readily cast from metal or formed with proper dies from sheet metal. The mounting of the lever on the

door is of value as use of one hand only is necessary for unlatching and drawing the door open. The ability to close the door and latch it automatically, irrespective of the position of the latch lever insures against injury to the latch or door and also insures that the door will be latched when it is swung shut. All of these features combined in the latch structure make it one of exceptional merit.

We claim:

1. In combination, a door and a casing therefor, a keeper attached to the casing comprising a base, an outstanding post and a head at the outer portion of the post, said head depending below the post and formed with upper and lower curved outer sides coming substantially to a point and with an inner upwardly and inwardly inclined side, a member attached to the door comprising a base, an integral outstanding post projecting from the base and a laterally extending arm at the upper end of the post paralleling the base, and a latch lever pivotally mounted between its ends between the said arm and base of said member, said lever having one arm formed with an under cam side extending from the pivot and adapted to be engaged under the depending portion of the keeper, a handle portion extending in the opposite direction from the pivot and another arm projecting from the handle portion a distance from the pivot and lying substantially at right angles to the first arm of the lever and likewise being formed with an inner cam side, substantially as and for the purposes described.

2. In combination, a door and a casing therefor, a keeper attached to the casing including an outer head spaced from the casing and formed with upper and lower curved outer sides coming substantially to a point and with an inner upwardly and inwardly inclined side, a member secured to the door, and a latch lever pivotally mounted between its ends on said member, said lever having one arm extended from the pivot adapted to ride against the lower outer side of the keeper head when the door is closed with the lever in horizontal position to automatically turn the lever to bring said arm back of the head, a handle portion extending in the opposite direction from said pivot and a second arm projecting from the handle portion at an angle to the first arm and adapted to ride against the upper outer side of the keeper when the door is closed with the lever positioned vertically to throw the lever to horizontal position and automatically engage the first arm with the keeper back of said head, substantially as described.

3. In combination with a door and casing therefor, of a keeper attached to the casing and a latch lever pivotally connected to the

door and engageable with the keeper to hold the door in closed position, of means on the keeper and means on the latch lever to engage with the keeper on the outer sides thereof to swing the lever into engagement with the keeper at the inner side thereof when the door is closed with the lever occupying either a vertical or a horizontal position, substantially as described.

4. In combination with a door and casing therefor, of a keeper attached to the casing and a latch lever pivotally connected to the door and engageable with the keeper to hold the door in closed position, of two arms on the latch lever one of which is engaged with an outer portion of the keeper when the door is moved to closing position to swing the lever from a vertical position to a horizontal position and engage the other arm under the keeper, and the other of which is engaged with a different outer portion of the keeper when the door is moved to closing position and the lever is horizontal to turn the lever upwardly toward vertical position or until said other arm passes under and engages with the keeper to hold the door closed, substantially as described.

5. In a latch of the character described, a supporting member adapted to be attached to a door, and a latch lever pivotally mounted between its ends thereon, said lever includ-

ing one arm extending from the pivot, a handle portion extending in the opposite direction from the pivot, and a second arm extending from the handle portion adjacent the pivot and in a direction substantially at right angles to the first arm, substantially as described.

6. A latch containing the elements in combination defined in claim 5, said arms on their inner sides being formed with cam surfaces, substantially as described.

7. In combination, a door and a casing therefor, a keeper attached to the casing, a latch lever pivotally mounted on the door between its ends, one end of the lever being formed into an operating handle and the other into a keeper engaging arm, a second arm projecting from the handle portion of the lever a short distance from its pivot and at an angle to the first arm, said keeper being formed at its outer sides for engagement with the respective arms when the lever is in horizontal and vertical positions, respectively, as the door is closed, to automatically operate the lever so that it will engage under the keeper when the door is entirely closed, substantially as described.

In testimony whereof we affix our signatures.

ALEXANDER F. WINTERS.  
BASIL R. CRAMPTON.



On the Meaning of “Patented Invention”: Tab 7

March 9, 1926.

1,575,647

T. O. SCHRADER

LOCK DEVICE FOR REFRIGERATOR DOORS

Filed June 30, 1925

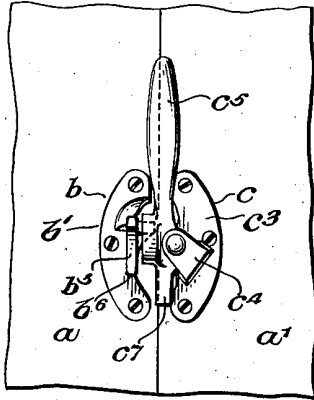


Fig. 1.

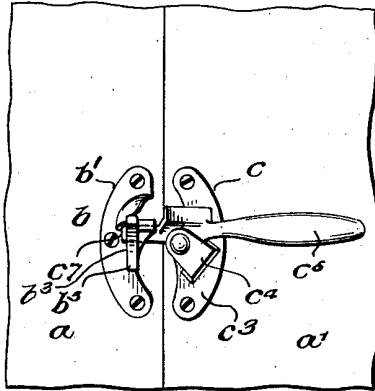


Fig. 2.

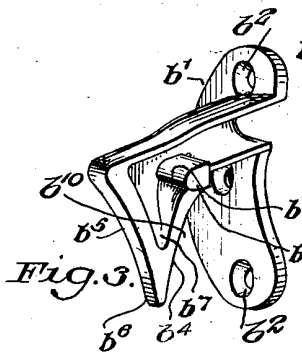


Fig. 3.

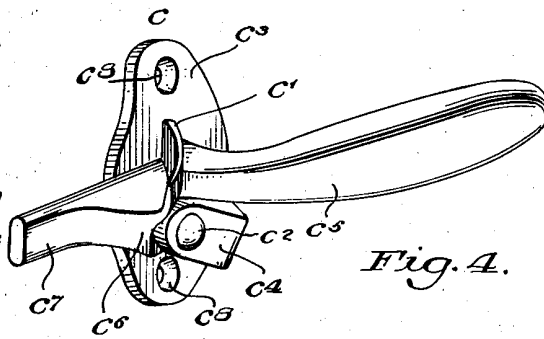


Fig. 4.

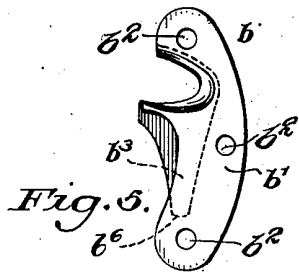


Fig. 5.

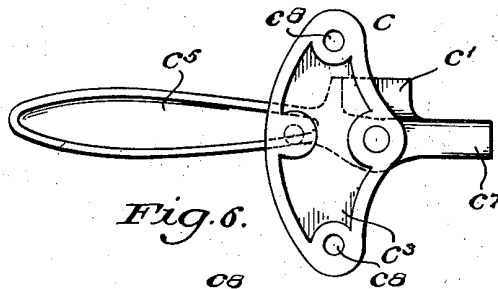


Fig. 6.

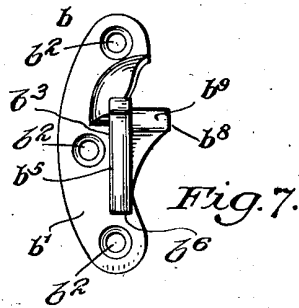


Fig. 7.

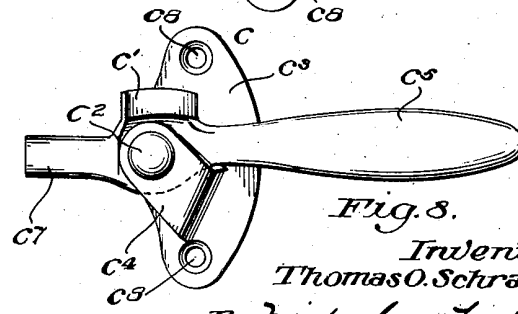


Fig. 8.

Inventor:  
Thomas O. Schrader

By *Wiederheim & Furlong*  
Attorneys



# UNITED STATES PATENT OFFICE.

THOMAS O. SCHRADER, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO DENT HARDWARE CO., OF FULLERTON, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## LOCK DEVICE FOR REFRIGERATOR DOORS.

Application filed June 30, 1925. Serial No. 40,474.

*To all whom it may concern:*

Be it known that I, THOMAS O. SCHRADER, a citizen of the United States, residing at the city of Allentown, in the county of Lehigh and State of Pennsylvania, have invented a certain new and useful Lock Device for Refrigerator Doors, of which the following is a specification.

My invention relates to a locking device for refrigerator and other doors; and in such connection it relates more particularly to a locking device adapted to be operated by the slamming or quick closing of the door, thereby to cause an automatic and instantaneous engagement between a movable tongue member and a stationary keeper of said locking device.

In the employment of locking devices on refrigerators, it is desirable, as well as important, to provide a fastening device for such structures that can be readily and quickly manipulated to both open and to close the door thereof, and also to maintain said door tightly locked, in the closed position, yet nevertheless, in such a manner as to be capable of being easily released when required; and to the foregoing ends, my present invention has been particularly designed, with a view to simplicity of structure and operation for effecting not only quick opening of the door but also quick closing of the same.

My invention, stated in general terms, consists of a refrigerator locking device constructively arranged in substantially the manner hereinafter described and claimed.

The nature and characteristic features of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings forming part hereof, in which—

Figure 1 is a fragmentary view in elevation of refrigerator parts showing the same provided with a locking device embodying main features of my invention, with the door of the refrigerator shown in partly open position, and the locking device unlatched.

Figure 2 is a similar view with the locking device in latched position.

Figures 3 and 4 are respectively, enlarged, detached perspective views of the locking device of my present invention comprising

the keeper member and the locking member.

Figures 5 and 6 are respectively, rear end views of the keeper and tongue members of the automatically actuating refrigerator lock, defining the particular arrangement of the same, and

Figures 7 and 8 are similar views from the opposite side of the respective keeper and tongue members, showing the structural arrangement of the same.

For the purpose of illustrating my invention I have shown in the accompanying drawings several forms thereof which are at present preferred by me, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

Referring to the drawings the reference letter *a* designates a refrigerator structure and *a*<sup>1</sup> the door thereof. There is shown applied to the structure *a*, the keeper member *b*, of my invention, which in structural arrangement, consists of a baseplate *b*<sup>1</sup>, formed with apertures *b*<sup>2</sup> for the reception of screws, to adapt the same for being secured in place, adjacent to the door opening. The keeper plate *b*<sup>3</sup> is formed integral with the base plate *b*<sup>1</sup> and projects upwardly therefrom at substantially a right angle thereto. The keeper plate *b*<sup>3</sup> is provided with the rear and front downwardly converging concaved edges *b*<sup>4</sup> and *b*<sup>5</sup> respectively; meeting in the downwardly projecting nose *b*<sup>6</sup>. The keeper plate *b*<sup>3</sup> is hollowed out at *b*<sup>7</sup> on its inner side and is provided with a laterally projecting pin *b*<sup>8</sup>, formed integral therewith and having the convexed front surface *b*<sup>9</sup>, forming a riding surface for a cam *c*<sup>1</sup>, of the locking member *c*, to be presently fully explained. The laterally projecting pin *b*<sup>8</sup> of the keeper plate *b*<sup>3</sup> serves to encounter a cam *c*<sup>1</sup> of the latch member *c* when the door is closed, thereby causing the handle *c*<sup>2</sup> of said latch member *c* to swing into a horizontal locking position and hence causing the tongue *c*<sup>3</sup> thereof to be wedged upwardly against the rear concaved edge *b*<sup>4</sup> of the

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keeper plate  $b^3$ , by the weight and momentum of the handle  $c^5$ , thereby to hold said tongue  $c^7$  securely in such locked position until it is desired to open the door  $a'$ , for any purpose.

The latch member  $c$  consists of a base plate  $c^3$ , perforated at  $c^8$ , for the reception of screws and provided with a right angular bearing bracket  $c^4$ , formed integral therewith, which is adapted to support the pivotal latch  $c^6$ . The pivotal latch  $c^6$ , carried by the pivot pin or rivet  $c^3$ , consists of the handle portion  $c^5$  and the tongue  $c^7$  extending in the opposite direction and in alinement therewith, and is also provided with the inclined concaved cam  $c^1$  also formed integral therewith, as shown particularly in Figure 4.

The described arrangement of keeper and latch is such that by slamming of the door with the lever rod or handle in a substantially vertical position and with the cam  $c^1$  thereof laterally projecting, the latter will contact with the pin  $b^8$  of the keeper  $b$ , so that the handle  $b^5$  will be deflected downwardly causing the tongue to enter the recess  $b^{10}$  behind the keeper plate  $b^3$  at the same time the cam  $c^1$  will ride onto the pin  $b^8$ , of the said keeper to impart momentum to the handle  $b^5$  and thus to force the tongue  $c^7$  into a wedging position in the recess  $b^{10}$  of said keeper thereby to hold the door securely against opening until a reversed movement of the lever rod which causes the cam to ride again over the pin  $b^8$ , of the keeper, and simultaneously therewith, causing the tongue  $c^7$  to be withdrawn from the recess  $b^{10}$  of the keeper  $b$ . In this position, the door occupies an open relation with respect to the refrigerator for access thereto.

The fastener will close automatically, due to the cam action, whether the handle is in horizontal or perpendicular position. When in horizontal position the tongue  $c^7$  rides the strike, or concave edge  $b^5$ , and the cam  $c^1$  will strike the pin  $b^8$  as the tongue reaches the nose  $b^6$  or lower terminal of the front concaved edge  $b^5$ , and give it momentum to throw the tongue under the rear concaved edge  $b^4$  of the keeper plate into recess  $b^{10}$ , closing the latch or fastener. When in perpendicular position the cam  $c^1$  rides the pin  $b^8$ , giving the handle momentum to throw the tongue  $c^7$  under the keeper plate  $b^3$  into the recess  $b^{10}$ , again throwing the latch into locked position.

I am aware of Patent No. 1385102 dated July 19, 1921, and I disclaim the structure therein disclosed, as my invention is differentiated therefrom, since whereas the structure disclosed in said patent utilizes a pin 12 carried by the latch arm 11, which coacts with an upper cam edge 18 of the keeper member 17; in my novel construction the upper edge of my keeper plate  $b^3$  has no

function, but the pivotal latch  $c^6$  carries a cam  $c^1$  inclined to the pivot of said latch and adapted to coact with a pin  $b^8$  carried by and laterally projecting from, the inner wall of the keeper plate  $b^3$  thereby to swing the terminal tongue of the latch into the horizontal locking position; and to none of the constructions of the prior art do I herein make claim.

It will now be apparent that I have devised a novel and useful construction which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description and while I have in the present instance shown and described the preferred embodiments thereof which have been found in practice to give satisfactory and reliable results, it is to be understood that the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a device of the character stated a fixed structure having an opening, a door for closing said opening, a keeper having a pin projecting laterally from its inner wall and a rear cam riding surface and a bottom recessed portion, a locking member for said door comprising a pivotal handle having a projected tongue in substantial alignment with the handle, said handle having an upper cam arranged at an angle to said handle and tongue whereby closing of said door causes said cam to be engaged by said pin to tilt said handle and to cause said tongue to engage said bottom recessed portion to automatically lock said door.

2. In a device of the character stated a fixed structure having an opening, a door for closing said opening a keeper of integral structure having a pin projecting laterally from its inner wall, said pin having its outer wall substantially convexed, and a rear cam riding surface and a bottom recessed portion, a locking member for said door comprising a pivotal handle having a projected integral tongue in substantial alignment with the handle, said handle having an upper cam arranged at an angle to said handle and tongue and integral therewith whereby closing of said door causes said cam to be engaged by said convexed pin to tilt said handle and to cause said tongue to engage said bottom recessed portion to automatically lock said door.

3. In a device of the character stated, a keeper plate having a bottom front, down and rearwardly inclined cam edge and a rear substantially upright locking edge, a pivotally mounted latch member including a handle and a terminal tongue in substantial alignment with each other, and an up-

per cam carried thereby, inclined to the axis of the pivot of said latch member; said terminal tongue being adapted to ride downwardly along said front cam edge of said keeper plate to deflect said latch member into a substantially upright position and said tongue being adapted to interlock with said upright rear locking edge on said keeper plate, when said latch member is in a substantially horizontal position, and a laterally projecting pin carried by the inner wall of said keeper plate and adapted to coact with said upper inclined cam carried by said latch member to deflect the latter from a substantially upright to a horizontal position, so as to cause said terminal tongue to interlock with said rear locking edge of said keeper plate.

THOS. O. SCHRADER.



On the Meaning of “Patented Invention”: Tab 8

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY *v.* FORMICA INSULATION COMPANY.

CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT.

No. 102. Argued October 22, 23, 1924.—Decided December 8, 1924.

1. An assignment of a patent, or of the invention upon which a patent is subsequently granted to the assignee, though not required to be under seal, works an estoppel as by deed, preventing the assignor from denying the novelty and utility of the patented invention when sued by the assignee for infringement. P. 348.
2. This estoppel, however,—distinct from any that might arise *in pais* from special representation,—while it estops the assignor from denying the validity of the claims, does not prevent him from narrowing or qualifying their construction by showing the state of the art. Pp. 350, 352.
3. The estoppel is applicable to claims added by an assignee and allowed by the Patent Office after the assignment, which were foreshadowed by the specifications sworn to by the assignor and accompanying his application. P. 353.
4. But it will not be enlarged by a claim originally made by the assignor but so manifestly invalid that it was promptly rejected by the Patent Office as embracing the prior art. P. 354.
5. Patent No. 1,284,432, issued to the plaintiff as assignee of O'Connor, covering a process of making composite electric insulation materials by coating sheets of fibrous material, such as cardboard, with adhesive binders and subjecting them to heat and pressure, applies, as between assignor and assignee, to nonplaniform articles (claims 11 and 12, added after assignment) but only where the "two-step" procedure,—viz., application of heat and high pressure to the superposed sheets and cooling them, and then the baking of them under lower pressure,—is employed in the manufacture. P. 353.

288 Fed 330, affirmed.

THIS is a writ of certiorari to the Circuit Court of Appeals for the Sixth Circuit in a patent suit. The Westinghouse Electric Company sued the Formica Com-

pany charging it with infringement of Claims 11 and 12 of Patent No. 1,284,432, issued November 12, 1918, to the complainant as assignee, on an application of O'Connor filed February 1, 1913. The patent covered a process for making composite electric insulation materials using paper, muslin, or other fibrous material. The fabric was to be coated on one side with an adhesive liquid, such as bakelite, a condensation product of phenol and formaldehyde. It was then dried by passing it over a series of rollers in a steam-heated oven. The thickness of the coating retained by the paper was regulated by varying the distance between the two rollers and by altering the viscosity of the liquid. The prepared paper was cut into sheets of any desired size, and a plate built up to the required thickness by placing the sheets together, with the untreated side of each sheet next to the treated side of the adjacent sheet. The built-up plate was then placed between thin sheet steel plates on which had been rubbed a small amount of machine oil. Any desired number of the steel plates carrying the sheets of paper were placed between the platens of a hydraulic press which had been previously heated by steam. The press was closed and pressure applied to as much as 800 pounds per square inch. Steam heat was first applied and then a cooling period followed. The period of pressure and heat was varied in proportion to the thickness of the plate according to a table set forth. The effect was firmly to cement together the sheets of paper and further to impregnate the paper with the bakelite. Thus the plate was transformed into a hard and compact mass. After cooling, the plates of insulation were removed from the press and clamped between steel plates to prevent warping during the baking. The plates were then placed in ovens, with an air pressure of 140 pounds per square inch, and the temperature regulated between 100 and 140 degrees centigrade. These conditions were main-

tained for approximately eight hours, when the plates were removed from the oven and the finished product allowed to cool. The specifications further said that, while the process was used for plates, the material could be similarly produced in the form of channel pieces or tubes that were cylindrical or rectangular in cross section or of other shape, as desired, by pressing in forms of the proper shape. The resultant material had a specific gravity of approximately 1.25, was practically nonabsorbent, even when soaked in hot water, and was insoluble.

The first ten claims subsequently allowed in the patent referred to the so-called "two-step" process, namely, first, the application of heat and pressure to the superposed sheets and cooling them, and second, the baking of them under a lower pressure.

The 11th and 12th claims, however, were as follows:

"11. The process of manufacturing a non-planiform article which consists in superposing a plurality of layers of fibrous material associated with an adhesive substance that is adapted to harden under the influence of heat and pressure into a substantially infusible and insoluble condition, and molding the superposed layers by means of a form of the proper shape while applying pressure and heat to compact and harden the materials.

"12. The process of manufacturing a non-planiform article which consists in superposing a plurality of layers of fibrous material associated with a phenolic condensation product and molding the superposed layers by means of a form of the proper shape while applying pressure and heat to compact and harden the materials."

It will be observed that there is no express provision or requirement in the 11th and 12th claims for the "two-step" process as an element. The defendant does not use the two-step process but does make non-planiform articles.

The defenses were that the two claims were invalid for want of novelty, or if valid must be limited to the

two-step process. A second defense was that complainant had been guilty of laches estopping it from prosecuting the action, in that it had known of the defendant's manufacture of its composition and its large investment in the business without objection for four years before the claims Nos. 11 and 12 were secured by the defendant as assignee from the Patent Office and did not sue for three years thereafter.

In reply, the plaintiff urged that the defendant, being in privity with O'Connor in the assignment and the infringement, was estopped to dispute the validity of the 11th and 12th claims construed according to the ordinary meaning of their language, which, as it contended, did not require the two-step process.

The District Court sustained the defense based on complainant's laches and dismissed the bill.

On appeal, the Circuit Court of Appeals held that the defense of laches could not be sustained. Coming to consider the defense of estoppel, the Court held that on the facts no estoppel arose as to the claims sued on, and, proceeding then to the merits, found that claims 11 and 12 were invalid for lack of invention.

O'Connor was a mechanical engineer, and after graduation from college entered the employ of the Westinghouse Company at a small salary, with the understanding that he was to be allowed to work in association with experienced engineers and gain experience in the line of his profession, and that inventions made by him when in the company's employ were to become the property of the company and to be assigned by him to it. O'Connor made this invention and disclosed it by written description to the company, which through its legal department prepared his application for a patent and an assignment, both of which he executed, receiving the nominal consideration of one dollar. Thereafter, pending the appli-



cation for the patent, O'Connor left the company's employ and associated himself in business with two others in the manufacture of electric insulating material, in a partnership, which was thereafter organized into a corporation known as the Formica Company, and its stock divided between the partners. From 1913 the partnership and succeeding company have been engaged in the manufacture and sale of laminated products having a phenolic condensation binder. They have made non-planiform articles, as well as flat plates, openly and with the knowledge and acquiescence of the Westinghouse Company from the beginning in 1913 down to the time this suit was brought July 6, 1920.

When the application for the patent here in suit was filed and was assigned to the company, there were no claims based on a distinction between flat plates and non-planiform articles. But the specifications signed by O'Connor contained the following: "While the process above described is that used for making plates, the insulating material may be produced in the form of channel pieces or tubes that are cylindrical or rectangular in cross section or of other shape, as desired, by pressing in forms of the proper shape."

The art of making insulating material was well advanced when O'Connor entered it. A Haefely patent owned by the Westinghouse Company, when O'Connor began his experiments, was for a process for making a hard material offering resistance to the electric current out of paper covered with varnish, wound around a mandrel and subjected to pressure and heat. The art also showed a forming press by Haefely for pressure of flat articles for such a purpose. There was a process patent to Thomson for making insulating material by applying to paper sheets an earthy or mineral substance with binding material, piling such sheets together and drying and heating the resulting mass. Baekeland had

invented much in this art and all before O'Connor. One of his discoveries was that of the "bakelite" which O'Connor suggests using in his process—a combination of phenol and formaldehyde, a viscous fluid resisting the electric current and attaining great hardness under heat and pressure for use as a binder. Another patent of Baekeland was for "a composite cardboard consisting of superposed layers of paper or the like combined with intermediate layers of an insoluble, infusible condensation product of phenols and formaldehyde," in which he described his process as follows:

"I apply to the surface of any of the ordinary grades of paper, or to asbestos paper or the like, a coating of a liquid condensation product of phenols and formaldehyde of such character that it is capable of transformation under the action of heat into an insoluble and infusible body. For this purpose I may use either a liquid condensation product of the character described, or a solution of the same in alcohol or other appropriate solvent. This layer is permitted to dry somewhat, when a second sheet of paper is superposed upon the first and similarly treated; or the several layers may be coated and preferably dried before being superposed. The condensation product may be applied to one or both sides of the sheets. The desired number of sheets having been assembled, the composite article is compacted by pressure, with or without the aid of heat. Heat is now applied in order to effect the transformation of the condensation product into an insoluble and infusible body."

*Mr. John C. Kerr and Mr. Drury W. Cooper for petitioner.*

*Mr. Frederic D. McKenney and Mr. John H. Lee, with whom Mr. Wm. H. Dyrenforth was on the brief, for respondent.*

MR. CHIEF JUSTICE TAFT delivered the opinion of the Court.

The important question in this case is the operation of the principle of estoppel on the character of defense to which the assignor of a patented invention is limited in a suit for infringement by the assignee. We may first usefully consider the rule that should obtain where the assignment is made after the issue of the patent, and then the difference in the rule, if any, where the assignment was made before the granting of the patent.

Congress under its power to secure for limited times to inventors the exclusive right to their discoveries, has enacted laws conferring such an exclusive right by patent after an application with specification of the invention and claims therefor and a favorable decision by the Commissioner of Patents. The patent of the exclusive right against the public carries with it a presumption of its validity. *Agawam Co. v. Jordan*, 7 Wall. 583; *Blanchard v. Putnam*, 8 Wall. 420; *Miller v. Eagle Mfg. Co.*, 151 U. S. 186; *Boyd v. Janesville Hay Tool Co.*, 158 U. S. 260. It is not conclusive but the presumption gives the grant substance and value. By § 4898, Rev. Stats., every such patent or any interest therein shall be assignable in law by an instrument in writing, and the patentee or his assigns or legal representatives may, in like manner, grant and convey an exclusive right under his patent to the whole or any specified part of the United States. The section further provides that an assignment, grant or conveyance shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless it is recorded in the Patent Office within three months from the date thereof. While a seal is not required to make an assignment legal, *Gottfried v. Miller*, 104 U. S. 521, there seems to be no reason why the principles of estoppel by deed should not apply to assignment of a patent right in accordance with the

statute. Its purpose is to furnish written and recorded evidence of title and to protect the purchaser of the title as recorded for value without notice. It was manifestly intended by Congress to surround the conveyance of patent property with safeguards resembling those usually attaching to that of land. This Court has recognized the analogy between estates in land by estoppel and the right to enjoy a patent right in the use of an article conveyed by one without authority but who acquires it by subsequent conveyance. *Gottfried v. Miller*, 104 U. S. 521; *Littlefield v. Perry*, 21 Wall. 205.

There are no cases in this Court in which the application of the principle of estoppel as by deed to the conveyance or assignment of patent property has been fully considered. But there are many in the reports of the Circuit and District Court decisions and in those of the Circuit Court of Appeals. They began as early as 1880 in *Faulks v. Kamp*, 3 Fed. 898, and were followed by a myriad. The rule supported by them is that an assignor of a patent right is estopped to attack the utility, novelty or validity of a patented invention which he has assigned or granted as against any one claiming the right under his assignment or grant. As to the rest of the world, the patent may have no efficacy and create no right of monopoly; but the assignor can not be heard to question the right of his assignee to exclude him from its use. *Curran v. Burdsall*, 20 Fed. 835; *Ball & Socket Fastener Co. v. Ball Glove Fastening Co.*, 58 Fed. 818; *Woodward v. Boston Lasting Machine Co.*, 60 Fed. 283, 284; *Babcock v. Clarkson*, 63 Fed. 607; *Noonan v. Chester Park Athletic Co.*, 99 Fed. 90, 91. There are later cases in nearly all the Circuit Courts of Appeal to the same point. In view of the usual finality of patent decisions in the Circuit Courts of Appeal, this Court will not now lightly disturb a rule well settled by forty-five years of judicial consideration and conclusion in those courts.

The analogy between estoppel in conveyances of land and estoppel in assignments of a patent right is clear. If one lawfully conveys to another a patented right to exclude the public from the making, using and vending of an invention, fair dealing should prevent him from derogating from the title he has assigned, just as it estops a grantor of a deed of land from impeaching the effect of his solemn act as against his grantee. The grantor purports to convey the right to exclude others, in the one instance, from a defined tract of land, and in the other, from a described and limited field of the useful arts. The difference between the two cases is only the practical one of fixing exactly what is the subject matter conveyed. A tract of land is easily determined by survey. Not so the scope of a patent right for an invention.

As between the owner of a patent and the public, the scope of the right of exclusion granted is to be determined in the light of the state of the art at the time of the invention. Can the state of the art be shown in a suit by the assignee of a patent against the assignor for infringement to narrow or qualify the construction of the claims and relieve the assignor from the charge? The Circuit Court of Appeals for the Seventh Circuit in *Siemens-Halske Electric Co. v. Duncan Electric Co.*, 142 Fed. 157, seems to exclude any consideration of evidence of this kind for such a purpose. The same view is indicated in subsequent decisions of that court. *Chicago & Alton Ry. Co. v. Pressed Steel Car Co.*, 243 Fed. 883, 887; *Foltz Smokeless Furnace Co. v. Eureka Smokeless Furnace Co.*, 256 Fed. 847. We think, however, that the better rule, in view of the peculiar character of patent property, is that the state of the art may be considered. Otherwise the most satisfactory means of measuring the extent of the grant the Government intended and which the assignor assigned would be denied to the court in

reaching a just conclusion. Of course, the state of the art can not be used to destroy the patent and defeat the grant, because the assignor is estopped to do this. But the state of the art may be used to construe and narrow the claims of the patent, conceding their validity. The distinction may be a nice one but seems to be workable. Such evidence might not be permissible in a case in which the assignor made specific representations as to the scope of the claims and their construction, inconsistent with the state of the art, on the faith of which the assignee purchased; but that would be a special instance of estoppel by conduct. We are dealing only with the estoppel of an assignment based on the specifications and claims without special matter *in pais*.

Mr. Justice Lurton, when Circuit Judge, speaking for the Circuit Court of Appeals of the Sixth Circuit, in *Noonan v. Chester Park Athletic Co.*, 99 Fed. 90, 91, used this language:

“It seems to be well settled that the assignor of a patent is estopped from saying his patent is void for want of novelty or utility, or because anticipated by prior inventions. But this estoppel, for manifest reasons, does not prevent him from denying infringement. To determine such an issue, it is admissible to show the state of the art involved, that the court may see what the thing was which was assigned, and thus determine the primary or secondary character of the patent assigned, and the extent to which the doctrine of equivalents may be invoked against an infringer. The court will not assume against an assignor, and in favor of his assignee, anything more than that the invention presented a sufficient degree of utility and novelty to justify the issuance of the patent assigned, and will apply to the patent the same rule of construction, with this limitation, which would be applicable between the patentee and a stranger.”

And he cites the following cases as sustaining this view:

Circuit Court of Appeals, First Circuit. *Ball & Socket Fastener Co. v. Ball Glove Fastening Co.*, 58 Fed. 818; *Babcock v. Clarkson*, 63 Fed. 607; *Martin Hill Cash-Carrier Co. v. Martin*, 67 Fed. 786, 787. Since the *Noonan Case*, the view thus announced has been approved in the Circuit Court of Appeals of the Second Circuit in *Standard Plunger Elevator Co. v. Stokes*, 212 Fed. 941, 943; of the Third Circuit in *Roessing-Ernst Co. v. Coal & Coke By-Products Co.*, 219 Fed. 898, 899; *Piano Motors Corporation v. Motor Player Corporation*, 282 Fed. 435, 437; of the Fourth Circuit in *Leader Plow Co. v. Bridgewater Plow Co.*, 237 Fed. 376, 377; of the Sixth Circuit in *Smith v. Ridgely*, 103 Fed. 875; *Babcock & Wilcox Co. v. Toledo Boiler Works Co.*, 170 Fed. 81, 85; *United States Frumentum Co. v. Lauhoff*, 216 Fed. 610; *Schiebel Toy & Novelty Co. v. Clark*, 217 Fed. 760, 763; of the Eighth Circuit in *Moon-Hopkins Co. v. Dalton Co.*, 236 Fed. 936, 937; and of the Ninth Circuit in *Leather Grille & Drapery Co. v. Christopherson*, 182 Fed. 817.

We have been speaking of the application of estoppel in the assignment of patents after they have been granted and their specifications and claims have been fixed. The case before us, however, concerns assignment of an invention and an inchoate right to a patent therefor before the granting of it which, after the assignment at the instance of the assignee, ripened into a patent. Section 4895 of the Revised Statutes authorizes the granting of a patent to the assignee of the inventor. The assignment must be first entered of record in the Patent Office, and in all such cases the application must be made and the specification sworn to by the inventor. It is apparent that the scope of the right conveyed in such an assignment is much less certainly defined than that of a granted patent, and the question of the extent of the estoppel

against the assignor of such an inchoate right is more difficult to determine than in the case of a patent assigned after its granting. When the assignment is made before patent, the claims are subject to change by curtailment or enlargement by the Patent Office with the acquiescence or at the instance of the assignee, and the extent of the claims to be allowed may ultimately include more than the assignor intended to claim. This difference might justify the view that the range of relevant and competent evidence in fixing the limits of the subsequent estoppel should be more liberal than in the case of an assignment of a granted patent. How this may be, we do not find it necessary to decide. We can well be clear, however, that if it is proper to limit the estoppel available for an assignee after patent as against his assignor by reference to the state of the art, *a fortiori* is such reference relevant where the estoppel is sought by the assignee before patent. In the light of this conclusion, we must now turn to the facts to which it should be applied.

The art which O'Connor entered was that of a composition of materials for insulating purposes, of leaves of fibrous material like paper superposed one on another and united by an adhesive binder coating the leaves, subjected to heat and pressure and hardened into a compact mass and rendered capable of high resistance to the electric current. In the specification of his patent he disclosed his idea of the defect of the then art, which he proposed to remedy by his process, as follows:

"Heretofore insulation material such as cardboard, composed of layers of paper glued together, has proved more or less unsatisfactory because of various defects, such as absorption of moisture from the atmosphere, inability to resist heat and chemical action, and lack of physical strength. Insulating material . . . must be free from these defects, and, in addition, must possess high dielectric strength."



He proposed to achieve his purpose by use of paper or cardboard, which was old for such purpose, by a binder of bakelite or phenol and formaldehyde, also well known for such use, by hydraulic pressure of 800 lbs. and steam heat, followed by cooling and then by baking in an oven at high heat and low pressure. There was indeed nothing new in O'Connor's invention but the two-step of pressure and heat, cooling and baking. If this two-step process was new, and the estoppel requires us to hold as against O'Connor that it was, his assignee had a right to claim the application of it as new, not only to flat articles of composition but also to non-planiform articles as in the 11th and 12th claims; for though O'Connor had not made such a claim, his original specification foreshadowed it as reasonable. In view of the art, however, it is very clear that the 11th and 12th claims must be read to include as an essential element of the combination therein claimed, the two-step process. Without this, there was nothing new in them in the field to which they applied.

The 11th and 12th claims were made by the company as assignee after O'Connor had left the company's employ and were not allowed until four years after O'Connor had participated in the making of the composition herein complained of, and for three years thereafter the company made no objection to his continuing the manufacture. But it is said, the assignee was entitled on O'Connor's original specifications to base claims which did not contain as an element the two-step process, because the 6th of his original claims was even broader than the 11th and 12th claims as subsequently made and allowed. It was as follows: "The process of manufacturing insulating material which consists in superposing layers of coated paper and applying heat and pressure thereto." This was promptly rejected by the Patent Office as it must have been in the then state of the art. It was so absurdly broad and all-inclusive as almost to

indicate that it was made to be rejected. O'Connor's signature to such a claim under the circumstances of course does not estop him when in fact it was not allowed; and certainly should not be used to bolster up a broad construction of the 11th and 12th claims when, as we have said, the state of the art must limit them.

We are clear then that the estoppel of the 11th and 12th claims against O'Connor does not extend to a single step process such as he has participated in as partner, stockholder or officer; and if it does not affect him, *a fortiori* does it not affect the respondent company.

This result makes it unnecessary for us to consider the objections that the Formica Company is not affected by an estoppel which would operate against O'Connor, or that the alleged nominal character of the consideration moving to O'Connor can not support an estoppel.

*Decree affirmed.*

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IN THE MATTER OF PETITION OF EAST RIVER  
TOWING CO., INC., FOR LIMITATION OF LIABILITY OF THE STEAMTUG EDWARD, HER ENGINES, ETC.

CERTIFICATE FROM THE CIRCUIT COURT OF APPEALS FOR THE  
SECOND CIRCUIT.

No. 81. Argued November 25, 1924.—Decided December 8, 1924.

1. An action at law brought under § 33 of the Merchant Marine Act of June 5, 1920, c. 250, 41 Stat. 988, to recover damages for the death of a seaman from personal injuries suffered in the course of his employment, is subject to the injunction provided by Admiralty Rule 51 in aid of limitation of liability proceedings. P. 366
2. The Merchant Marine Act, § 33, did not impliedly repeal the statute regarding limitation of liability of shipowners (Rev. Stats., §§ 4283, *et seq.*) so far as claims or suits based on personal injuries to, or death of, seamen are concerned. *Id.*



## On the Meaning of “Patented Invention”: Tab 9

# United States Court of Appeals for the Federal Circuit

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**CORDIS CORPORATION,**  
*Plaintiff-Appellant,*

v.

**BOSTON SCIENTIFIC CORPORATION  
AND BOSTON SCIENTIFIC SCIMED, INC.  
(FORMERLY KNOWN AS SCIMED LIFE SYSTEMS, INC.),**  
*Defendants-Cross Appellants.*

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2010-1311, -1316

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Appeals from the United States District Court for the District of Delaware in case no. 98-CV-0197, Judge Sue L. Robinson.

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Decided: September 28, 2011

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GREGORY L. DISKANT, Patterson Belknap Webb & Tyler LLP, of New York, New York, argued for plaintiff-appellant. With him on the brief were EUGENE M. GELERNTER, SCOTT B. HOWARD, IRENA ROYZMAN, CHARLES D. HOFFMANN.

FRANK P. PORCELLI, Fish & Richardson P.C., of Boston, Massachusetts, argued for defendants-cross appel-

lants. With him on the brief were LAUREN A. DEGNAN and CHERYLYN ESOY MIZZO, of Washington, DC.

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Before BRYSON, MAYER, and GAJARSA\*, *Circuit Judges*.

GAJARSA, *Circuit Judge*.

Cordis Corporation (“Cordis”) appeals the United States District Court for the District of Delaware’s grant of judgment as a matter of law (“JMOL”) that Boston Scientific Corporation and Boston Scientific Scimed, Inc. (collectively, “BSC”) do not literally infringe claim 25 of U.S. Patent No. 5,879,370. Cordis also appeals the district court’s denial of JMOL on the issue of non-infringement by the reverse doctrine of equivalents. BSC cross-appeals the district court’s judgment that U.S. Patent Nos. 5,643,312 (the “312 patent”) and 5,879,370 (the “370 patent”) are not unenforceable due to inequitable conduct. For the reasons stated below, we affirm.

#### BACKGROUND

This dispute relates to balloon-expandable stents, devices which are used to treat occluded blood vessels. We have previously summarized the importance of such stents:

The development of balloon-expandable coronary stents marked a significant advance in the treatment of coronary artery disease by providing an alternative to balloon angioplasty and bypass surgery. In balloon angioplasty, an inflated balloon crushes built-up plaque against the arterial wall to improve blood flow. The balloon is withdrawn at the end of the procedure, however, which allows

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\* Circuit Judge Gajarsa assumed senior status on July 31, 2011.

the artery to close again over time. A stent of the sort disclosed in the patents at issue in this case is mounted on an angioplasty balloon and is forced to expand against the arterial walls when the balloon is inflated. When the balloon is deflated and withdrawn, the stent retains its shape and remains in the artery to keep it open.

*Cordis Corp. v. Medtronic AVE, Inc.*, 339 F.3d 1352, 1354-55 (Fed. Cir. 2003). Both of the patents at issue are directed to, *inter alia*, stents having undulating longitudinal sections.

On February 25, 1994, Robert E. Fischell and two of his sons, David R. Fischell and Tim A. Fischell, filed U.S. Patent Application No. 08/202,128 (the “128 application”), which ultimately issued as the ’312 patent. For the first two years after the ’128 application was filed, Robert Fischell prosecuted the application *pro se*. He did, however, retain an attorney, Morton J. Rosenberg, to prosecute foreign counterparts.<sup>1</sup>

On July 17, 1995, Mr. Rosenberg forwarded to Robert Fischell a “Search Report from the European Patent Office” (“EPO Search Report”) regarding a European counterpart to the ’128 application. The EPO Search Report identified six references, and categorized them according to relevance. Category “X” documents were “particularly relevant if taken alone,” category “Y” documents were “particularly relevant if combined with another document of the same category,” and category “A” documents were “technological background.” J.A. 11523. Only one reference, European Patent Application 566807

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<sup>1</sup> At the time the ’128 application was filed, Robert Fischell had personally prosecuted more than twenty patents. Mr. Rosenberg was substituted as the attorney prosecuting the ’128 application in February 1996.

(“Sgro”), was identified as a category X reference. In an accompanying letter, Mr. Rosenberg explained:

the only reference which is stated as being particularly relevant to Claim 1 is European Patent Application # 566807 whose inventor is Jean-Claude Sgro. We have made a Patentee Search to determine whether we have any corresponding Patent in the United States but have come up negatively. It may pay us to make a translation from the French to determine if this is relevant.

J.A. 11946.

As in the original '128 application, the only claim in the European application that mentioned undulating longitudinalinals was claim 8. The EPO Search Report identified four “Y” references as being relevant to that claim. Among the references so identified was U.S. Patent No. 4,856,516 (“Hillstead”), a patent directed to, *inter alia*,

[a] stent for reinforcing a vessel within a subject comprising a cylindrical support dimensioned to fit within an interior of said vessel constructed from an elongated wire *bent to define a series of relatively tightly spaced convolutions or bends*, said wire also bent in the form of a plurality of loops . . . .

Hillstead, col.4 ll.37-42 (emphasis added). Figure 2A from Hillstead, also displayed on the cover page of that patent, is reproduced below, along with Figure 8 from the '312 patent for comparison.

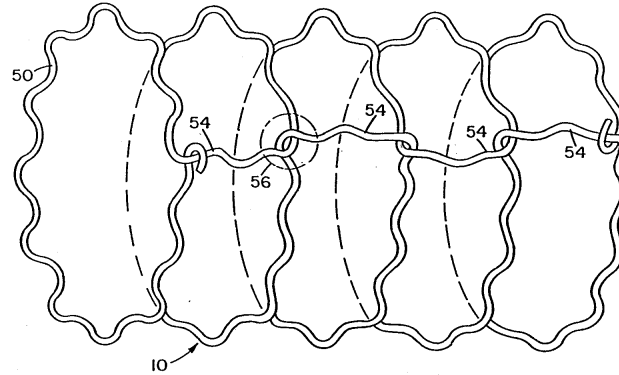


FIG. 2A

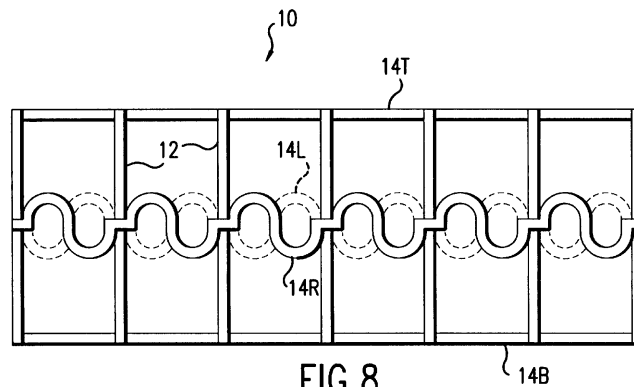


FIG. 8

In the course of this case, Mr. Rosenberg testified it was his practice to “carefully” review the “X” references in EPO search reports, i.e., those that—like Sgro—are “particularly relevant if taken alone.” *Cordis Corp. v. Boston Scientific Corp.*, 641 F. Supp. 2d 353, 355-56 (D. Del. 2009) (“*Cordis III*”). But his practice was to “just scan” “Y” references, i.e., those that—like Hillstead—are “particularly relevant if combined with another document of the same category.” *Id.* Similarly, Robert Fischell testified it was his practice to “look at the pictures and see if the pictures [in the references] look like the invention, the inventive concept for which we’re trying to get claims.” Bench Trial Tr. 846:1-17; *see also* Bench Trial Tr.



845:10-16, 852:7-24. Nevertheless, both Mr. Rosenberg and Robert Fischell testified that they did not recall looking at Hillstead until April 1998, even though it was identified in the EPO Search Report and both had retained copies of Hillstead in their files since at least July 1995. Not surprisingly, Hillstead was never disclosed to the U.S. Patent and Trademark Office in the course of the '312 patent's prosecution, despite multiple amendments adding limitations regarding undulations and the importance given those undulations in distinguishing various prior art references.<sup>2</sup>

Just prior to the July 1, 1997, issuance of the '312 patent, the Fischells filed U.S. Patent Application 08/864,221 ("the '221 application") as a continuation of the '128 application. Robert Fischell was thereafter shown a copy of Hillstead during a meeting with Cordis's counsel.<sup>3</sup> Robert Fischell testified that this meeting—apparently in April 1998—was the first time he specifically recalled seeing Hillstead.

In May 1998, an information disclosure statement ("IDS") regarding the '221 application was filed with the Patent and Trademark Office. The IDS cited forty-one U.S. patents, seven foreign patent documents, and thirteen articles. Hillstead, along with the other three "Y"

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<sup>2</sup> Of relevance here, the Fischells specifically distinguished U.S. Patent No. 5,269,802 ("Garber") as lacking "the undulating shape or contour" in the longitudinals of their own claimed invention. J.A. 254-55. The Fischells similarly distinguished other references as not providing "the undulating sections of each longitudinal structure being of a generally curved shape." J.A. 235-36.

<sup>3</sup> Through a series of transactions in 1998 and 1999, Cordis acquired various assets of the Fischells' company, IsoStent, and agreed to assume certain of IsoStent's obligations to the Fischells.

references from the EPO Search Report, was included in the disclosure. Among the seventy references ultimately identified, Hillstead was never emphasized as being of particular interest. The '221 application subsequently issued as the '370 patent, with Hillstead among the "References Cited" on the face of the patent.

The present litigation began on October 3, 1997, when Cordis filed suit against Medtronic AVE, Inc., BSC, and Scimed Life Systems, Inc. As relevant to this appeal, Cordis ultimately accused BSC's NIR stent of infringing the '312 and '370 patents. Following a multi-week trial, a jury found that BSC's NIR stent does not literally infringe claim 21 of the '312 patent, and claim 21 is not invalid for obviousness or lack of written description. *Cordis Corp. v. Medtronic AVE, Inc.*, 194 F. Supp. 2d 323, 339 (D. Del. 2002) ("*Cordis I*"). It also found that the NIR stent literally infringes claims 25 and 26 of the '370 patent, but no infringement of either claim by virtue of the reverse doctrine of equivalents. *Id.* Moreover, it determined that claim 25 of the '370 patent is not invalid for lack of written description, but claim 26 of the '370 patent is invalid for lack of written description. *Id.*

Both parties moved for JMOL. The district court granted BSC's motion for JMOL that the NIR stent does not literally infringe claims 25 and 26 of the '370 patent. *Id.* at 354. Consequently, Cordis's motion for JMOL on the reverse doctrine of equivalents was denied as moot. *Id.* BSC's motion for JMOL that claim 25 of the '370 patent and claim 21 of the '312 patent are invalid for lack of written description was also denied. *Id.* at 354-55.

Following the jury trial, the district court conducted a four-day bench trial on the issue of unenforceability due to inequitable conduct. BSC contended that the patentees failed to disclose Hillstead during the prosecution of the

'312 patent, and the patentees knew, or should have known, that Hillstead would be material to the examiner's consideration of patentability. *Id.* at 362. After making findings of fact, the district court concluded BSC proved "by clear and convincing evidence the threshold levels of materiality and intent with respect to nondisclosure of the Hillstead patent" during the prosecution of the '312 patent. *Id.* at 367. The court found "[t]he patentees purposefully neglected their responsibility of candor to the PTO by 'putting their heads in the sand' regarding prior art related to [undulating longitudinals]." *Id.* The court then concluded that the '370 patent's prosecution was tainted by the lack of candor in the '312 prosecution because, when the patentees finally disclosed Hillstead, they did so in the midst of numerous other references and without identifying it as being of particular interest. *Id.* at 368. The district court therefore held both patents unenforceable due to inequitable conduct. *Id.*

Both parties appealed. Cordis challenged the portions of the judgment relating to literal infringement, the reverse doctrine of equivalents, and unenforceability, all with respect to the '370 patent. *Cordis Corp. v. Boston Scientific Corp.*, 188 F. App'x. 984, 985 (Fed. Cir. 2006) ("*Cordis II*"). On the issue of unenforceability, this court agreed that the Hillstead reference was material, but remanded for additional findings regarding intent to deceive. *Id.* at 986. We therefore declined to reach the issues of literal infringement and reverse doctrine of equivalents. *Id.* at 985. BSC cross-appealed from the portion of the judgment holding the '370 patent not invalid, but we affirmed the district court on that issue. *Id.*

On remand, the district court made additional findings, but concluded "[u]pon further reflection, the

evidence of record that tends to support a finding of deceptive intent is not clear and convincing.” *Cordis III*, 641 F. Supp. 2d at 358. Because it found “the inferences argued by [Cordis] are supported by evidence of record and are as reasonable as those inferences argued by [BSC],” the district court concluded “it would be clear error . . . to imbue [Fischell’s and Rosenberg’s] conduct with deceptive intent . . .” *Id.* at 359. The court went on to note that, even had it concluded otherwise, BSC “failed to prove, by clear and convincing evidence, that the nondisclosure of Hillstead during the ’312 prosecution carried over and affected the later ’370 patent prosecution” so as to taint the latter. *Id.* In short, neither patent was unenforceable by reason of inequitable conduct. Following the district court’s denial of BSC’s motion for reconsideration, *Cordis Corp. v. Boston Scientific Corp.*, No. 98-197, 2010 WL 1286424 (D. Del. Mar. 31, 2010) (“*Cordis IV*”), the parties renewed their remaining arguments on appeal.<sup>4</sup>

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<sup>4</sup> Returning to this court for a second time, this case is but one installment—albeit, at nearly fourteen years, perhaps the longest—in an ongoing and epically expensive litigation saga known as the “Stent Wars.” *E.g.*, Barnaby J. Federer, *Keeping Arteries Cleared and the Courts Clogged*, N.Y. TIMES, Oct. 4, 2007, at C1; *see also Spectralytics, Inc. v. Cordis Corp.*, --- F.3d ---, 2011 WL 2307402 (Fed. Cir. June 13, 2011); *Boston Scientific Corp. v. Johnson & Johnson*, 647 F.3d 1353 (Fed. Cir. 2011); *Cordis Corp. v. Boston Scientific Corp.*, 561 F.3d 1319 (Fed. Cir. 2009); *Boston Scientific Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982 (Fed. Cir. 2009); *Cordis Corp. v. Medtronic AVE, Inc.*, 511 F.3d 1157 (Fed. Cir. 2008); *Advanced Cardiovascular Sys., Inc. v. Medtronic Vascular, Inc.*, 182 F. App’x. 994 (Fed. Cir. 2006); *Cordis Corp. v. Boston Scientific Corp.*, 99 F. App’x. 928 (Fed. Cir. 2004); *Scimed Life Sys., Inc. v. Johnson & Johnson*, 87 F. App’x. 729 (Fed. Cir. 2004); *Cordis Corp. v. Medtronic*

## DISCUSSION

## I.

We turn first to the issue of infringement. The infringement analysis is a two step inquiry. “First, the court determines the scope and meaning of the patent claims asserted, and then the properly construed claims are compared to the allegedly infringing device.” *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc) (internal citations omitted).

On appeal, only dependent claim 25 of the ’370 patent is at issue with respect to JMOL of no infringement. That claim, along with independent claim 22 on which it depends, reads:

22. A pre-deployment balloon expandable stent structure adapted for percutaneous delivery to the curved coronary arteries, the stent structure being generally in the form of a thin-walled metal tube having a longitudinal axis, the stent structure having a multiplicity of closed perimeter cells, each cell having one or more *undulating* sections, each undulating section having a generally curved shape and having a first end point and a second end point wherein a line drawn from the first end point to the second end point is generally parallel to the stent’s longitudinal axis.

25. The stent of claim 22 wherein the *undulating* section of each closed perimeter cell comprises a “U” shaped curve.

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*AVE, Inc.*, 339 F.3d 1352 (Fed. Cir. 2003); *Advanced Cardiovascular Sys., Inc. v. Scimed Life Sys., Inc.*, 261 F.3d 1329 (Fed. Cir. 2001); *Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc.*, 248 F.3d 1303 (Fed. Cir. 2001).

'370 patent col.6 ll.17-26, 35-36 (emphasis added).

During claim construction, the parties disputed whether the term “undulating” required both a crest *and* a trough, as opposed to a crest *or* a trough. *Cordis I*, 194 F. Supp. 2d at 353 n.22. Citing claim 25, Cordis argued that “undulating structures include those that have [only] a wave-like crest, and are not limited to structures that have both a crest and an associated trough.” J.A. 954, 1206. BSC, on the other hand, explicitly argued that “undulating” cannot simply mean “curved,” J.A. 1261, and instead “requires that a structure have both a ‘crest’ and a ‘trough,’” J.A. 1269. The district court embraced BSC’s proposed construction and construed “undulating” to mean “rising and falling in waves, thus having at least a crest and a trough.” *Cordis Corp. v. Boston Scientific Corp.*, No. 1:98-cv-197, Order at 2 (DE 154) (D. Del. Sept. 7, 2000).

As noted above, BSC moved for JMOL that the NIR stent does not literally infringe claim 25 of the '370 patent. Jury Trial Tr. 1576:2-1577:7. When the motion was subsequently renewed, BSC argued that “Cordis inappropriately altered the parties’ and the court’s understanding of the term ‘undulating’ and, under the intended construction of the term, the evidence presented at trial does not support a conclusion that the NIR stent contains ‘undulating’ sections.” *Cordis I*, 194 F. Supp. 2d. at 353. Agreeing with BSC, the district court clarified that its “use of the plural ‘waves’ implies a change in direction,” and entered JMOL that claim 25 was not infringed. *Id.* at 354. Cordis challenges the district court’s grant of JMOL on two grounds. First, Cordis argues that BSC improperly urged a narrower and erroneous claim construction on the district court. And second, even if the district court’s claim construction did imply “arcing curves” and “a change in direction,” Cordis argues that a reasonable jury

could still find that the NIR stent infringed claim 25. We treat each of Cordis's arguments sequentially.

A.

Cordis correctly notes that a party prevailing on an issue of claim construction cannot argue for a differing claim construction following an adverse jury verdict. *E.g.*, *Hewlett-Packard Co. v. Mustek Systems, Inc.*, 340 F.3d 1314, 1320 (Fed. Cir. 2003) (citing *Interactive Gift Express, Inc. v. Compuserve, Inc.*, 256 F.3d 1323, 1345-46 (Fed. Cir. 2001)). The question here is whether BSC did, in fact, seek to alter the district court's claim construction. No rule of law restricted BSC from seeking to clarify or defend the original scope of its claim construction. *Interactive Gift Express*, 256 F.3d at 1346. Similarly, nothing prevented the district court from clarifying its previous construction of the term "undulating." *See Network Commerce, Inc. v. Microsoft Corp.*, 422 F.3d 1353, 1358 n.4 (Fed. Cir. 2005). But because BSC did not object to the court's jury instruction regarding the construction of the term "undulating," "[t]he verdict must be tested by the charge actually given [under] the ordinary meaning of the language of the jury instruction," *Hewlett-Packard*, 340 F.3d at 1321.

Cordis does not challenge the district court's construction of the term "undulating" as requiring "at least a crest and a trough." We therefore do not review the construction itself, and instead focus on what that construction means. Based on the ordinary meaning of the construction as given to the jury, it is apparent that the construction requires multiple "waves." *See Webster's Third New International Dictionary* 2586 (1968) (defining "wave" as "a shape or outline having successive curves like those of ocean waves: one of the crests of such a form or a crest with its adjacent trough"). Accordingly, the terms "crest"

and “trough,” as used in district court’s claim construction, implicate changes of direction, with the curve extending beyond the point of inflection. The district court’s post-verdict elaboration on this point only clarified what was inherent in the construction. Doing so was not error; it merely made plain what, as we detail below, should have been obvious to the jury.

We acknowledge that the terms “crest” and “trough” can, in some cases, merely indicate points on a curve. Here, however, we are not persuaded by Cordis’s citation to expert testimony and portions of dictionary entries defining a “crest” as, *inter alia*, “the top” or “highest point of the waveform.” So defined, the requirement in the construction for “both a ‘crest’ and a ‘trough’” becomes meaningless: every trough would necessarily include a “highest point” that would satisfy Cordis’s definition of “crest.” Indeed, Cordis’s expert testified as much:

Q. So does every letter U shape have two crests?

A. Well, I haven’t looked at every. I mean, some people’s handwriting is illegible and certainly doesn’t, but, yes.

Jury Trial Tr. 989:20-23. Cordis’s definition would thus impermissibly render superfluous the requirement for a “crest” in addition to a “trough.”

Our conclusion about the ordinary meaning of the jury instruction is bolstered by the parties’ arguments during claim construction. Accordingly, this is not a case where Cordis can plead surprise at the trial court’s clarification. Indeed, during the *Markman* phase, BSC raised claim construction arguments from which the district court’s understanding logically flows and which, indeed, mandate it. BSC specifically pointed to arguments made during the prosecution of the ’128 application in which the



Fischells' "undulating" structure was distinguished from structures that were merely curved.<sup>5</sup> *Cordis Corp. v. Boston Scientific Corp.*, No. 1:98-cv-197, BSC Reply Br. in Support of Defendant's *Markman* Memorandum at 4-8 (DE 133); *see also Markman* Hr'g Tr. 37:23-39:19.

Claim terms must be construed in light of all of the intrinsic evidence, which includes not only the claim language and patent written description, but also the prosecution history. *ERBE Elektromedizin GmbH v. Canady Tech. LLC*, 629 F.3d 1279, 1284-85 (Fed. Cir. 2010). As noted by BSC, the Fischells traversed an anticipation rejection over U.S. Patent No. 5,269,802 ("Garber"), directed to a prostatic stent, by arguing that the invention disclosed in Garber lacked the "undulating shape or contour" required by the claims of their own invention. J.A. 255. Although the Fischells referred to the "connecting arms" in Garber as "substantially linearly directed," J.A. 255, a cursory review of that patent shows the structures at issue have an obvious and defined curve, Garber Figs. 2, 3. Indeed, the Garber specification notes that "[i]n use, the pressure of the bladder neck against the branching [connecting] arms tends to arc the arms inward" resulting in "an hour glass shape." Garber col.4 ll.5-7, col.5 ll.30-31. Cordis's suggestion that a single curve can satisfy the "undulating" limitation of the asserted claims was thereby foreclosed. *See Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 979 (Fed. Cir. 1999) (not-

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<sup>5</sup> The argument in question was made in the course of the '128 application, which resulted in the '312 patent, while only the claims of the '370 patent are at issue in this portion of the appeal. Arguments made in the course of prosecuting the '128 application are relevant, however, because a disclaimer in the parent application carries forward into the construction of the same claim term in the child. *Verizon Servs. Corp. v. Vonage Holdings Corp.*, 503 F.3d 1295, 1306 (Fed. Cir. 2007).

ing that “[a]rguments made during the prosecution of a patent application are given the same weight as claim amendments”). That remains true whether Cordis couches its argument in terms of claim differentiation, the phrase “comprising a ‘U’ shaped curve,” or dictionary entries. *See, e.g., Free Motion Fitness, Inc. v. Cybex Int’l, Inc.*, 423 F.3d 1343, 1348-49 (Fed. Cir. 2005); *Seachange Int’l, Inc. v. C-COR, Inc.*, 413 F.3d 1361, 1372-73 (Fed. Cir. 2005); *Kraft Foods, Inc. v. Int’l Trading Co.*, 203 F.3d 1362, 1368 (Fed. Cir. 2000).

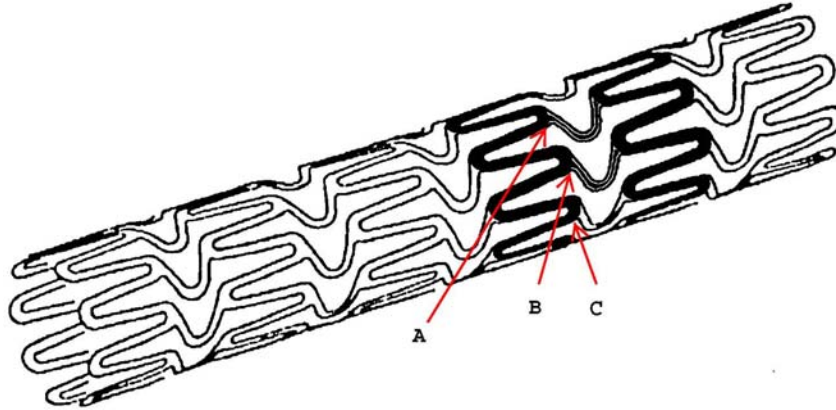
### B.

Having found no error in the district court’s clarification of its construction of the term “undulating,” we turn to the merits of its grant of JMOL that claim 25 was not infringed by BSC’s NIR stent. “This court reviews without deference a district court’s grant of JMOL under Federal Rule of Civil Procedure 50.” *LNP Eng’g Plastics, Inc. v. Miller Waste Mills, Inc.*, 275 F.3d 1347, 1353 (Fed. Cir. 2001). JMOL is appropriate when “a party has been fully heard on an issue during a jury trial and the court finds that a reasonable jury would not have a legally sufficient evidentiary basis to find for the party on that issue . . . .” Fed. R. Civ. P. 50(a)(1). In determining whether a reasonable jury would have a legally sufficient evidentiary basis for the facts as found, “we must presume that the jury resolved all factual disputes in favor of the prevailing party, and we must leave those findings undisturbed as long as they are supported by substantial evidence.” *Akamai Techs., Inc. v. Cable & Wireless Internet Servs., Inc.*, 344 F.3d 1186, 1192 (Fed. Cir. 2003). Substantial evidence requires more than a mere scintilla, however, and we must review the record as a whole, taking into consideration evidence that both justifies and detracts from the jury’s decision. *Id.*; *see also Johnson v. Campbell*, 332 F.3d 199, 204 (3d Cir. 2003) (“The question

is not whether there is literally *no evidence* supporting the unsuccessful party, but whether there is evidence upon which a reasonable jury could properly have found its verdict.” (internal quotations omitted)).

As did the district court, we focus on whether the NIR stent satisfies the “undulating sections” limitation of claim 25. Cordis identifies three categories of evidence supporting the jury verdict: the testimony of its expert, various photographs, and engineering drawings. Cordis Br. 48-50. BSC correctly argues that we must disregard the testimony of Cordis’s expert that the NIR stent has two crests and a trough because, as the quotation in Part II-A indicates, that testimony was based on an incorrect understanding of the claim construction. *See Frank’s Casing Crew & Rental Tools, Inc. v. PMR Techs., Ltd.*, 292 F.3d 1363, 1375 (Fed. Cir. 2002) (finding no evidence that a limitation was satisfied after noting that contrary testimony was based on an incorrect interpretation of a claim term).

Referencing the drawing below, copied from Cordis’s brief and extensively relied on by both parties, the NIR stent includes so-called C-loops stacked circumferentially about the stent body, with longitudinal members known as U-loops in between.



Cordis Br. 11; *see also* Jury Trial Tr. 1510:10-24. The drawing leaves unclear where the U-loops end and the C-loops begin. *See* Points A, B, and C, as labeled by this court. The photographs and engineering drawings in evidence are, however, more clear. In those renderings, if the width of the C-loops is treated as approximately constant, with the C-loops maintaining the same curvature as they display before the junction with the U-loops, the geometry resembles points B and C, rather than point A. *See, e.g.*, J.A. 12500-530. The U-loops thus merely level out, and they lack the change in direction required for literal infringement. We note that our conclusion is consistent with the testimony of Cordis's expert that the "[u]ndulating [section] is fitted onto the end of the ring," i.e., the C-loops, and is "[a] cup, a claw on the end of the . . . ring element." Jury Trial Tr. 986:21-987:18; *see also* Cordis Br. 48-49. It is also consistent with the testimony of BSC's expert that the U-loops include a trough, but no crest as that term was used in the claim construction. *See* Jury Trial Tr. 1625:7-21. It is not, however, consistent with the jury's verdict on literal infringement.

Indeed, absent the testimony of Cordis's expert regarding troughs and crests, and the corresponding testimony concluding infringement, we find very little

evidence to support the jury's verdict that claim 25 was literally infringed. Substantial evidence, as required to support the jury's verdict, demands more than a mere scintilla. *Johnson*, 332 F.3d at 204. We therefore affirm the district court's grant of JMOL that claim 25 was not literally infringed. Consequently, we decline to reach the denial of Cordis's motion for JMOL on the issue of non-infringement by the reverse doctrine of equivalents.

## II.

We turn next to BSC's cross-appeal of the district court's judgment that the '312 and '370 patents are not unenforceable due to inequitable conduct. BSC first argues that the enforceability of the '312 patent is not properly before this court and, regardless, the trial court violated our mandate in *Cordis II* by revisiting the issue of unenforceability *vel non*. BSC also argues that the trial court's findings in *Cordis III* are, on the merits, clearly erroneous. We address each in turn.

### A.

In its Corrected Reply Brief in *Cordis II*, Cordis stated that "the '312 patent is *not* being asserted by Cordis and its enforceability is *not* the subject of this appeal. This appeal concerns a different and separate patent — the '370 patent." Cordis *Cordis II* Corrected Reply Br. 1. BSC correctly suggests that this statement constitutes a waiver by Cordis of any challenge to the district court's finding in *Cordis I* that the '312 patent is unenforceable. BSC Br. 47-48. BSC errs, however, in concluding that the waiver rendered the associated judgment unreviewable.

This court properly reaches "waived" issues when they are necessary to the resolution of other issues directly before it on appeal. *See Pfizer, Inc. v. Teva Pharms. USA, Inc.*, 518 F.3d 1353, 1359 n.5 (Fed. Cir. 2008); *Long Island*

*Sav. Bank, FSB v. United States*, 503 F.3d 1234, 1244-45 (Fed. Cir. 2007); *see also* U.S. Supreme Ct. Rule 14.1(a) (“The statement of any question presented is deemed to comprise every subsidiary question fairly included therein.”). Applied here, we conclude that the enforceability of the ’312 patent was necessarily before this court in *Cordis II*.

In our previous opinion, we characterized Cordis as “challeng[ing] the district court’s conclusion that the patentees engaged in inequitable conduct during the prosecution of [the ’312 patent] that rendered the ’370 patent unenforceable.” *Cordis II*, 188 F. App’x. at 985. Consistent with that characterization, both parties addressed the issues of materiality and intent to deceive, but they did so *only with respect to the ’312 patent prosecution*. *Cordis Cordis II* Br. 53-66; *BSC Cordis II* Br. 23-39. To be sure, the parties also addressed potential taint of the ’370 patent prosecution, but only subsequent to far more extensive arguments regarding the conduct of the ’312 prosecution. *Cordis Cordis II* Br. 67-69; *BSC Cordis II* Br. 39-43. Moreover, neither party has suggested that the ’370 patent is unenforceable independent of the enforceability of its parent. We therefore regard the enforceability of the two patents as inextricably linked, with the enforceability of the ’312 patent a predicate issue necessary to our determination of the enforceability of the ’370 patent. *See Therasense, Inc. v. Becton, Dickinson & Co.*, --- F.3d ---, 2011 WL 2028255, at \*8 (Fed. Cir. May 25, 2011) (en banc); *cf. City of Sherill v. Oneida Indian Nation of New York*, 544 U.S. 197, 214 n.8 (2005) (noting that the case was resolved “on considerations not discretely identified in the parties’ briefs” because those considerations were “inextricably linked to, and thus fairly included within, the questions presented” (internal quotation omitted)).

## B.

BSC next argues that the district court violated our mandate in *Cordis II* by reconsidering its finding of intent to deceive. Our review of the district court's actions implicates the scope and interpretation of our mandate, which we review without deference. See *Engel Indus., Inc. v. Lockformer Co.*, 166 F.3d 1379, 1382 (Fed. Cir. 1999).

In *Cordis II*, we stated that “[i]t is unclear to us precisely what the district court has found with regard to [Robert] Fischell’s and Mr. Rosenberg’s knowledge. In particular, we are uncertain whether the district court faulted [Robert] Fischell for merely failing to conduct a prior art search, or whether the district court faulted [him] for ‘cultivating ignorance’ with respect to the Hillstead reference.” 188 F. App’x. at 988 (quoting *FMC Corp. v. Hennessy Indus., Inc.*, 836 F.2d 521, 526 (Fed. Cir. 1987)). We therefore remanded “for the purpose of enabling the district court to provide more specific findings as to the state of knowledge of [Robert] Fischell and Mr. Rosenberg.” *Id.* In doing so, we instructed the district court to address “whether, in addition to reading the July 1995 letter from Mr. Rosenberg, [Robert] Fischell read the accompanying search report . . . and whether [Robert] Fischell read the Hillstead patent at that time.” *Id.*

On remand, the district court made detailed findings regarding the prosecution of the ’312 patent. *Cordis III*, 641 F. Supp. 2d. at 355-57. It did not, however, make the requested findings as to Robert Fischell’s actions and knowledge with respect to the search report and the Hillstead patent. Instead, the district court reversed its prior finding of specific intent to deceive, concluding that “the inferences argued by plaintiff are supported by

evidence of record and are as reasonable as those inferences argued by defendants,” and “it would be clear error . . . to imbue [Robert Fischell’s and Mr. Rosenberg’s] conduct with deceptive intent on this record.” *Id.* at 359 (referencing *Scanner Techs. Corp. v. ICOS Vision Sys. Corp.*, 528 F.3d 1365, 1376 (Fed. Cir. 2008)).

We find no error in the district court’s actions. Implicit in our request for additional findings was a conclusion that the findings before us were lacking. Rather than reversing the district court’s judgment, we requested specific findings on issues that we identified as outcome determinative. The district court’s subsequent conclusion that the record was insufficient to make the requested findings was entirely consistent with our mandate. For the same reason, our mandate must be read to have left unenforceability *vel non* an open issue. It would be illogical for this court to remand for findings on unresolved outcome determinative issues, while simultaneously foreclosing reconsideration of the outcome after the district court considered those issues for the first time.

### C.

Finally, BSC directly challenges the district court’s supplemental findings of fact and the resulting determination that the ’312 and ’370 patents are not unenforceable. BSC Br. 53-59. On appeal, “[w]e review the district court’s findings of fact for clear error and [its] ultimate determination of whether inequitable conduct occurred for abuse of discretion.” *Warner-Lambert Co. v. Teva Pharms. USA, Inc.*, 418 F.3d 1326, 1343 (Fed. Cir. 2005).

In *Therasense, Inc. v. Becton, Dickinson & Co.*, we made clear that a finding of inequitable conduct requires specific intent to deceive, and “to meet the clear and convincing evidence standard, the specific intent to deceive must be ‘the single most reasonable inference able to



be drawn from the evidence.” 2011 WL 2028255, at \*10 (quoting *Star Scientific, Inc. v. R.J. Reynolds Tobacco Co.*, 537 F.3d 1357, 1366 (Fed. Cir. 2008)). In light of this standard, we cannot agree that the district court’s supplemental findings were clearly erroneous or that its ultimate determination on inequitable conduct was an abuse of discretion.

The record reflects that in July 1995, Robert Fischell’s attorney forwarded him a copy of an EPO Search Report identifying Hillstead, as well as a copy of the Hillstead patent. The accompanying letter, however, drew attention to a different reference—Sgro—as the “only reference . . . being particularly relevant.” J.A. 11946. Robert Fischell consistently testified that, while he looked at the Sgro reference in 1995, he did not recall reviewing Hillstead until after the ’312 patent had issued. The district court explicitly found that no communications in the record called Hillstead to Fischell’s attention until after the ’312 patent issued, and that Fischell relied on his attorney’s advice vis-à-vis the EPO Search Report. Notably, when Hillstead was eventually brought to Fischell’s attention, he promptly disclosed it to the Patent and Trademark Office in connection with the ’370 prosecution, albeit without emphasis.

The district court ultimately concluded that “the evidence cited in support of finding inequitable conduct is not clearly more compelling than the evidence cited in support of not finding inequitable conduct.” *Cordis III*, 641 F. Supp. 2d at 359. On these facts, particularly the finding with respect to Robert Fischell’s reliance on Mr. Rosenberg’s advice, *id.* at 359 n.8, we do not find clear error in the district court’s conclusion that the evidence does not unequivocally demonstrate specific intent to

deceive.<sup>6</sup> We therefore affirm the district court's conclusion that BSC failed to prove inequitable conduct in the '312 and '370 patent prosecutions.

#### CONCLUSION

We affirm the district court's grant of judgment as a matter of law that claim 25 of the '370 patent is not literally infringed by the NIR stent. We also affirm the district court's conclusion that 'the 312 and '370 patents are not unenforceable due to inequitable conduct. As did the district court, we decline to reach Cordis's appeal on the issue of reverse doctrine of equivalents because that issue is moot in light of our holding on literal infringement.

#### AFFIRMED

No costs.

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<sup>6</sup> This appears to be a case where BSC proved the threshold level of intent to deceive, but that proof was rebutted by Robert Fischell's good faith explanation. *See Therasense*, 2011 WL 2028255, at \*10 (quoting *Star Scientific*, 537 F.3d at 1368). BSC's argument therefore hinges, as it did below, on Robert Fischell's credibility. Reviewing the record, we agree that there is substantial evidence calling into question Robert Fischell's veracity. But it was the province of the district court to determine credibility, and "[t]his court gives great deference to the district court's decisions regarding credibility of witnesses." *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1378-79 (Fed. Cir. 2000); *see also Anderson v. Bessemer City*, 470 U.S. 564, 575 ("[O]nly the trial judge can be aware of the variations in demeanor and tone of voice that bear so heavily on the listener's understanding of and belief in what is said.").



On the Meaning of “Patented Invention”: Tab 10



US005879370A

# United States Patent [19]

[11] **Patent Number:** **5,879,370**

**Fischell et al.**

[45] **Date of Patent:** **Mar. 9, 1999**

- [54] **STENT HAVING A MULTIPLICITY OF UNDULATING LONGITUDINALS**
- [76] Inventors: **Robert E. Fischell**, 14600 Viburnum Dr., Dayton, Md. 21036; **David R. Fischell**, 71 Riverlawn Dr., Fair Haven, N.J. 07704; **Tim A. Fischell**, 1018 Chancery La., Nashville, Tenn. 37215

[21] Appl. No.: **864,221**

[22] Filed: **May 28, 1997**

### Related U.S. Application Data

[63] Continuation of Ser. No. 202,128, Feb. 25, 1994, Pat. No. 5,643,312.

[51] **Int. Cl.<sup>6</sup>** ..... **A61M 29/00**

[52] **U.S. Cl.** ..... **606/198; 623/1; 623/12**

[58] **Field of Search** ..... 606/1, 108, 191, 606/194, 198, 200; 623/1, 12

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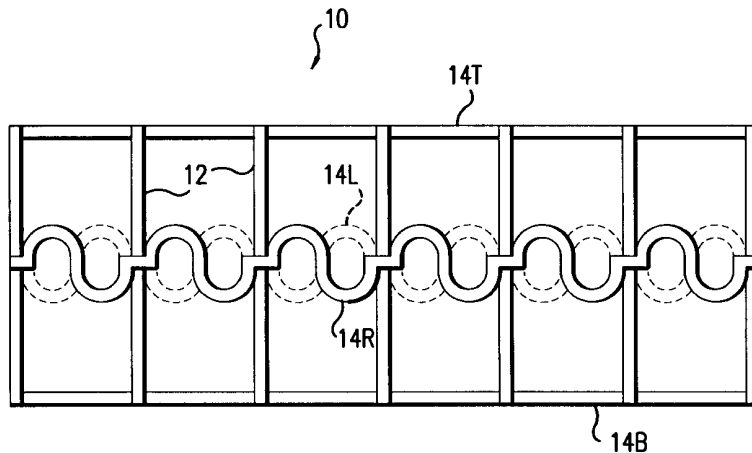
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### [57] ABSTRACT

The present invention provides for an expandable stent (**10** or **20**) for use in an artery or other vessel of a human body. The stent structure (**10** or **20**) maintains the patency of the vessel within which the stent (**10** or **20**) is expanded radially outward. One embodiment of the present invention is a stent (**10**) having a multiplicity of frames (**12**) joined together by at least two undulating longitudinal structures (**14L** and **14R**) which can readily change their length in the longitudinal direction so as to provide increased longitudinal flexibility for the stent (**10**) for easy passage through and placement within a curved vessel such as a coronary artery. The stent (**20**) is an embodiment of the present invention having frames (**22**) joined with longitudinal structures (**24B**, **24T** and **24R**) and formed from a single, thin-walled piece of metal by means of laser cutting or chemical etching. Because the stent (**20**) is fabricated from a single piece of metal, it provides a multiplicity of closed perimeter cells that are formed as a continuous metal structure.

**26 Claims, 4 Drawing Sheets**



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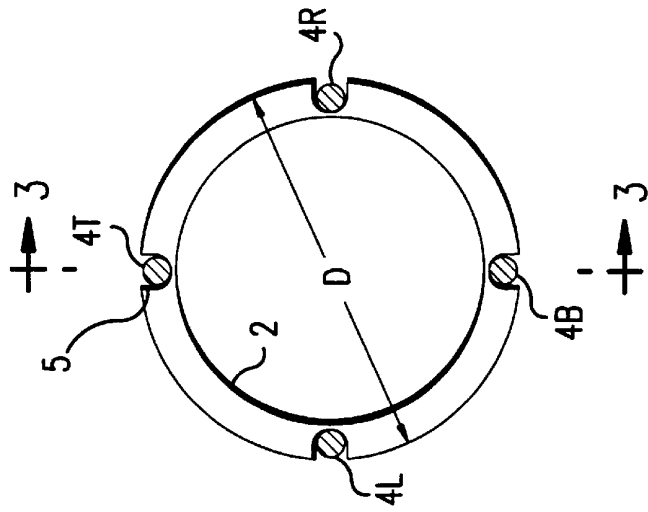


FIG. 2

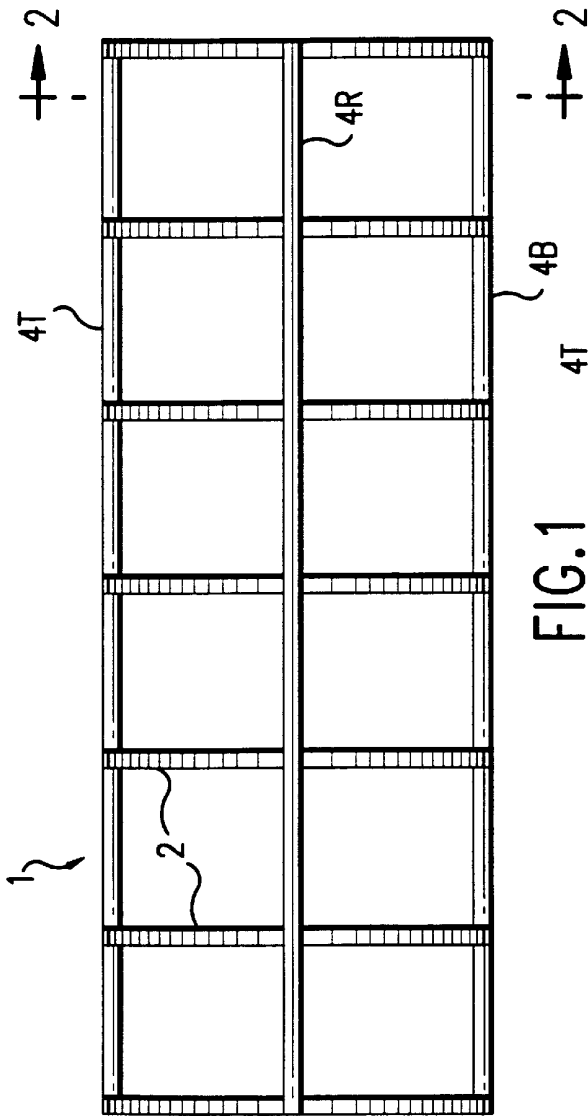


FIG. 1

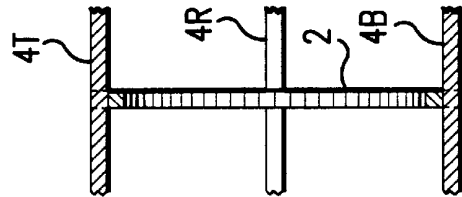


FIG. 3

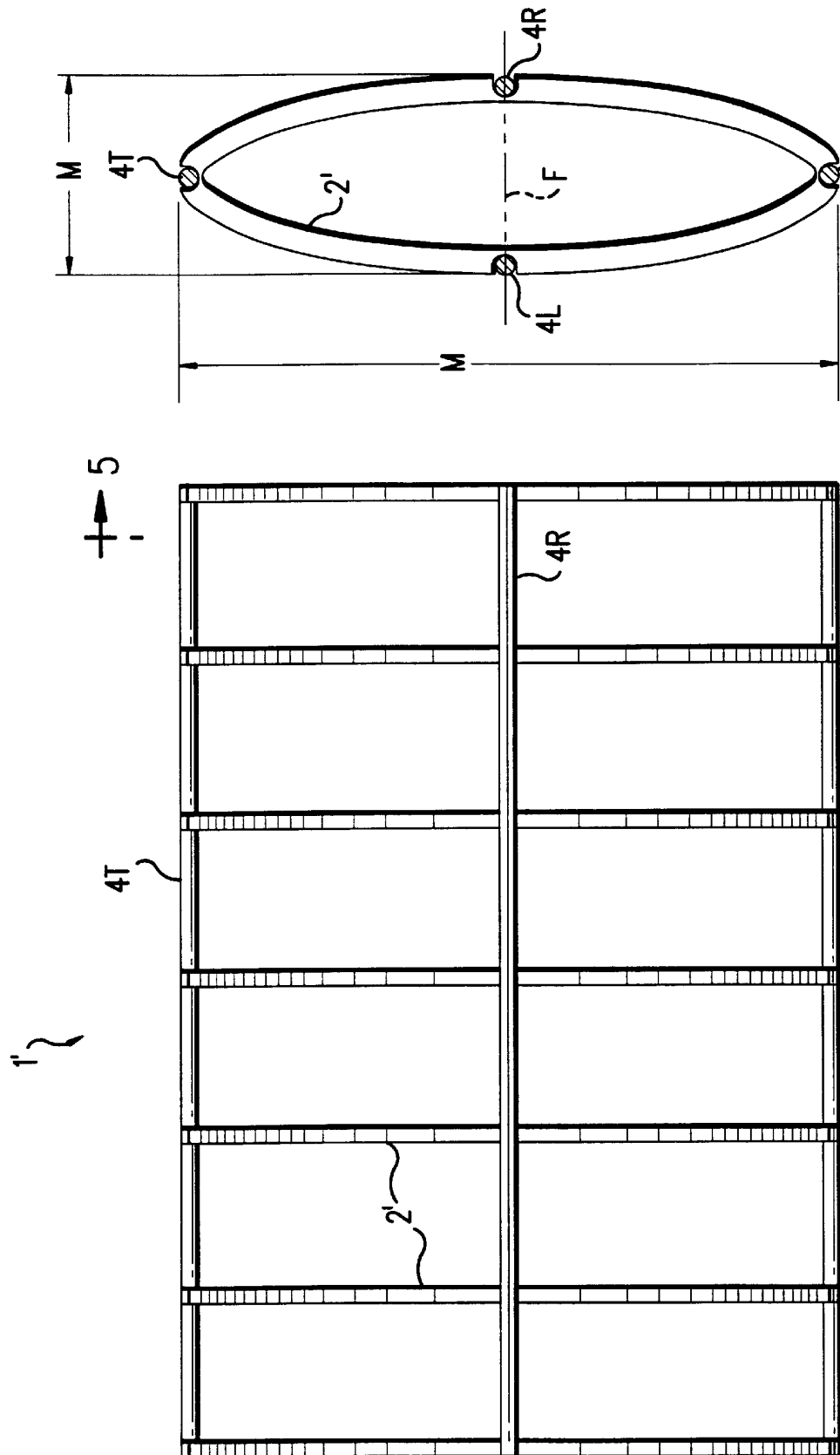


FIG. 5

FIG. 4

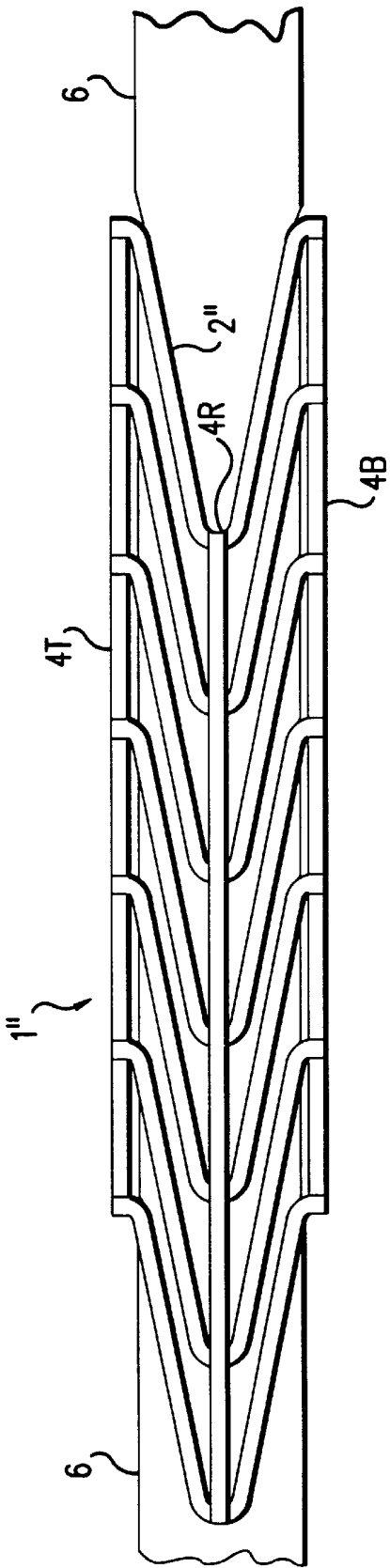


FIG. 6

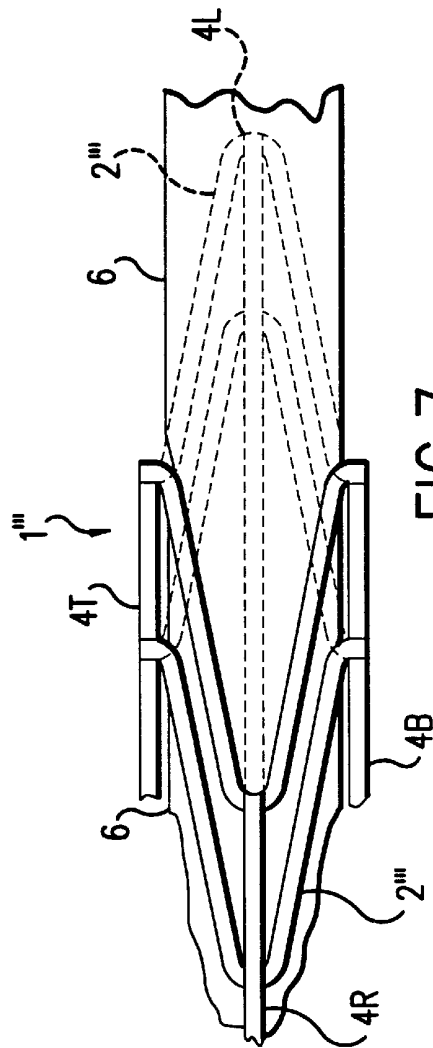


FIG. 7



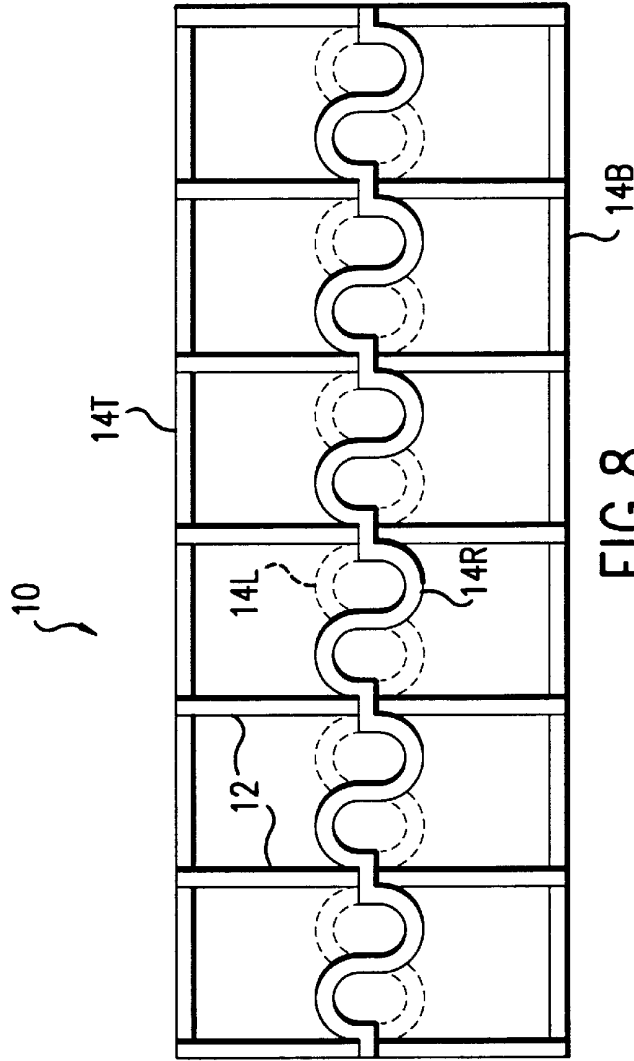


FIG. 8

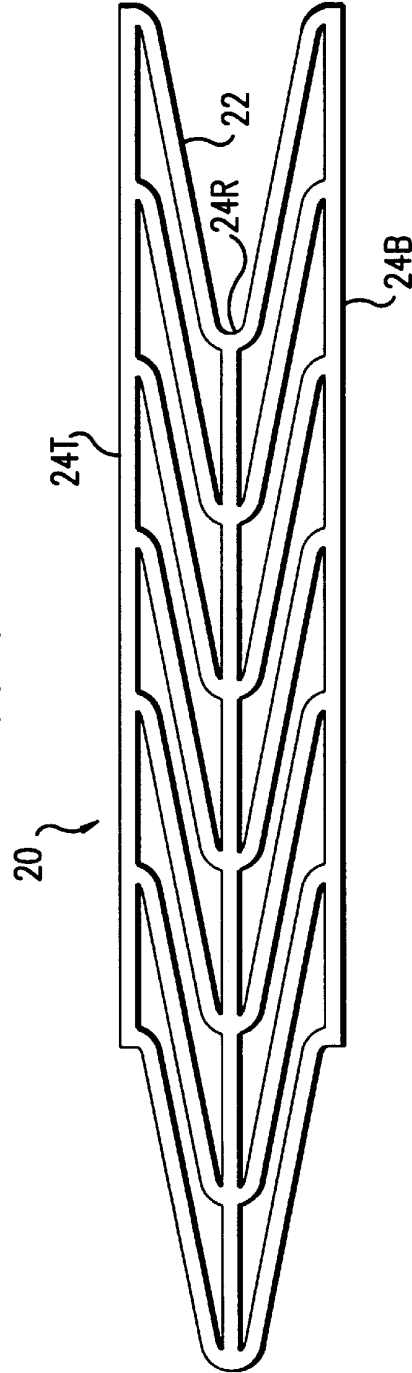


FIG. 9

## STENT HAVING A MULTIPLICITY OF UNDULATING LONGITUDINALS

This is a continuation of application Ser. No. 08/202,128 filed on Feb. 25, 1994 now U.S. Pat. No. 5,643,312.

### FIELD OF THE INVENTION

This invention is in the field of stents for maintaining patency of any one of a multiplicity of vessels of the human body.

### BACKGROUND OF THE INVENTION

In the last decade, many different designs of stents have been used to maintain patency of arteries and other vessels of the human body. In all such devices, hoop strength is an important characteristic. Specifically, the stent must have enough hoop strength to resist the elastic recoil exerted by the vessel into which the stent is placed. The Mass stent described in the U.S. Pat. No. 4,553,545 and the Dotter stent described in U.S. Pat. No. 4,503,569 are each open helical coils. The Palmaz stent described in the U.S. Pat. No. 4,733,665 is of the "chinese finger" design. The Gianturco-Rubin stent currently sold by Cook, Inc. is another stent design which like the stents of Mass, Dotter and Palmaz does not have any closed circular member to optimize hoop strength.

The ideal arterial stent utilizes a minimum wire size of the stent elements to minimize thrombosis at the stent site after implantation. The ideal arterial stent also possesses sufficient hoop strength to resist elastic recoil of the artery. Although the optimum design for maximizing hoop strength is a closed circular structure, no prior art stent has been described which has a small diameter when percutaneously inserted into a vessel and which expands into the form of multiplicity of closed circular structures (i.e. rings) expanded outward against the vessel wall.

### BRIEF SUMMARY OF THE PRESENT INVENTION

The present invention is an expandable stent that can be used in an artery or any other vessel of the human body which, when expanded, forms a multiplicity of generally circular rings whose closed structure optimizes hoop strength so as to minimize elastic recoil of the vessel into which the stent is inserted. Furthermore, the structure of the stent in the present invention is initially in the form of folded ellipses or ovals which can be formed to a small diameter for percutaneous insertion by means of a stent delivery catheter. The ovals are joined to each other by either a straight or undulating shaped wires which are called "longitudinals" which serve to space the deployed rings within the vessel. Straight longitudinals are used in straight vessels and undulating longitudinals can be employed in either straight or highly curved vessels such as some coronary arteries.

Thus, an object of this invention is to provide a stent having a maximum hoop strength by the employment of closed, generally circular structures which are in fact rings.

Another object of this invention is that the rings are initially in the form of ovals that can be folded to fit onto a cylindrical structure at a distal portion of a stent delivery catheter.

Still another object of this invention is that the fully deployed rings are spaced apart by means of longitudinals which are either straight or undulating wires that are placed to be generally parallel to the longitudinal axis of the vessel into which the stent is deployed.

Still another object of this invention is that the pre-deployment stent structure is formed as a single piece out of a metal tube having a smaller inside diameter as compared to the outside diameter of an expandable balloon onto which the pre-deployment stent is mounted.

These and other important objects and advantages of this invention will become apparent from the detailed description of the invention and the associated drawings provided herein.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the stent after it has been deployed; i.e., in its post-deployment form.

FIG. 2 is a transverse cross section at section 2—2 of FIG. 1 illustrating how the longitudinals are joined to the rings.

FIG. 3 is a cross section at section 3—3 of FIG. 2 showing the joining of a single ring to the longitudinals.

FIG. 4 is a side view of the stent prior to being mounted onto a stent delivery catheter; i.e., in the form of an initial structure.

FIG. 5 is a transverse cross section at section 5—5 of FIG. 4 illustrating how the longitudinals are joined to the ovals.

FIG. 6 is a side view of a pre-deployment form of the stent structure in which the ovals have been folded into a small diameter cylinder that is placed around a deflated balloon situated near the distal end of a stent delivery catheter.

FIG. 7 is a partial side view of a pre-deployment stent structure showing only two of a multiplicity of folded ovals formed around an expandable balloon in which the ovals are folded in an alternative manner as compared with FIG. 6.

FIG. 8 is a side view of a post-deployment stent structure which utilizes two undulating longitudinals on opposite sides of the stent for improved placement in curved vessels.

FIG. 9 is a side view of a stent as etched out of a small diameter metal cylinder as a single piece of metal.

### DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the cylindrical stent 1 of the present invention shown in its post-deployment configuration. The stent 1 has a multiplicity of rings 2 which are spaced apart by four wires called longitudinals. As seen in FIGS. 1 and 2, at the top of the stent is longitudinal 4T, at the bottom is longitudinal 4B, at the left side is longitudinal 4L and at the right side is longitudinal 4R. Although FIGS. 1 and 2 show 7 rings and 4 longitudinals, it is apparent that the stent can be made longer by adding rings or increasing the separation between rings. In a similar manner, the stent can be made shorter by reducing the number of rings or decreasing the spacing between rings. Also variable spacing of the rings is envisioned for accomplishing a variety of purposes including increased hoop strength at a particular section of the stent. Also, it is envisioned that the two or more longitudinals could be utilized for this stent design with a maximum number being 32.

FIGS. 2 and 3 illustrate the joining of the longitudinals to the rings. Specifically the longitudinals can be placed into cutouts in the form of notches 5 located on the outside perimeter of the ring 2. The longitudinals can then be spot welded, adhesively bonded or joined by any variety of means to the rings 2. It is also envisioned that the longitudinals could be placed on the inside perimeter of the ring 2, or holes could be mechanically or laser drilled through the ring 2 for placement therethrough of the longitudinals.

FIGS. 4 and 5 illustrate a stent 1' shown in one particular form in which it could be fabricated; i.e., in an initial

structure form. Specifically, FIGS. 4 and 5 show that this initial form of the stent 1' is a multiplicity of parallel ellipses or ovals 2' each oval having the same minor axis dimension m and major axis dimension M. The oval's minor axis passes through the center of the longitudinals 4L and 4R. The oval's major axis passes through the center of the longitudinals 4T and 4B. It is important to note that, if it is desired to have a final outside diameter D (as seen in FIG. 2) of the ring 2 after it is fully deployed, then it can be shown that D is given by the equation  $D^2 = \frac{1}{2}(m^2 + M^2)$ .

To place the stent design of FIGS. 4 and 5 onto a balloon that is mounted near the distal end of a stent delivery catheter, it is necessary to fold the ovals 2' around that balloon. Specifically, the pre-deployment cylindrical stent 1" can be formed onto an expandable balloon 6 as shown in FIG. 6 by folding the ovals 2' about the dotted line F (which is the minor axis of the oval 2') as shown in FIG. 5. Specifically, as seen in FIG. 4, the top and bottom of the ovals 2' could be held stationary while the side longitudinals 4R and 4L are pushed to the left which results in the pre-deployment structure which is shown as the stent 1" in FIG. 6. An optimum design has the folded ovals 2" as shown in FIG. 6 with the stent 1" being a cylinder whose outside diameter is equal in size to the minor axis dimension m. When the balloon 6 of FIG. 6 is expanded, the pre-deployment stent 1" structure forms the post-deployment stent 1 structure having circular rings 2 as shown in FIGS. 1 and 2.

The stent 1'" is an alternative embodiment for a pre-deployment structure of the stent of the present invention as it is placed onto a balloon. Specifically, FIG. 7 shows 2 folded rings 2'" of a multiple ring stent 1"". The stent 1'" being formed by holding the top and bottom of the stent 1' of FIG. 4 stationary while pushing the longitudinal 4R to the left and pushing the longitudinal 4L to the right. Like the stent 1" of FIG. 6, when mounted onto a balloon, the stent 11'" has a cylindrical shape with a diameter equal to the dimension m.

FIGS. 1 to 7 inclusive illustrate stents that employ longitudinals that are formed from generally straight wires. FIG. 8 shows an alternative embodiment of a stent 10 that has two undulating longitudinals. Specifically, the left side longitudinal 14L (shown as dotted lines) and the right side longitudinal 14R are each undulating shaped longitudinals. A stent such as stent 10 could have two or more undulating longitudinals. Such a stent would bend more easily during insertion into a vessel and would be more readily adaptable for placement in curved vessels such as some coronary arteries.

Typically, the rings and longitudinals of the stents would be made of the same material. Typical metals used for such a stent would be stainless steel, tantalum, titanium, or a shape memory metal such as Nitinol. If Nitinol is used, the stent would be heat treated into the shape at body temperature having circular rings 2 as shown in FIGS. 1 and 2. The rings could then be distorted into ovals as shown in FIGS. 4 and 5 and then mounted onto a stent delivery catheter which does not employ a balloon but is of the more general shape described in the previously cited U.S. Pat. No. 4,553,545 by C.T. Dotter. Such a design would provide the desired stent structure having a multiplicity of generally circular rings instead of the Dotter design of a helical spring which inherently has a lesser hoop strength as compared to the present invention.

It should be understood that once the ovals are folded onto a stent delivery catheter, when they fully deploy, they do not

form perfectly circular rings as shown in FIG. 2, but rather they are of a generally circular shape. Such comparatively small deviations from an exactly circular shape do not appreciably decrease hoop strength because they are in fact closed structures that are almost exactly circular.

It should also be understood that at least part of the end rings of the stent could be fabricated from or coated with a radiopaque metal such as tantalum or gold to provide a fluoroscopic indication of the stent position within a vessel. However, the other rings and the longitudinals could be made from a much less dense metal which would provide less obscuration of the central region within the stent. For example, the stent rings and longitudinals could all be fabricated from titanium or a titanium alloy except the end rings which could be formed from gold which is then plated with titanium. Thus, the entire outside surface of the stent would be titanium, which is known to be a comparatively non-thrombogenic metal while the gold in the end rings provides an improved fluoroscopic image of the stent extremities.

The dimensions of stent rings are typically 0.1 to 0.3 mm thick, with a width of 0.1 to 0.5 mm and an outside diameter D between 2.0 and 30.0 mm depending on the luminal diameter of the vessel into which it is inserted. The length of the stent could be between 1 and 10 cm. The wire diameter for the longitudinals would typically be between 0.05 and 0.5 mm.

Although the designs of FIGS. 1 through 7 inclusive illustrate separate longitudinals attached to a multiplicity of rings, this invention also contemplates an initial stent structure which is chemically etched from thin-walled tubing having an oval transverse cross section. Thus the oval and longitudinals would be formed from a single piece of metal thus precluding the need for attaching the longitudinal to the rings. In a similar manner laser or EDM machining could be used to form the stent from a thin-walled tube.

It is further anticipated that a pre-deployment stent structure 20 as shown in FIG. 9 could be formed from a thin-walled cylindrical tube whose inside diameter is slightly smaller than the outside diameter of the balloon 6 shown in FIG. 6. A pattern such as that shown in either FIG. 6 or FIG. 7 could be photoetched onto a thin-walled metal cylinder. The one piece structure 20 shown in FIG. 9 has folded ovals 22 and longitudinals 23T, 24B, 24R and (not shown) 24L. This pre-deployment stent structure 20 could then be mounted onto the expandable balloon; the stent having sufficient elastic recoil to firmly grasp down onto the balloon.

Various other modifications, adaptations, and alternative designs are of course possible in light of the above teachings. Therefore, it should be understood at this time that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed is:

1. A stent structure for maintaining patency of a vessel of a human body comprising a multiplicity of structures forming longitudinals extending in a substantially longitudinal direction, at least a portion of at least one of said longitudinals having an undulating shape.

2. The stent structure as recited in claim 1 including a frame extending around a longitudinal axis of said stent structure, said longitudinals being fixedly coupled to said frame.

3. The stent structure as recited in claim 2 where said frame is formed of at least a pair of longitudinally displaced frame elements, said longitudinals being secured to at least two of said frame elements.

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4. The stent structure as recited in claim 3 where said frame elements are formed in a closed contour.

5. The stent structure as recited in claim 3 where said frame includes a pair of opposing end frame elements having a radiopacity value different than a radiopacity value of other frame elements forming said frame.

6. The stent structure as recited in claim 3 where said stent structure is formed from a metal having a shape memory characteristic.

7. A stent structure for maintaining patency of a vessel of a human body comprising:

(a) a frame displaceable in a radial direction for contiguous interface with an inner wall of said vessel of said human body; and,

(b) a multiplicity of longitudinals secured to said frame, at least two of said longitudinals having an undulating contour for enhancing longitudinal flexibility.

8. The stent structure as recited in claim 7 where said longitudinals extend in a substantially longitudinal direction.

9. The stent structure as recited in claim 7 where said frame includes a plurality of longitudinally displaced frame elements, each of said frame elements being fixedly coupled to at least one of said longitudinals.

10. The stent structure as recited in claim 8 where said frame elements are formed in closed contour formation.

11. The stent structure as recited in claim 8 where said frame elements are formed of wire members.

12. The stent structure as recited in claim 8 where said longitudinals are formed of wire members.

13. The stent structure as recited in claim 8 where said frame elements and said longitudinals are formed of a metal composition.

14. The stent structure as recited in claim 9 where said frame includes a pair of longitudinally displaced end frame elements having a differing radiopacity when taken with respect to at least one other frame element of said frame.

15. A pre-deployment stent structure having a longitudinal axis comprising at least two longitudinal structures each having at least one straight section and at least one undulating section with each said straight section being joined continuously to said at least one undulating section, the straight sections of all of the longitudinal structures being generally parallel to the longitudinal axis of the stent, the undulating section of each longitudinal structure extending generally in a circumferential direction and being of a generally curved shape so as to allow each undulating longitudinal structure to readily change length during insertion of the stent structure into a curved vessel of a human body.

16. The pre-deployment stent structure of claim 15 wherein the undulating section of the longitudinal structures

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extend first in one circumferential direction and then extend in the opposite circumferential direction.

17. The pre-deployment stent structure of claim 15 wherein each undulating section is joined at each of its ends to a straight section.

18. The pre-deployment stent structure of claim 15, wherein each undulating structure is in the general form of a sine wave.

19. The pre-deployment stent structure of claim 15 in which the stent is formed as a one piece structure that is photo-etched from a single piece of metal.

20. The pre-deployment stent structure of claim 15 in which the stent is formed as a one piece structure that is EDM machined from a thin-walled tube.

21. The pre-deployment stent structure of claim 15 in which the stent is formed as a one piece structure that is laser machined from a thin-walled tube.

22. A pre-deployment balloon expandable stent structure adapted for percutaneous delivery to the curved coronary arteries, the stent structure being generally in the form of a thin-walled metal tube having a longitudinal axis, the stent structure having a multiplicity of closed perimeter cells, each cell having one or more undulating sections, each undulating section having a generally curved shaped and having a first end point and a second end point wherein a line drawn from the first end point to the second end point is generally parallel to the stent's longitudinal axis.

23. The stent of claim 22 wherein the line drawn from the first end point to the second end point of the generally curved shape remains generally parallel to the longitudinal axis of the stent as the stent is expanded into its post-deployment state.

24. The stent of claim 22 wherein each cell has at least one circumferentially adjacent cell which shares one undulating section.

25. The stent of claim 22 wherein the undulating section of each closed perimeter cell comprises a "U" shaped curve.

26. A balloon expandable coronary stent comprising:

(a) a stent in the form of a thin-walled metal tube capable of being mounted on an expandable balloon for percutaneous delivery of the stent into a coronary artery, the stent having a plurality of zig-zag segments, the zig-zag segments capable of being expanded by the balloon; and,

(b) a plurality of longitudinally undulating sections of a generally curved shape positioned between and connecting the zig-zag segments, wherein the plurality of longitudinally undulating sections can expand and contract in length while being passed through a curved coronary artery.

\* \* \* \* \*

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 5,879,370  
DATED : March 9, 1999  
INVENTOR(S) : Robert E. Fischell et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 4,

Line 48, insert the following sentence;

-- Another method to form the pre-deployment stent is by etching the correct pattern onto a thin, flat metal plate, then forming a tube from that plate and then making a longitudinal weld to form a cylindrically shaped structure which is, in fact, the pre-deployment stent structure 20 shown in Fig. 9. --

Signed and Sealed this

Twenty-seventh Day of August, 2002

*Attest:*

A handwritten signature in black ink, appearing to read "James E. Rogan", with a horizontal line drawn underneath it.

*Attesting Officer*

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