WESTINGHOUSE AIR-BRAKE CO. v. NEW YORK AIR-BRAKE CO. et al.

WESTINGHOUSE et al. v. SAME.

(Circuit Court of Appeals, Second Circuit. October 15, 1894).

Nos. 4,976, 4,977, and 5,315.

1. PATENTS—AIR BRAKES — CONSTRUCTION — PIONEER INVENTION — INFRINGEMENT.
The improvement in quick-acting automatic air brakes, consisting of a supplemental chamber having direct connections to the brake cylinder and brake pipe, with a valve controlling communication between these connections, and an emergency piston independent of and unconnected with the triple-valve piston, and actuated by pressure from the auxiliary reservoir in a direction to impart opening movement to the valve, for which a patent (No. 376,837) was granted to George Westinghouse, Jr., January 24, 1888, by which the problem of immediate stoppage of long trains of cars in time of danger was successfully solved, after many years' experiments, is to be liberally construed, as a pioneer invention; and its claims will not be limited to the precise mechanical means described in the specification by which the supplementary piston is actuated, but compel it to be disconnected with and to be independent of the triple-valve piston, and to be actuated from an auxiliary reservoir by some means equivalent to the means described in the specification; and, as thus construed, the patent is infringed by defendants' device of a supplementary chamber, whose piston is actuated by different mechanical means.

2. SAME—ANTICIPATION.
The Westinghouse patent, No. 448,827, for a valve controlling communication between a supply passage from the train pipe and a delivery passage to the open air or a brake cylinder, etc., whose distinctive feature is that the emergency valve is actuated to open the exhaust port "independently of the action of the triple-valve device," is invalid, as covered by the broad claims of patent No. 376,837.

3. SAME—CONSTRUCTION—SUBORDINATE PATENT.
Patent No. 393,784, to Harvey S. Park, granted December 4, 1888, which merely substituted train-pipe pressure to move the emergency valve in the supplementary chamber for the auxiliary reservoir pressure which Westinghouse used, being a subordinate patent, will not be so construed as to include the various devices which may actuate an emergency valve in a supplemental chamber by train-pipe pressure, and is not infringed by a device in which the valve is not held to its seat and not restored to its place by the piston, as in the patented device.

4. SAME—INFRINGEMENT.
A claim in an air-brake patent (No. 172,064) for a combination containing a port through the center of the piston, described as substituted for a side port, with which the patent dispenses, is not infringed by defendants' device, having no such center port, but using a side port in combination with different elements, which are admitted by the patent to be a part of the prior art.

5. SAME—PIONEER INVENTION—MECHANICAL EQUIVALENTS.
The Westinghouse invention (patent No. 222,803), to be used in connection with an air brake, consisting of an engineer's valve, which, by the movements of a single stem or lever, should admit, and automatically stop admitting, fluid pressure to the brake pipes, by means of a charging valve, automatically retain such pressure, and permit its escape by an exhaust valve, with means of automatically closing either valve when the desired pressure has been charged into or withdrawn from the train pipe to which the device was connected, being construed as a pioneer invention, is infringed by defendants' device,

the only difference in which is the substitution for the direct action of the piston through the interposed stem in opening the valve, as used in the patented device, of the action of a bell-crank lever, pin, and lever.

6. SAME—ANTICIPATION.
Such patent (No. 222,803) was not anticipated by the Westinghouse patent, No. 128,015, or by the Fay & Cairns patent, No. 141,685, for an apparatus for regulating the flow of water in houses, and shutting it off when there is an excess of pressure.

These were suits by the Westinghouse Air-Brake Company against the New York Air-Brake Company and others, and by George Westinghouse, Jr., and the Westinghouse Air-Brake Company against the New York Air-Brake Company and others, for the infringement of certain patents for improvements in railroad brakes. The bills were dismissed as to some of the patents, and decrees granted as to certain specific claims in the rest of the patents. 59 Fed. 581. Complainants and defendants respectively appeal from these decrees.

George H. Christy, Frederic H. Betts, and J. Snowden Bell, for complainants.

J. E. Maynadier, Fred'k P. Fish, Esek Cowen, and Edward C. James, for defendants.

Before WALLACE, LACOMBE and SHIPMAN, Circuit Judges.

SHIPMAN, Circuit Judge. The various appeals in these three cases are from decrees of the circuit court for the southern district of New York upon three bills in equity for the alleged infringement of letters patent. No. 4,977 was founded upon letters patent No. 376,837, dated January 24, 1888, and letters patent No. 172,064, dated February 11, 1876, each issued to George Westinghouse, Jr. The circuit court decreed that the defendants should be enjoined against their infringement of the first, second, and third claims of No. 376,837, and that the bill should be dismissed as to No. 172,064. No. 5,315 was founded upon letters patent No. 448,827 to George Westinghouse, Jr., dated March 24, 1891. The circuit court decreed that the defendants should be enjoined against the infringement of the first and second claims of this patent. No. 4,976 was founded upon letters patent No. 393,784, dated December 4, 1888, to Harvey S. Park, and No. 222,803, dated December 23, 1879, to George Westinghouse, Jr. The circuit court dismissed the bill as to No. 393,784, and decreed that an injunction should issue against the infringement by the defendants of the second, third, and fourth claims of No. 222,803. The complainants and defendants have respectively appealed from the decrees which were respectively adverse to them.

These patents are for improvements in railroad brakes by fluid pressure, and will be better understood if they are considered in the order of their relation to each other, rather than as they are grouped in the bills in equity; and therefore Nos. 376,837 and 448,827, which was originally applied for in the application which resulted in No. 376,837, naturally take precedence. It is necessary to give the history of the development by the patentee of the au-

tomatic, "Quick-Action" air-brake system, because the construction of the important claims of the two patents now under consideration, and of the patent to Park (No. 393,784), depends, to a great degree, upon a knowledge of this history, which was accurately condensed by Judge Townsend, as follows:

"The first practical air brake is known as the 'plain brake,' and is described in patent No. 88,929, granted to George Westinghouse, Jr., April 13, 1869. It consisted of a pump operated by steam from the locomotive boiler, which compressed air into a reservoir located under the locomotive cab, which reservoir communicated by a pipe with a cock or valve in said cab, called the 'engineer's valve,' which was so located as to be readily manipulated by the engineer. From this valve a pipe extended back under the tender, and was connected to a similar pipe under the entire length of the first car by a flexible hose. Each of the succeeding cars had a similar pipe, similarly connected. This pipe was called the 'train pipe.' From the train pipe of each car a branch pipe communicated with the forward end of a cylinder called the 'brake cylinder.' This cylinder was provided with a piston, the stem of which was connected with the brake levers on the car. When the engineer wished to apply the brakes, he opened the engineer's valve, and the compressed air from the main reservoir flowed back through the train pipe and branch pipes into the brake cylinder on each car, pushing the pistons backward, causing the piston stems to operate the brake levers, and force the brake shoes against the wheels. When he wished to release the brakes, he so shifted the valve as to shut off the flow of compressed air from the main reservoir, and to open a port or vent leading from the train pipe to the open air. Thereupon, the compressed air in the brake cylinders escaped into the open air, the pressure of the pistons was removed, and the pistons were forced forward again by means of springs, thus moving the brake shoes away from the wheels. The validity of this patent was sustained in Westinghouse v. Air-Brake Co., 9 O. G. 538, Fed. Cas. No. 17,450. The operation of this plain brake was open to certain objections. It was too slow, and was attended by danger of collision in case one part of the train became detached from the other part.

"The next brake to be considered is known as the 'automatic brake,' which appears to have been patented by George Westinghouse, Jr., about 1872 or 1873. It embodied the addition of an auxiliary reservoir and a triple-valve device to each car. Each reservoir was of sufficient capacity to operate its brakes once, thus to provide for automatic action in case of accident. The triple-valve device was located at the junction of connections between pipes leading to the train pipes, the brake cylinder, and the auxiliary reservoir. In addition to these three ports, there was a fourth port leading to the open air. The operation of this brake was radically different from that of the plain brake. In the former, the compressed air was stored in the main reservoir until required for the application of brakes; in the latter, the main and auxiliary reservoirs and train pipe were always charged with compressed air at working pressure, to prevent the application of the brakes. When the engineer wished to apply the automatic brake, he shifted the engineer's valve so as to cut off the flow of compressed air from the main reservoir, and open a port from the train pipe to the open air. The effect of this was to reduce the air pressure in the train pipe, and cause a back pressure from each auxiliary reservoir through the triple valve, which shifted it so as to close the port from the branch pipe to the train pipe, and stop the escape of air from the auxiliary reservoir, to close the port leading from the brake cylinder to the open air, and to open the port leading from the auxiliary reservoir, and connect it with the port leading to the brake cylinder. Thereupon, the compressed air in the auxiliary reservoir flowed into the brake cylinder, and applied the brakes. It will thus be seen that, while the former system was operated by pressure from the main reservoir, the

latter was operated by withdrawal of pressure. The result was automatic action in case of accidents, whereby air was caused to escape from the train pipe, as by bursting of hose, or the train breaking in two. In such cases the release of pressure operated the triple valve, and automatically applied the brakes. It is necessary here to consider 'train-brake graduation' or 'service stops,' as distinguished from 'emergency stops.' While, for the latter, it may be necessary to admit to the brake cylinder the full pressure of compressed air, say seventy or eighty pounds, yet, where it is desired merely to slow up without stopping, it may be necessary to admit only, say, ten or twenty pounds, graduating the amount of flow according to the character of service desired. It is important to bear this distinction in mind, because the appliances hereafter to be considered have been so devised as to provide therefor, and that such graduation shall be under the control of the engineer.

"The chief objection to this automatic brake lay in the fact that it was not capable of successful operation on long trains of freight cars. The time consumed by the progressive operation of the brakes between the grip on the first and last car allowed of so much slack motion between them as to cause violent shocks. This automatic brake was publicly tested near Burlington, Iowa, in 1886. The growing importance of the subject of automatic freight graduation, the inadequacy of existing systems to protect the lives of railroad employés, and the disastrous results therefrom, had become so evident that in 1885 the Railway Master Car-Builders' Association arranged for a series of experiments known as the 'Burlington trials.' The Westinghouse Company, and several other companies engaged in the manufacture of brake apparatus, competed at these trials. None of the competitors succeeded in stopping long trains of freight cars without violent and disastrous shocks. In 1887 the trials were renewed. There were five competing parties, including one of the leading experts for the defendants and the complainant company. The latter then presented an improved apparatus covered by patent No. 360,070, granted to George Westinghouse, Jr., March 29, 1887. The report of the committee of the Car-Builders' Association shows that they considered 'the field for improvement open as wide as in 1886,' and concluded that air brakes actuated by electricity were the only ones likely to be capable of successful operation on long trains of freight cars. The improved Westinghouse apparatus, while it reduced the length of time between the application of the first and last brakes, produced greater shocks than did the automatic apparatus of the preceding year. In this condition of affairs, George Westinghouse, Jr., set himself to work to obviate these difficulties. Upon the conclusion of the 1887 trials, he renewed his investigations and experiments, and by certain changes and improvements in the old apparatus, and the introduction of new elements, he succeeded in the latter part of the year 1887 in constructing a quick-action automatic brake, capable of being successfully applied to a train of fifty freight cars, and operative under all conditions of practical railway service. On October 1, 1887, he applied for a patent for this apparatus, and on January 24, 1888, the patent was granted. Said patent, No. 376,837, is the first of the patents in suit. Before proceeding to consider in detail the claims of this patent, it should be stated that the following were among the requirements for the practical operation of air brakes: (1) The regulation of the force to be applied to the brake shoes so as to secure all necessary graduations, from the mere slackening of speed to the service stop, and from the service stop to the emergency stop. (2) The automatic operation of the brakes in case of accident. (3) The practically simultaneous operation of the brakes on each car, so that, in long trains of freight cars, shocks might be avoided. (4) The control of all these operations by the engineer. (5) Certainty of operation under all conditions."

The automatic brake system constructed in general accordance with the invention described in No. 376,837 complies with all these

essential conditions. It was unquestionably the first system which practically solved the problem of immediate stoppage of a long freight train in time of danger, in connection with and supplemental to "train-brake graduation," and so promptly was its success recognized that 125,000 of this kind of brakes were bought and used by the railroad companies of this country within a period of little more than three years. It is therefore important to understand the nature of the improvement which created success. The promptness with which an automatic air-brake system could be made effectual depended upon the promptness with which air pressure in the train pipe could be reduced, and the equalization of pressure could be changed. Before the series of inventions originated by the Burlington trials, this reduction had been effected in passenger trains of ordinary length by "venting" the train pipe, or opening a port from the train pipe to the open air, which was initiated by a turn of the engineer's valve on the locomotive. Westinghouse, in his attempt to create efficient and immediate service upon each car of a long train, enlarged the venting system, so that, when the reduction of train-pipe pressure had commenced by the turn of the engineer's valve, the triple valve under each car should also vent the train pipe of that car. Each car therefore contained its own venting mechanism, and, as the mechanism did its work upon its own car, it hastened the work upon the car next in the rear. Westinghouse also sought to save and did save power by compelling the compressed air thus vented to pass into the brake cylinder, instead of into the open air. But sudden and large reduction of pressure is only to be used in a case of emergency, and therefore means for such reduction must be made supplementary to the means for the ordinary service of the brakes, so that ordinary and extraordinary use of the brakes can each be made available as necessity arises. The method in No. 360,070 was to make the ordinary range of motion of the triple-valve piston, which was produced by a reduction of train-pipe pressure of a few pounds, do the ordinary work of "braking" a train, and to make an extraordinary range of motion throughout the entire length of its capacity for travel, which was produced by a reduction of 15 or 20 pounds, do the extraordinary work which gave to the brake the name of "quick action." When the piston of the triple valve moved through the entire length which it could travel, the stem of the piston came in contact with the stem of the emergency valve, opened it, which uncovered a port, and thereby the train-pipe pressure was vented into the brake cylinder. The claims of the patent call the first or ordinary range of motion of the piston "a preliminary traverse," which admits air from the auxiliary reservoir to the brake cylinder, and the second range of motion "a further traverse," which enables the piston to admit air directly from the main pipe to the brake cylinder. This invention, palpably and confessedly, lacked success in the Burlington trials. The reason of its failure, and its remedy in No. 376,837, are described by Mr. Massey, a competent expert for the defendants and the patentee of the infringing valve, whose

testimony upon this subject is admitted to be correct. He said, upon direct examination, in reply to the question:

"What is the practical objection, if any, to the quick-action triple valve of 360,070, and how is that remedied by the apparatus of 376,837? Before answering, state what is meant by the 'Westinghouse Quick-Action Automatic Brake.' Ans. The term 'Westinghouse Quick-Action Automatic Brake,' as used by Mr. Stone, undoubtedly refers to the quick-action triple valve described in patent 376,837, and illustrated on sheet 2 of that patent. It is also the quick-action triple valve which is illustrated in the Westinghouse catalogue of 1890. In the quick-action triple valve described in 360,070, in addition to the triple valve, the stem of the piston came in contact with an emergency valve, and the extreme motion of the triple-valve piston caused the emergency valve to open a small passage between the train pipe and the brake cylinder; thus causing a local exhaust of the air from the train pipe, and therefore reducing the pressure in the train pipe quicker than would be done by the vent through the engineer's valve. The port which was opened by the emergency valve was necessarily restricted in size, as, in order to be effective, the piston of the triple valve must be able to open it within a moderate reduction of train-pipe pressure, and therefore with but little force in addition to that consumed by the piston in moving the ordinary triple-valve mechanism. If the emergency valve had been arranged to open a very large port, the time required to exhaust the train pipe through the engineer's valve sufficiently to allow the piston to open the emergency valve would be materially increased. This defect in the emergency valve of 360,070 would not be serious in trains of moderate length, as under, say, twenty-five cars; but in the 50-car train used at Burlington in May, 1887, the effect was disastrous. This defect is remedied in 376,837 by using a supplemental piston to open the emergency valve, and actuating that piston by fluid pressure from the reservoir through a passage controlled by a valve which is actuated by the triple-valve piston. In this case the triple-valve piston has only to open a comparatively small port in addition to its regular function, and fluid pressure in the auxiliary reservoir then causes the supplemental piston to open the emergency valve. The length of time required, in the use of the single valve of patent No. 360,070, to open a sufficiently large port, above referred to, appears to have been in the mind of Westinghouse, in providing a separate piston of the patent in suit to open the emergency valve, for in the description of this improved invention, it will be remembered, he states that 'its object is to facilitate the application of brakes with great rapidity, and full, or approximately full, force, as from time to time required, by the provision of means whereby the admission of air from the brake pipe to the brake cylinders may be effected as directly as practicable, and through passages of as large capacity as may be desired.' "

No. 376,837 abandoned reliance upon the piston of the triple valve as the means of opening the emergency valve, and used a supplementary piston, contained in a supplementary chamber, and actuated by pressure from the auxiliary reservoir. The port through which, when uncovered, this pressure passes, is, in the mechanism shown in the specification, uncovered by the excess stroke of the triple-valve piston. The description of the mechanism, which is contained in the next paragraph, is in the language of the opinion in the circuit court; and, inasmuch as the intricate mechanisms of the various devices which are the subject of discussion in the three cases now grouped together were accurately described by Judge Townsend, his language will be used, instead of attempting to formulate independent descriptions of the same series of devices:

"This emergency action is secured, in the patent in suit, by means of a separate, supplemental piston and valve, in a supplemental valve cham-

ber, below the main slide valve of the triple-valve device. This chamber connects the train pipe with the brake cylinder, communication between them being regulated by the supplemental valve, opening outwardly, or downwards, and a check valve opening inwardly, or upwards. These valves are held upon the seats, under ordinary conditions, by a spring bearing upon their stems. In the bushing which forms the valve face of the main slide valve are four ports, governed by said slide valve. One of these ports leads to the brake cylinder, two lead to the supplemental valve chamber on the upper or inner side of the supplemental piston, and one leads to an exhaust port. When an emergency stop is to be made, the engineer throws his engineer's valve wide open, thereby causing a sudden and material reduction of pressure. The excess of auxiliary reservoir pressure then forces the main piston stem against said other stem, overcoming the tension of its spring, drives the main piston to the extreme limit of its stroke, and thereby uncovers the ports leading from the auxiliary reservoir to the supplemental valve chamber. This pressure drives the supplemental piston outwardly, or downwards, against the stem of the supplemental valve, and forces it from its seat. Thereupon, the preponderance of train-pipe pressure in the brake pipe opens the check valve, and the air from the train pipe rushes directly from the brake pipe to the brake cylinder. The result of this operation is twofold: It hastens the application of the brakes on the car on which it is operated, and by venting the train pipe it hastens a similar reduction of pressure and consequent similar operation in the next succeeding triple-valve device on the next car. The release of the brakes is accomplished by the admission of air from the main reservoir."

The three claims which were found to have been infringed are as follows:

"(1) In a brake mechanism, the combination of a chamber or casing, having direct connection to a brake cylinder and to a brake pipe, respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of and unconnected with a triple-valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth. (2) The second claim includes a check or nonreturn valve controlling communication between said valve and the brake-pipe passage of the chamber, substantially as set forth. (3) In a brake mechanism, the combination with a triple valve of a supplemental chamber or casing having passages leading to a brake cylinder and to a brake pipe, respectively, a supplemental piston operating independently of the triple-valve piston, and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir, substantially as set forth."

The vital parts of this mechanism are the supplemental chamber having direct connections to the brake cylinder and the brake pipe; the valve, 41, which controls communication between these connections; the emergency piston, 63, independent and unconnected with the triple-valve piston, and actuated by pressure from the auxiliary reservoir in a direction to impart opening movement to the valve. To these essential parts the defendants would add another,—the particular means by which, in the specification, the emergency piston is actuated,—viz. the excess stroke of the triple-valve piston, which uncovers the port, 61, through which the auxiliary reservoir pressure passes. Upon the scope of the invention the question of infringement depends. The defendants insist that the only invention "resides in the use of an emergency piston, which is open to the exhaust port on one side, and to the brake cylinder on the other side, and which is not subject to operative pressure from the reservoir

except by the extreme stroke of the triple-valve piston." The assignments of error are confined to this question, and the consequent construction of the first three claims, and to the question of infringement. The defendants' theory mistakes the character and scope of the invention, which was another and successful way to accomplish the work designed to be accomplished by No. 360,070, and to be effected upon the same general plan of instantaneous brake-pipe venting, by the new means contained in the supplemental chamber, which have been named. In No. 360,070 the stem of the triple-valve piston directly engaged with the stem of the emergency valve, and consequently its action directly depended upon the movement of the piston. The invention in 376,837 radically departed from this method of actuating the emergency devices, by making a new piston, independent of and unconnected with the triple-valve piston. It was to be actuated by auxiliary reservoir pressure, but the particular means by which this pressure was to be permitted to exert itself, whether continuously, or only when a port should be opened, do not constitute an essential part of the invention. Means must necessarily be shown in the specification, but the identical means or the special devices were not, in the language of Machine Co. v. Lancaster, 129 U. S. 263, 9 Sup. Ct. 299, "necessary constituents" of the invention, either in the specification or in the claim. The skill and mechanical ingenuity of constructors of locomotives can, as will be seen hereafter, in the examination of other patents and of the infringing devices, arrange different details of mechanical construction, by means of pistons, valves, ports, and springs, which, adopting the supplemental chamber system, first conceived and embodied by the patentee, and a kindred, but not precisely the same, mechanical method for the movement of the piston, will accomplish the same result. The patentee was a pioneer, in that he designed, in No. 376,837, a new way to accomplish a desired result, but upon the same general idea which he had unsuccessfully tried to work out in the earlier patent. His later patent was the bridge, and not a mere step, which carried railroad car builders from failure to success. It is not important now to determine the grade of its pioneership, and whether it may be classed in the list of those inventions which are of the highest rank; but it was an invention created to achieve great necessities, and overcome great hindrances, and was one of wide breadth. A court would not be justified in adopting "a narrow or astute construction," which should minimize the character of the invention, leave its real scope open to trespassers, and thus "be fatal to the grant." The claims of the patent do not contract the grant to narrower limits than those which the invention, as made by the patentee, actually covered; and the claims, therefore, are not limited to the precise mechanical mans described in the specification, by which the supplementary piston is actuated. They compel it to be disconnected with and to be independent of a triple-valve piston, and to be actuated by pressure from an auxiliary reservoir by some means equivalent to the means which are described in the specification. The rule which permits, and indeed compels, courts to give a wide range to the equivalents which a

broad or pioneer patent can include, is thus expressed in Miller v. Manufacturing Co., 151 U. S. 186, 14 Sup. Ct. 310: "If the invention is broad or primary in its character, the range of equivalents will be correspondingly broad, under the liberal construction which the courts give to such inventions."

The defendants use two forms of devices, known respectively in the case as "Defendants' Quick-Action Triple Valve," and "Defendants' Modified Quick-Action Triple Valve." Each has the supplementary chamber, with its contents, and in each the various elements conform to the general phraseology of the claims; but in neither does the movement of an emergency piston have any relation to the extreme movement of the triple-valve piston, and herein is contained what is claimed to be the essential difference between the patented device and the defendants' valves. In the defendants' modified valve, the pressure upon opposite sides of the emergency piston, numbered 13, which corresponds in function with emergency piston, 63, of the patent, is always counterbalanced when quick action is not desired, whereas emergency piston, 63, of the Westinghouse valve, is not subjected to auxiliary pressure until its action is required, when port, 61, is uncovered. In the defendants' modified valve, train-pipe pressure is reduced when quick action is wanted; the auxiliary reservoir pressure becomes controlling, forces down emergency valve, 20, which corresponds in function with the Westinghouse emergency valve, 41, and which, when unseated, opens direct communication between the train pipe and the brake cylinder. This difference between the means which are used to actuate the pistons is not of patentable importance. The operative features of the invention which are described in the three claims are the same, whether auxiliary pressure is permitted to exert itself continuously or intermittently when a port is opened. The defendants' earlier device uses two pistons. The first, No. 13, is forced down by auxiliary reservoir pressure, but does not act directly upon the emergency valve. When forced down, "it opens a port, whereby train pressure is admitted to the upper side of the other piston, No. 17, which, being thereby forced down, imparts opening movement to an emergency valve leading to the brake cylinder." It is true that piston, 13, which is the one actuated by auxiliary reservoir pressure, does not, directly and of itself, impart opening movement to the emergency valve, but uncovers a port which admits train-pipe pressure to the brake cylinder; and it is true that piston, No. 17, is actuated by the train-pipe pressure thus admitted. These two pistons do the work of the one piston of the defendants' modified valve. Auxiliary reservoir pressure moves the piston, which, through the intervention of piston, 17, imparts opening movement to the emergency valve. Mr. Massey states the difference between the two valves of the defendant to be that in the "quick-action triple valve the initially operating piston, 13, actuates the emergency valve indirectly,—that is to say, through the intermediation of the piston, 17,—while in the other valve the initially operating piston, 13, actuates the emergency valve directly, as in patent 376,837." This is not a material difference, of a patentable character, when

considered with reference to this patent, and the result is that each of the defendants' valves is an infringement. The quick-action valve infringes the first three claims, while the second form, not having the additional check valve of the second claim, infringes the first and third claims.

No. 448,827 will next be considered. The form of automatic air-brake apparatus shown in this patent was originally included in the application for No. 376,837, which also included the form which has been already described, in which port, 61, was uncovered by the excess stroke of the triple-valve piston. But the applicant was precluded by a rule of the patent office from adding to his generic claims a specific claim for the form which is now described in No. 448,827, and therefore a subordinate patent was applied for. The details of the device are described by Judge Townsend as follows:

"The alleged invention consists of a valve controlling communication between a supply passage from the train pipe and a delivery passage to the open air or a brake cylinder. This valve is held in position by a spring, so as to close ports leading to the delivery passage, and not to be moved from its seat by ordinary reductions of pressure for service stops. There is also a diaphragm and valve stem interposed between the supply passage and a passage to a special reservoir, or an auxiliary reservoir. Said controlling valve is connected to said valve stem. Train-pipe pressure passes through a small passage in said diaphragm into said reservoir, thus equalizing pressure on the opposite sides of said diaphragm. Upon a sudden reduction of pressure, sufficient for an emergency stop, the excess pressure on one side of said diaphragm moves it and its valve stem and the said controlling valve downwardly, so as to open said ports, and allow the compressed air to pass through the delivery passage to the open air or brake cylinder."

The two claims of the patent which are said to have been infringed by the defendants' two valves which have been before described are as follows:

"(1) In a fluid-pressure brake apparatus, normally operated by a triple-valve device, the combination with such an apparatus of a valvular appliance having a casing provided with supply and discharge passages or connections, and a valve controlling an exhaust port from the supply passage to the discharge passage for quickly releasing pressure in the supply passage, said valve being actuated to open the exhaust port by a greater than normal reduction of pressure in the supply passage independently of the action of the triple-valve device, substantially as set forth. (2) The combination with a triple-valve mechanism of a discharge valve controlling an exhaust port from a supply passage to a discharge passage for quickly releasing the pressure in the supply passage, said valve being actuated to open the exhaust port by fluid pressure in an auxiliary reservoir on reduction of pressure in the supply passage below the normal degree, in whatever position the slide valve of the triple-valve mechanism may be brought by such reduction, substantially as set forth."

Infringement of these claims is admitted, and the only question is in regard to their validity. The distinctive feature of the alleged invention is that the emergency valve is actuated to open the exhaust port "independently of the action of the triple-valve device." The theory of the complainants is that, whereas the leading characteristic of novelty in patent No. 376,837 is the "utilization of auxiliary reservoir pressure operating a supplemental piston in proper direc-

tions to impart opening movement to the emergency valve," the invention of No. 448,827 was the means of imparting movement to the valve by "auxiliary pressure, so applied that the action or nonaction of the triple-valve piston shall be eliminated as an element of control," and that its distinctive feature was "the removal from the apparatus of all obstructive mechanical connection between the triple piston and emergency valve, whereby the latter may be impeded in its movements by the former." This theory omits an important characteristic of the novelty of No. 376,837, which is the independency and disconnection of the supplemental piston from the triple-valve piston. In the form left in the application for the patent, after the divisional application was made, there was no mechanical connection between the two pistons; but the stroke of the triple-valve piston exercised a control over the movement of the supplemental piston, by uncovering the port which admitted auxiliary reservoir pressure. The form in 448,827 permits, as do the defendants' valves, auxiliary reservoir pressure to be present at all times, and to act upon the piston, but counterbalanced during ordinary service stops. It was included in the generic claims of No. 376,837, and, in view of those claims, no invention could consist in the mere fact of the elimination of the action of the triple-valve piston as an element of control. When the patentee obtained the broad claims of No. 376,837, he exhausted his powers to obtain additional patents for mere modifications of means by which the piston should be made independent of the triple-valve piston, unless the modification contained a patentable improvement upon the form disclosed in that patent. For any new and useful improvement which contained also the element of invention, or for a separate invention, a subordinate patent could be obtained. Were the changes made in 448,827, after the idea of 376,837 had been embodied in its original form, the work of invention? So far as the first two claims are concerned, the changes consisted in a port from the auxiliary reservoir to one side of the emergency piston, which port was always open, and the counterbalance to reservoir pressure by a spring on the opposite side of the piston, so that ordinary variations of pressure would not destroy the equilibrium necessary to be maintained until excessive reduction of pressure should take place. In view of the various forms and modifications and improvements of automatic brakes and brake mechanism which had been made known before the date of this invention, and which are a part of the record in these three cases, there was no patentable invention in this modified form, apart from the invention shown in No. 376,837. It was simply what the patentee first deemed it to be,—a form of the invention of that patent and covered by it. The first two claims of No. 448,827 contain no patentable improvement upon the form specifically described in the claims of its predecessor, and are void. We omit any description of the other grounds upon which the invalidity of these claims is placed by the defendants.

No. 393,784: This patent is subordinate to 376,837. The device which it describes has the supplemental chamber, with the emergency piston and valve, and the important elements of the Westing-

house patent, except that the emergency valve is moved by train-pipe pressure, instead of by auxiliary reservoir pressure.

"This result was accomplished by providing a separate emergency piston and valve, ordinarily exposed to train-pipe pressure above said piston, which pressure served to hold the valve on its seat, and was not affected by ordinary reductions of pressure for service stops. But the considerable reduction of pressure necessary for an emergency stop carried air from the train pipe to be vented into the space below said piston, equalizing the pressure on both sides, and acting on the under side of said valve, causing it to be unseated, and to thus allow the train-pipe pressure to be vented directly into the brake-pipe cylinder."

The claims said to be infringed are as follows:

"(1) In a brake mechanism, the combination of a valve controlling the direct passage of pressure from a train-pipe to a brake cylinder, a piston connected to said valve and actuated wholly by train-pipe pressure, and a valve controlling the train-pipe pressure on the piston for opening and closing the communication between a train pipe and a brake cylinder through the direct action of train-pipe pressure, substantially as specified. (2) In a brake mechanism, the combination of a train pipe, a brake cylinder, an interposed chamber communicating with the train pipe and brake cylinder, a piston in said chamber, a piston stem, a valve on the piston stem controlling the passage from the interposed chamber to the brake cylinder, and a controlling valve and passages for the admission of pressure from the train pipe to move the piston and open the valve, substantially as and for the purposes specified."

The emergency piston, 13, in the defendants' modified valve, is actuated wholly by reservoir pressure, and this valve is therefore not claimed to be an infringement. The emergency piston, 13, in defendants' quick-action valve, is forced down by reservoir pressure, but when it is pressed down it causes train-pipe pressure to be admitted, which acts upon and presses down piston, 17, whose spindle presses upon and unseats the emergency valve. Inasmuch as the valve is disconnected from piston, 17, it is returned to its seat when train-pipe pressure is removed from the upper side of the piston, mainly by the elastic force of a spring. This patent is a subordinate one, and must receive a narrow construction. It is not permissible to give to the terms of a patent of that class so wide a sweep as to include the various devices which may actuate an emergency valve in a supplemental chamber by train-pipe pressure, and the range of its monopoly is a limited one. The language of each claim indicates that a connected valve and piston were to be employed, and Parks' method of opening and closing the valve required that they should be mechanically connected. A mechanical connection would not be indispensable, unless there was a necessity for it, or unless a mechanical separation created a difference in the means by which the result was accomplished, which, in view of the narrowness of the invention, was a radical difference. The Park piston holds the valve to its seat, in the normal condition of pressure. It is lifted up when the valve is lifted by train-pipe pressure, and, when extraordinary pressure is removed, it restores the valve to its seat. It does not unseat the valve. The defendants' piston does not hold the valve to its seat, and does not restore it to its place. When train-pipe pressure comes upon the upper side of the piston, and forces it down, it unseats the valve; and after pressure has been removed the spring, as it resumes its shape, returns the valve to its seat. The differ-

ence in the way in which the two pistons accomplish the general result would not be a substantial one in a primary patent. It is substantial with respect to an invention which merely substitutes train-pipe pressure for the auxiliary reservoir pressure which Westinghouse used. The circuit court properly held that neither claim was infringed.

No. 172,064: The invention of this patent was an improvement upon the improvement patented to Mr. Westinghouse by patent No. 168,359, and was a part of the brake apparatus used before the invention of the quick-action brake. It related to the direct admission of air from the brake pipe to the brake cylinder. The defense that the defendants use the original and not the later improvement was satisfactorily sustained. The peculiarity of the patented invention and of the device used by the defendants is shown in Judge Townsend's description, as follows:

"Patent No. 168,359 provides for a piston and slide valve so arranged that air pressure transmitted through the train pipe shall pass on the under side of the piston, and hold it in an upward position, and thence pass through a side port in the piston-valve case, and certain other ports and passages, into the auxiliary reservoir. The effect of this pressure is to hold the slide valve in position above two connected ports,—one leading to the brake cylinder, the other to the open air,—so that any pressure in the brake cylinder will escape to the open air, and the brakes will be off. When the pressure is reduced in order to apply the brakes, the back pressure from the auxiliary reservoir depresses said piston so that it passes down, and closes the supply ports and shifts the slide valve, so as to open the port leading to the brake cylinder, and exposes it to auxiliary reservoir pressure, and so as to close the port leading to the open air. In patent No. 172,064, the inventor dispensed with said side port in the valve case, and substituted therefor a port through the piston itself. The piston was so arranged, in connection with this port, that said port could be opened or closed without moving the slide valve. This was accomplished by having the stem of the piston fitted to the port in the piston, so that it would close the port when moved into it, and open it when removed, and by further providing that the slide valve should be made shorter than the distance between the collars on its stem, thus insuring the necessary slack motion for closing the supply port before the slide valve begins to move. Claim 3 is as follows: '(3) The slide valve, H, made shorter than the distance between its end bearings, in combination with the port, s, and stem, c, relatively arranged with reference to the operation of the valve, H, while the port, s, is closed, substantially as set forth.' Defendants' device, as illustrated by 'Defendants' Plain Triple Valve,' contains the slide valve, made shorter than the distance between its end bearings on the piston stem. It is also provided with two ports, one of which leads from the train pipe through the piston chamber, and by other passages to the auxiliary reservoir. The other port leads from the auxiliary reservoir to the brake cylinder. This port is closed by having the end of the piston stem slide onto it, and cover it, like a valve upon its seat. There is no port through defendants' piston, and consequently no piston stem fitted to enter such port."

The claim is for the valve made shorter than the distance between its bearings with the specified improvements upon 168,359, viz. the air port through the piston, which is opened and closed by the stem. The effect of this arrangement is stated in the specification as follows:

"The port, s, will be closed before the valve, H, begins to move for applying the brakes, and will be kept closed until the valve, H, shall have been brought back to the proper position for a full release of the brakes.

Consequently, the valve, H, can be operated as may be desired in applying and releasing the brakes, and in graduating the brake pressure, without leakage or loss at the air-supply port, s, and with such port always closed."

It is undoubtedly true that the two devices accomplish the same result, and close the supply port before the valve begins to move; but infringement can only be found by giving a construction to the third claim which disregards the fact that No. 172,064 substitutes the air port, s, with its plug, c, for the side port of 168,359. The conclusion which the circuit court reached was the correct one. It was stated as follows:

"Inasmuch as complainants claim a combination which contains a port through the center of a piston, described as substituted for a side port, with which said improvement dispenses, and as defendants' device depends upon the use of a side port, and has no port through the piston, but is made up by a combination of different elements, which are admitted in patent No. 172,064 to be a part of the prior art, the combination claimed in claim 3 of said patent is not infringed. A correct construction of the claim must include the port through the center of the piston, substituted for the side port of patent No. 168,359."

The invention of No. 222,803 was an engineer's valve, which, speaking in very general terms, should by the movements of a single stem or lever, admit, and automatically stop admitting, fluid pressure to the brake pipes, by means of a charging valve, automatically retain such pressure, and permit its escape by an exhaust valve, with means for automatically closing either valve when the desired pressure had been charged into or withdrawn from the train pipe to which the device was connected. The patentee summarized, in his specification, his invention, as follows:

"It will now be seen that I provide for operating both the supply and the exhaust valves by a single stem; that only one can be opened at once; that either may be opened separately (much or little); and that both may be closed simultaneously and automatically, and kept closed, whether the brakes are on or off."

This automatic closing of the charging and exhaust valves was a very important part of the invention. The patented valve, so far as the second, third, and fourth claims are concerned—

"Consists of piston case containing a piston governing a charging valve held up to its seat partly by fluid pressure and partly by a spring, and an escape valve held down to its seat partly by gravity and partly by a preponderance of fluid pressure on its upper end. This governing piston is exposed on its under side to fluid pressure, and on the upper side to pressure from a spring. A screw stem worked by a crank arm is so arranged, in connection with said spring, that by the revolution of the crank arm the downward pressure of said spring upon said piston is increased or lessened. The effect of such change of pressure is to cause the piston to be moved upwards or downwards, according as it is acted upon by an excess of fluid or of spring pressure, and to open or close the charging and escape valves. Beneath the lower end of the escape valve, provision is made for a certain amount of slack motion, so that the governing piston may be moved up or down for a short distance without unseating the escape valve. The effect of this arrangement is to prevent the possibility of both valves being open at the same time. The operation of said apparatus is as follows: In order to apply the brakes or to open the charging valve, the crank arm is screwed down, and this increase of pressure, transmitted through the stem of the piston head to the charging valve, unseats it, and permits fluid pressure to pass from the boiler or storage reservoir to the train pipe and brake cylinders. The fluid pressure

also passes upward to the space below the piston head, and exerts the same pressure upon it as in the train pipe or brake cylinders. The engineer knows, from his engineer's gauge, just how far to screw down his crank, so that when the necessary amount of pressure has passed through to the train pipe or brake cylinder the same pressure will automatically lift the piston and close the charging valve. The crank arm is screwed up in order to open the escape valve, and after the proper amount has been discharged the escape valve automatically closes in the same way as already shown in the case of the charging valve."

The three claims which the circuit court found were infringed are as follows:

"(2) As a means for automatically cutting off the fluid-pressure supply when the desired pressure has been charged into the brake cylinders, a piston head, P, movable by the operative brake pressure or any excess thereof, in combination with the charging valve and a connection from one to the other, substantially as set forth, whereby such movement of the piston head will result in the automatic closing of the charging valve, substantially as set forth. (3) The combination of piston head, charging valve, interposed stem, and escape valve, substantially as set forth with reference to the opening and closing of the charging valve, without necessarily opening the escape valve, substantially as set forth. (4) The combination of piston head, charging valve, interposed stem, escape valve, and a single operating stem, adapted by independent connections with both valves to shift both by independent, successive motions, substantially as set forth."

The defendants' valve has a single lever, which is moved from side to side by a single handle having a reciprocating motion. The valve has also a piston exposed to fluid pressure on both sides, which controls a charging and an escape valve, which performs the same functions as in the patented valve.

"The main lever, which is fastened to said handle, carries an eccentric pin, which passes through said lever, and which moves in the arc of a circle. The right end of the lever is held stationary by a jaw and fulcrum pin; the left end, when said handle is moved to the right, is lifted by the rock-shaft motion imparted by said pin, and strikes against another pin attached to the escape valve, and raises and opens said escape valve. This lever has also an upper jaw, which moves in a pin attached to a bell-crank lever, the arm of which is directly beneath the charging valve. In order to open this valve, the handle is moved to the left, which causes the main lever and pin to move to the left, and to raise the arm of the bell-crank lever and open the charging valve. Provision is made for slack motion by a space between the top of the escape valve and said pin attached thereto, whereby the left end of the main lever is permitted to have a certain amount of play before it strikes said pin."

In addition to fluid pressure, the piston is "acted upon from below by a bell-crank lever, or bent lever with vertical arms, connected by links to the piston and to a second lever, which second lever is connected with a light spring."

An attempt was made in the testimony to claim that the patented valve lacked novelty, or that its descent could be traced from patents No. 128,015, dated July 16, 1872, issued to Fay & Cairns, and No. 141,685 dated August 12, 1873, issued to George Westinghouse, Jr. The Fay & Cairns patent was for an apparatus for regulating the flow of water in houses, and shutting it off when there is an excess of pressure, so as to prevent the bursting of pipes. The Westinghouse patent was for a triple valve, and it was admitted in the course of the testimony that the patent described nothing designed for

or capable of performing the functions of the engineer's valve. The Fay & Cairns invention was a pressure regulator, contained no exhaust valve, and could not be an engineer's valve. The idea that either of these patents anticipated or restricted the patentable character of the whole invention is not now entertained. The defendants are, however, of opinion that No. 141,685 is an anticipation of the second claim. The importance of this suggestion will be considered hereafter. The invention, as a whole, is thus conceded to be without a predecessor, and the importance of an invention by which both valves could be automatically closed upon the desired amount of pressure being charged into or exhausted from the train pipe is manifest. The object of the defendants' valve is, by the movement of a single handle, to accomplish the same results which the patented valve attains; and it is conceded that the valve has a piston head movable by operative brake pressure, or any excess thereof, a charging valve, an escape valve, and interposed connections, so arranged that the charging valve may be opened and closed without necessarily opening the escape valve, a connection between the piston head and charging valve, consisting of a bell-crank lever, a pin and lever, and a projection on the piston head, and that by reason of this connection a movement of the piston head under the operative pressure, or any excess thereof, will result in the automatic closing of the charging valve. But it is contended that the second claim of the patent is void by reason of the Fay & Cairns patent; that the defendants' valve has not the interposed stem of the third and fourth claims, because the motion of the complainants' piston always acts through the stem to open the valve; that the defendants' piston does not open the charging valve, as required in the third claim, and does not open either valve, except only that the pin carried by its piston is the fulcrum of the lever when the escape valve is opened, whereas neither of the valves in 222,803 can be opened except by moving its piston, and therefore that the true construction of the third and fourth claims is as follows:

In regard to the third claim:

"The combination of a piston for opening and closing two valves by reverse motions of the piston; those valves; and a part interposed, whereby the motion of the piston in one direction from its position with both valves closed opens one of the valves, and its return motion allows that valve to close, while its motion in the opposite direction opens the other valve, and its return motion allows that valve to close."

In regard to the fourth claim:

"The above combination, with the addition of a single handle, by means of which the engineer can vary the pressure on one side of the piston."

The second claim of the patent contained the case provided with a piston chamber and valve chamber in addition to the three elements which are specifically named.

The Fay & Cairns patent was a water-pressure regulator. The specification says that it consisted of a hollow cylinder attached to a valve, and communicating at one end with the water pipe into which the water flows through the valve. In the cylinder is a piston whose rod is connected to the valve. A coiled spring is

behind the piston, under such tension as to hold the valve open until the pressure becomes too great for the pipe beyond the valve, when the water pressure on the piston closes the valve, and keeps it closed until the pressure on the piston and in the pipes falls below the power of the spring, when it will open the valve cylinder. There is no exhaust valve, but claim 2 does not include an exhaust valve, and the valve is connected with the piston, whereas in No. 222,803 the charging valve is closed by a separate spring; but this is thought by the defendants to be immaterial in a structure not having an exhaust valve, "the purpose of separation being to permit a further upward movement of the piston so as to open the exhaust valve after the charging valve has been seated." The needs of a water-pressure regulator to be attached to a water pipe which conveys water into a house, and an engineer's valve, in which there must be a charging and an escape valve, are very different. In an engineer's valve, opened by a single stem, the charging valve must be separated from the piston, or the device would be useless; and it is no answer to the validity of the claim to say that some other fluid regulating device was operated by a different arrangement of valve and piston, which, though it might come within the general terms of that claim, would be useless in the device which was the subject of the patent. The great dissimilarity in form and appearance between the patented valve and the defendants' valve tends to confuse the mind when the question of the infringement of the third and fourth claims is first looked at. The defendants' valves and piston are not arranged in the same axial line. Motion is not communicated to the piston in an endwise direction, but through a series of bell-crank levers, which at first seem to be operating upon a different system from that of the patent. A closer examination shows that the series of operations in the patented valve is substantially reproduced in the defendants' valve by like instrumentalities. It is not denied that the defendants' valve has a series of levers and pins, which may be called an "interposed stem," and which communicate motion somehow; but it is said that its piston and its stem do not correspond with these elements in the third and fourth claims, mainly because in the Westinghouse device the motion of the piston acts through the stem to push the valve open, and the defendants' piston does nothing to open either valve. It is true that in the Westinghouse valve there is a direct connection between the piston and the charging valve, and that the movement of the piston opens the valves, and that in the defendants' valve the charging valve is opened by the manual movement of the handle and lever, 49, and the piston at the time remains stationary. By the subsequent movement of the piston, when sufficient train-pipe pressure has been admitted, the charging valve is closed automatically. It is also said that the defendants' piston does not open the escape valve, except that the pin carried by the piston is the fulcrum of the lever when the escape valve is opened. This may also be considered as true, but it should also be said that there is an upward movement of the piston before the valve is opened. As explained by Mr. Barnes, for the complainant, the

movement of the handle to the right raises the fulcrum of the lever, which imposes upward pressure upon the piston. It moves upward until the elastic resistance below the piston is reduced so much that the train-pipe pressure on top of the piston can lift the escape valve by means of the lever known as "43." If the third and fourth claims require that one or both valves must be both opened and closed by the motion of the piston, and that the interposed stem must move with the piston to open one or both valves, then there is no infringement. The third claim, for example, is for the combination of piston head, charging valve, interposed stem, and escape valve with reference to the opening and closing of the charging valve. As the invention did not consist in the particular way in which the elements of this combination co-operated, in reference to the mere opening of the valve, and as the language of the claim is not limited to anything more narrow than the actual invention, the construction which the defendants seek is not necessary. The only question is whether the differences which have been stated, and which are in substance the difference between the direct action in the patented device of the piston, through the interposed stem, in opening the valves, and the action of the bell-crank lever, pin, and lever, which are the interposed stem of the defendants' device, constitute such a departure from the means which the patentee used and described as to constitute new and different means, which escape a just charge of infringement. The question of infringement is controlled by the principles restated in Machine Co. v. Lancaster, 129 U. S. 263, 9 Sup. Ct. 299, and confirmed in subsequent and recent cases (Miller v. Manufacturing Co., supra), and which makes these actual differences, which would be important in a subordinate patent, unessential when a patent for a pioneer invention is under examination. If such differences should be regarded by courts as essential, when the claims do not make the specific devices essential, patents for pioneer inventions would ordinarily have but little value.

All the decrees of the circuit court in case No. 4,976 and in case No. 4,977, which have been appealed from, are affirmed, with costs of this court. The interlocutory decree of the circuit court in case No. 5,315 is reversed, with costs of this court, and the cause is remanded to that court with instructions to dismiss the bill, with costs of that court.

ACCUMULATOR CO. v. EDISON ELECTRIC ILLUMINATING CO. OF NEW YORK.

(Circuit Court, S. D. New York. October 8, 1894.)

1. PATENTS—PROCESS AND PRODUCT—INFRINGEMENT — SECONDARY BATTERIES.
Reissue No. 11,047, of the Swan patent for a secondary battery, in which the active material is packed in and confined to perforations extending through the plate, is a patent for a product, and not for a process; and hence infringement is not avoided by arranging pastilles or buttons of the material in molds, and then casting the plate around them, instead of first making the plate, and then packing the material in the perforations.