nition and understood that peril was imminent. Petitioner testified without contradiction that he "hollered" his warning loudly; that only a narrow space separated his perch from the engineer's seat; that the engineer's hearing was "all right"; that petitioner and the engineer could and did carry on "normal conversations" while the train was operating; and that there was comparatively little noise in the cab from the train.

Judged by the test outlined above, that evidence was ample to warrant submission of the issue to the jury. Since other questions, which our decision does not touch, were presented to the Supreme Court of Missouri, the judgment is reversed and the cause is remanded to that court for further proceedings not inconsistent with this opinion.

Reversed.

DETROLA RADIO & TELEVISION CORP. *v.* HAZELTINE CORPORATION.

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

No. 666. Argued April 7, 1941.—Decided May 12, 1941.

Wheeler reissue patent, No. 19,744, Claims 1–7, inclusive, and 9–13, inclusive, relating to amplifiers in modulated current-carrying signaling systems, wherein the limit of amplification is automatically maintained substantially at a predetermined level,—*held* invalid for want of invention over the prior art. P. 268.

The alleged invention, as upheld by the court below, was of improved means for obtaining automatic amplification control by the combination in a radio receiver of a diode detector with a high resistance connected between the anode of the detector and the cathode of the amplifying tube, and a direct connection between the anode of the detector and the grid of the amplifier for impressing negative potential upon the latter, thus obtaining from the signal voltage a so-called linear response to the variations in the amplitude of the signal current.

Wheeler accomplished an old result by a combination of means which, singly or in similar combination, were disclosed by the prior art, and notwithstanding the fact that he was ignorant of the pending applications which antedated his claimed date of invention and eventuated into patents, he was not in fact the first inventor, since his advance over the prior art, if any, required only the exercise of the skill of the art.
117 F. 2d 238, reversed.

CERTIORARI, 312 U. S. 671, to review a decree which affirmed the District Court in upholding a patent, enjoining infringement, and retaining jurisdiction to take an account of profits, assess damages, etc.

Mr. Samuel E. Darby, Jr., with whom *Mr. Floyd H. Crews* was on the brief, for petitioner.

Mr. William H. Davis, with whom *Messrs. R. Morton Adams* and *George E. Faithfull* were on the brief, for respondent.

MR. JUSTICE ROBERTS delivered the opinion of the Court.

July 7, 1927, Harold A. Wheeler applied for a patent for a circuit designed automatically to control the amplitude of amplified signal voltage in modulated carrier-current signalling systems. Patent No. 1,879,863 issued September 27, 1932, to the respondent as assignee of Wheeler.

A suit was brought in the Eastern District of New York for infringement of Claims 1, 5, 6, and 10.[1] The District Court held the claims invalid for want of invention. The Circuit Court of Appeals for the Second Circuit affirmed the decree.[2]

September 26, 1934, while the appeal to the Circuit Court of Appeals was pending, respondent applied for

[1] *Hazeltine Corporation* v. *Abrams*, 7 F. Supp. 908.
[2] *Hazeltine Corporation* v. *Abrams*, 79 F. 2d 329.

a reissue. After the decision of the Circuit Court of Appeals, respondent redrafted the claims and, October 29, 1935, a reissue patent, No. 19,744, was granted. The present suit was thereafter instituted against the petitioner for infringement of all the thirteen claims of the reissue except Claim 8.* The District Court held the patent valid and infringed, and its decree was affirmed by the Circuit Court of Appeals.[3] The petition for certiorari presented, *inter alia,* the question whether the decision conflicts with that of the Second Circuit.

Control of the amplification of a modulated carrier-wave signal is useful in connection with transmitting and receiving apparatus and, in the original patent, Wheeler claimed his system as respects both. In his specifications, however, he confined himself to its application to receivers, wherein its function is to control the volume of sound emitted from the loud speaker. In broadcasting, a high frequency wave, known as a carrier wave, is impressed with another low frequency wave or, as it is said, modulated. The high frequency, or signal, wave is picked up by the antenna of a receiver and conducted thence to the input of an amplifying device which consists of an amplifier tube, or several of them in series. These tubes have three electrodes, a cathode, an anode, and a grid, and are called triodes. The signal wave, as amplified, is carried from the output of the amplifying device to the input of a vacuum tube, known as a detector or rectifier, which transmutes the alternating current into a unidirectional or direct pulsating current. This is led to audio tubes which enhance its volume, and thence to a loud speaker. Such a receiving set has other equipment for selecting signals of varying frequency and adjusting the amplification of the audio waves, with which we need not concern ourselves.

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*As amended by order of October 13, 1941, see 314 U. S. — REPORTER.

[3] *Detrola Radio & Television Corp.* v. *Hazeltine Corporation,* 117 F. 2d 238.

One of the problems of the art has arisen from variations of the received signals. When the set is tuned from a weak signal to a much stronger one, the tendency is for potential to build up in the last amplifying tube, which results in what is known as blasting in the loud speaker. Often the same signal varies in intensity. Weakening may result in fading, whereby the sound production weakens or disappears; and strengthening may beget distortion of the sounds emitted.

Wheeler essayed to obviate these objectionable features. It was known that the amplification of the carrier signal could be controlled by increasing or decreasing the potential upon the grid of a triode amplifier. Wheeler proposed automatically to vary this potential so as to increase or decrease the degree of amplification and thus hold it at a substantially predetermined level. To this end he provided means to increase the negative potential upon the anode of the detector tube in step with the increased strength of the signal and to conduct a direct current from that anode to the grid electrode of one or more of the amplifying tubes. Thus an increase of the strength of the signal would automatically increase the negative potential on the grid of the amplifier and decrease the amplification; the reverse result would be effected if the signal weakened. The means he adopted to accomplish this were alternative.

According to one method, the signal was amplified to a comparatively high voltage, and a diode used as a detector. The output voltage from the detector was approximately as great as that of the amplified signal. By coupling the cathode and anode of the detector and inserting a resistance in the coupling he could maintain the anode of the detector slightly negative at all times. Since he connected all the cathodes in parallel the cathode of the detector was maintained at substantially the same potential as the cathode of the radio frequency am-

plifier. By this means, the anode of the detector could be maintained normally negative relative to at least a part of the amplifier cathode. When the rectified current flowing through the detector circuit increased with the strength of the signal, there was developed at the output terminal of the detector circuit, through the operation of the resistance, which was also connected between the anode of the detector and the grid of the amplifier, an increase of negative voltage which, through the direct current connection from the terminal of the detector circuit to the grid of the amplifier, increased the negative potential thereof, and lessened the signal amplification. Conversely, if the strength of the signal current decreased, the negative potential developed upon the anode of the detector correspondingly decreased and there was a decreased inhibition of the amplifying power of the signal amplifier.

In his alternative method, he accomplished the same result with a triode detector. In this arrangement he maintained a negative voltage on the grid of the detector triode by the use of a battery and a potentiometer connected across the cathode of the detector tube. The output circuit of the detector included a resistance connected between the anode of the detector and the common "B" battery of a radio set. A direct connection was provided from the output terminal of this circuit to the grid of the signal amplifier for impressing thereon the potential developed on the anode of the detector. The amplified signal voltage operated to bring into play the voltage of the battery which created the potential on the anode of the detector.

According to the specifications, each arrangement had advantages and disadvantages. The diode detector used in the first furnished no amplification but it dispensed with the necessity of an additional battery or source of current supply. The second not only required an addi-

tional battery but an adjustment between the voltage delivered by the two batteries which coöperate to vary the negative potential on the anode of the triode detector.

Both arrangements include devices to prevent the passage from the detector to the audio tubes, and from the detector to the grid of the amplifier tubes, of undesired forms of electrical energy and both embrace means to provide a time constant with respect to the transmission of negative potential from the anode of the detector to the grid of the amplifier. None of these are now asserted to be novel or to constitute a part of the asserted invention.

In Wheeler's drawings and specifications he exhibited both methods and said of them that they operate "substantially in the same manner," and again that they are "substantially similar in operation." In his application he presented claims which did not specify the kind of detector to be used, and others calling for a diode. All of the latter were disallowed and he concurred in their cancellation without prejudice. He had asserted in prosecuting his application that "the invention can obviously be used with any kind of detector." Nine claims were finally allowed. Just before the patent issued, and nearly five years after original application, Wheeler presented a number of additional claims. In two he described the detector as a diode and in one of these he denominated the resistance connected between the detector anode and the amplifier cathode as a "high resistance." He asserted that these two claims were "practically the same as allowed Claim 11," which became Claim 1 of the patent as issued and specified no particular form of detector tube and no high resistance. They were allowed as Claims 10 and 11 of the patent as issued.

In the *Abrams* suit only Claims 1, 5, 6 and 10 were in issue. The contention was that the invention was a broad one covering the principle of automatic volume control by means of any form of circuit. The defendant insisted

that the patent involved no invention in view of the prior art and cited patents issued before Wheeler's date of conception [4] and others issued before the patent in suit on applications antedating his date of invention and pending when his application was filed.[5]

Some of these were for transmission systems and some for receiving systems. Several disclosed automatic amplification control. All constituted prior art.[6] Hazeltine attempted to distinguish them from the Wheeler patent in three respects. It contended that Wheeler's patent was limited to the receiving art and that prior inventions addressed to automatic amplification control in transmission did not constitute anticipation. The District Court answered that Wheeler's patent was not limited but was for any modulated wave carrier signalling system. Hazeltine also insisted that some of the prior art dealt with amplification control in amplifiers beyond the detector rather than in those through which the controlled current passed before it reached the detector, as in Wheeler. The District Court was unable to find any such distinction from the prior art in the Wheeler claims. Finally, Hazeltine urged that the time constant device was not found in the prior art cited. The District Court held that, if any of these alleged differences constituted invention on Wheeler's part the claims did not disclose them, and that to sustain Hazeltine's contention would be to rewrite the claims.

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[4] Wheeler's date of conception of his invention, according to his testimony, was December 17, 1925.

[5] Affel, 1,574,780, March 2, 1926; Heising, 1,687,245, October 9, 1928; Bjornson, 1,666,676, April 17, 1928, and Schelleng, 1,836,556, December 15, 1931. Friis, 1,675,848, July 3, 1928, and Evans, 1,736,852, November 26, 1929, were also cited but not discussed in the opinion. It was stipulated that the disclosures and claims of these patents did not differ materially from those embodied in the applications therefor.

[6] *Alexander Milburn Co.* v. *Davis-Bournonville Co.*, 270 U. S. 390.

The Circuit Court of Appeals took a more liberal view of the Wheeler patent as evidenced by the claims in connection with the specifications. It assumed, for the purposes of decision, that Wheeler's patent was limited to receivers. It recognized the difference between the feed of the negative potential back to the radio frequency amplifiers instead of forward but it found no invention in the change. It held there was no invention in the provision of a time constant. That court, therefore, found that all Wheeler did was to take certain obvious steps in an already crowded art, which steps were based upon various disclosures of that art, and that the changes he made did not amount to invention. Both the District Court and the Circuit Court of Appeals found that the mention of a diode detector in Claim 10 represented no new inventive element since at least one of the patents in the prior art—that of Heising—disclosed the use of such a tube in an automatic amplification control system.

Confronted with these holdings, Hazeltine, as has been stated, rewrote the specifications and claims in its application for reissue. It eliminated all reference to the use of a triode detector in its drawings and specifications and limited them to a system employing a diode. Certain of the claims of the old patent, however, were retained which make no distinction between a diode and a triode since they refer merely to a detector. Hazeltine also altered the specifications to refer particularly to a diode and a high resistance. Such a high resistance had been claimed as part of the invention in Claim 11 of the original patent, which claim was not in suit in the *Abrams* case. This fact is significant for, if the high resistance had been considered novel or essential to the invention, it is hard to see why suit was not founded on Claim 11, the only claim which disclosed it.

It is evident that Hazeltine found it necessary to abandon its broad claims to a monopoly of automatic

volume control circuits and to limit the claims to an alleged improvement in such circuits. The petitioner insists that the effort is unavailing for the reason that the patent, as defined in the reissue, fails to disclose invention in view of the prior art.

As is admitted, automatic amplification control was old in the art when Wheeler made his alleged invention. The invention must then consist in the conception of improved means for obtaining such control. The courts below have found invention in the combination in a radio receiver of a diode detector with a high resistance connected between the anode of the detector and the cathode of the amplifying tube and a direct connection between the anode and the grid of the amplifier for impressing negative potential upon the latter, thus obtaining from the signal voltage a so-called linear response to the variations in the amplitude of the signal current. This combination, they held, was such an advance in the art as to constitute invention. We think the decision below conflicts with that in the *Abrams* case and fails to give due weight to the disclosures of the prior art.

The Circuit Court of Appeals distinguishes from Wheeler's conception automatic amplification control used in receivers, such control used in transmitters, such control used for other purposes than volume control of audio waves, or accomplished by the use of a triode or by means other than those which employ the signal current itself and also sets apart amplification control which does not produce a linear response.

There can be no question that the patents cited as prior art disclose the accomplishment of linear response. The curve exhibited in Wheeler's drawings to illustrate the result of the use of his system is duplicated in similar curves by Affel and Friis. It cannot be claimed, therefore, that Wheeler has accomplished a new result. At most he can have obtained an old result by new means.

The prior art discloses that automatic amplification control is useful both in receiving and transmitting devices for the accomplishment of various ends, including volume control. We agree with the Circuit Court of Appeals for the Second Circuit that the limitation of Wheeler's claims to receivers of radio signals would not spell invention.

The respondent insists, and the courts below held, that the reissue patent is limited to claiming a diode detector and a high resistance connected between the detector anode and the amplifier cathode and a direct connection of anode with cathode. Passing the fact that Claims 2, 3, and 6 in suit embrace any sort of detector without limitation, and assuming that the reissue is limited as suggested, it remains that practically all of the patents cited from the prior art employ a resistance to impress the required potential on the amplifier grid for controlling amplification and that two of them, those of Heising and Slepian, disclose the use of a resistance in connection with a diode.

The court below distinguishes Heising on the ground that his purpose was not to control the volume of audio waves but rather to use less current in the radio frequency amplifiers of a transmitter. We hold, as did the Circuit Court of Appeals of the Second Circuit, that these distinctions do not negative anticipation by Heising. With respect to Slepian, the court below remarks that his device was intended to accomplish a different end. This is true for his object was to provide a receiving system which would admit of an extremely high amplification of received signal impulses. But the use of automatic amplification control, whatever the end in view, is the critical consideration.

The court below states that neither Heising nor Slepian succeeded in producing automatic amplification control. In this the court overlooked the uncontradicted testimony

of the respondent's expert, Dr. Hazeltine, who flatly testified that each of them does produce it. And Heising produces it from the signal current by the use of a diode detector, a "high resistance" inserted between the anode thereof and the cathode of the amplifier and a direct current connection from the detector anode to the amplifier cathode.

We think the court below was in error in stating that all the workers in the prior art obtained their control potential from an additional battery whereas Wheeler obtained it from signal energy. This is not true of Heising or Slepian.

Nor can Wheeler claim novelty, as the court held, in the production of a linear response. While Friis obtained energy for the production of potential from a battery, he discloses a resulting linear response comparable to that claimed by Wheeler. If, as is now asserted, the insertion of a high resistance between the anode of the detector and the cathode of the amplifier is an integral part of Wheeler's conception, it may be noted that a resistance to develop a potential to be carried to the amplifier grid is disclosed by prior inventors, including Heising, Friis, Slepian, Affel and Evans and several of them describe it as Wheeler does, namely, a "high resistance."

We conclude that Wheeler accomplished an old result by a combination of means which, singly or in similar combination, were disclosed by the prior art and that, notwithstanding the fact he was ignorant of the pending applications which antedated his claimed date of invention and eventuated into patents, he was not in fact the first inventor, since his advance over the prior art, if any, required only the exercise of the skill of the art.

The judgment is reversed and the cause is remanded for further proceedings in conformity with this opinion.

Reversed.