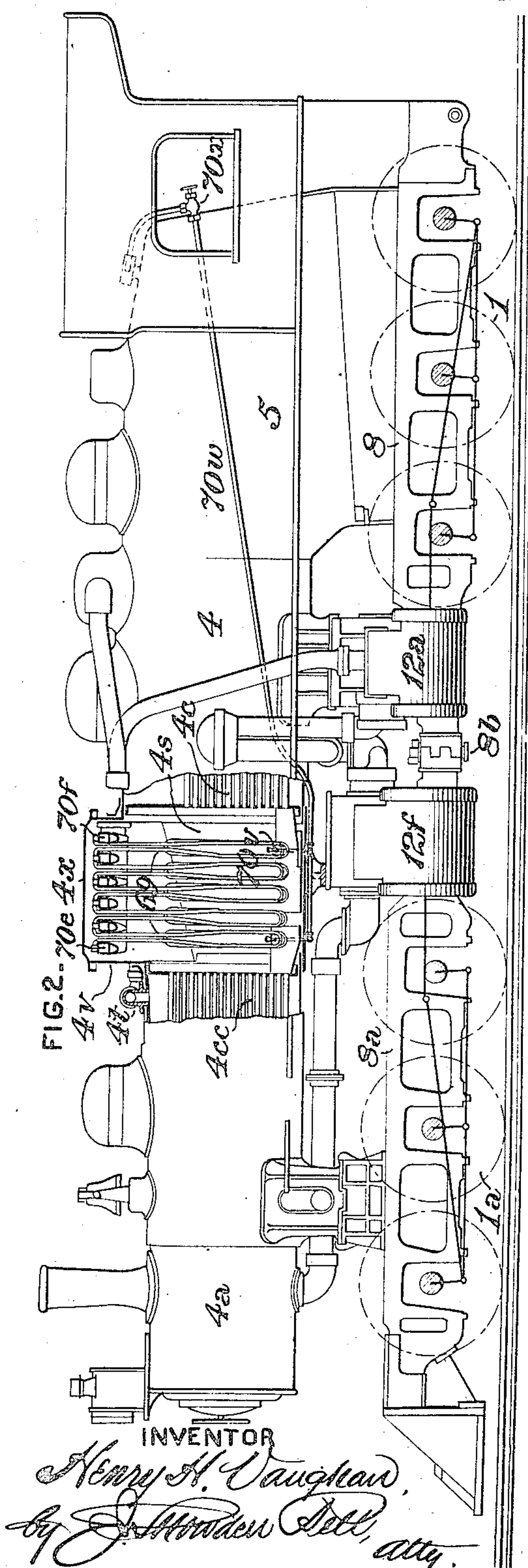
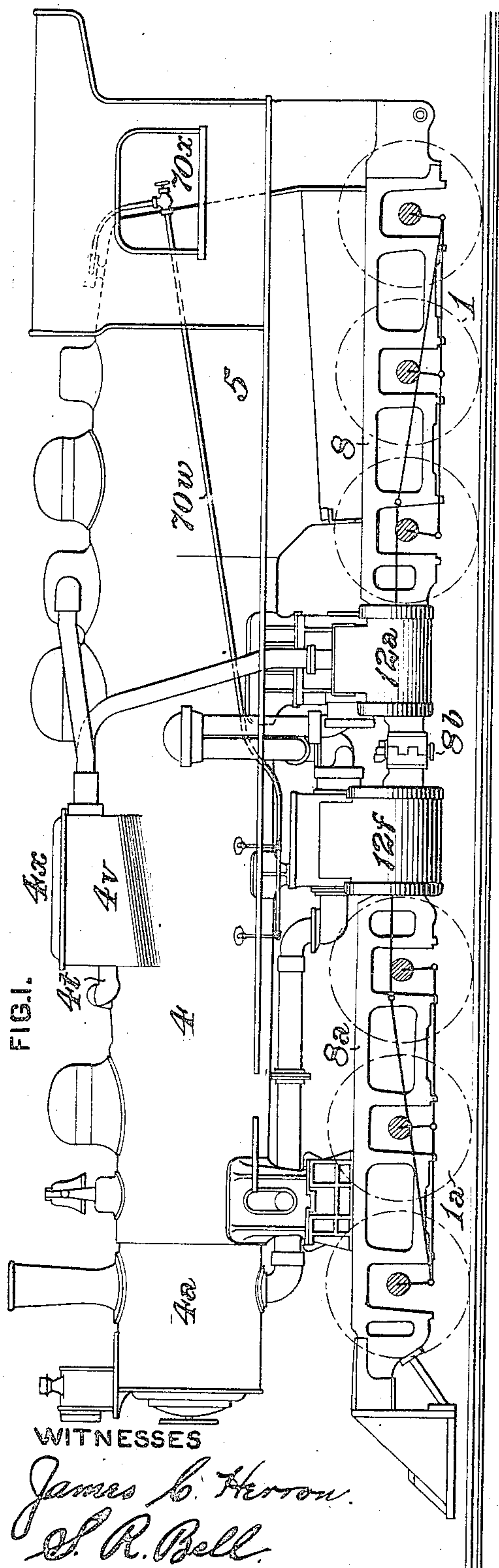


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 STEAM BOILER SUPERHEATER.  
 APPLICATION FILED OCT. 12, 1910.

994,045.

Patented May 30, 1911.

3 SHEETS—SHEET 1.



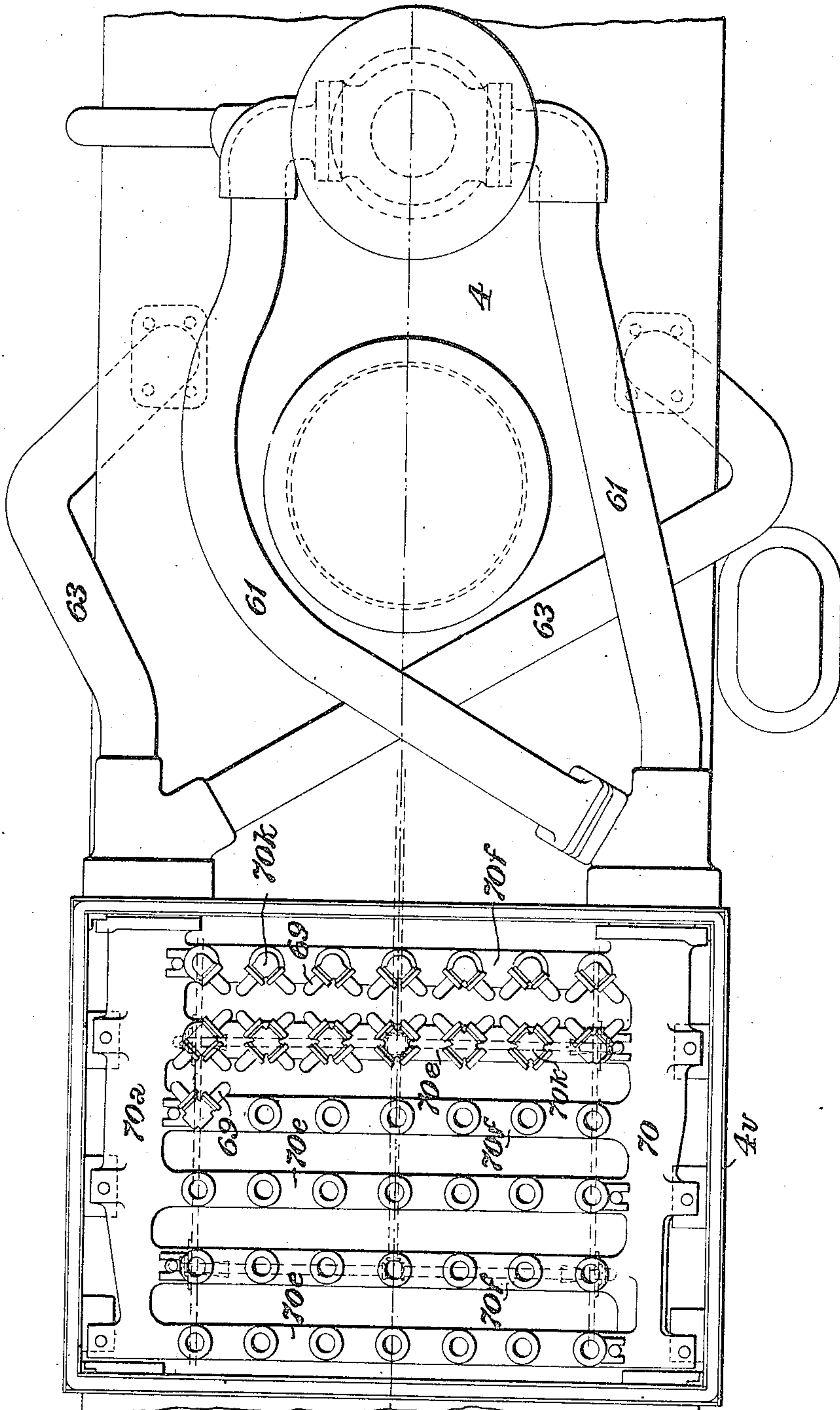
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3 SHEETS—SHEET 2.

FIG. 3—



WITNESSES

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3 SHEETS—SHEET 3.

FIG. 4.

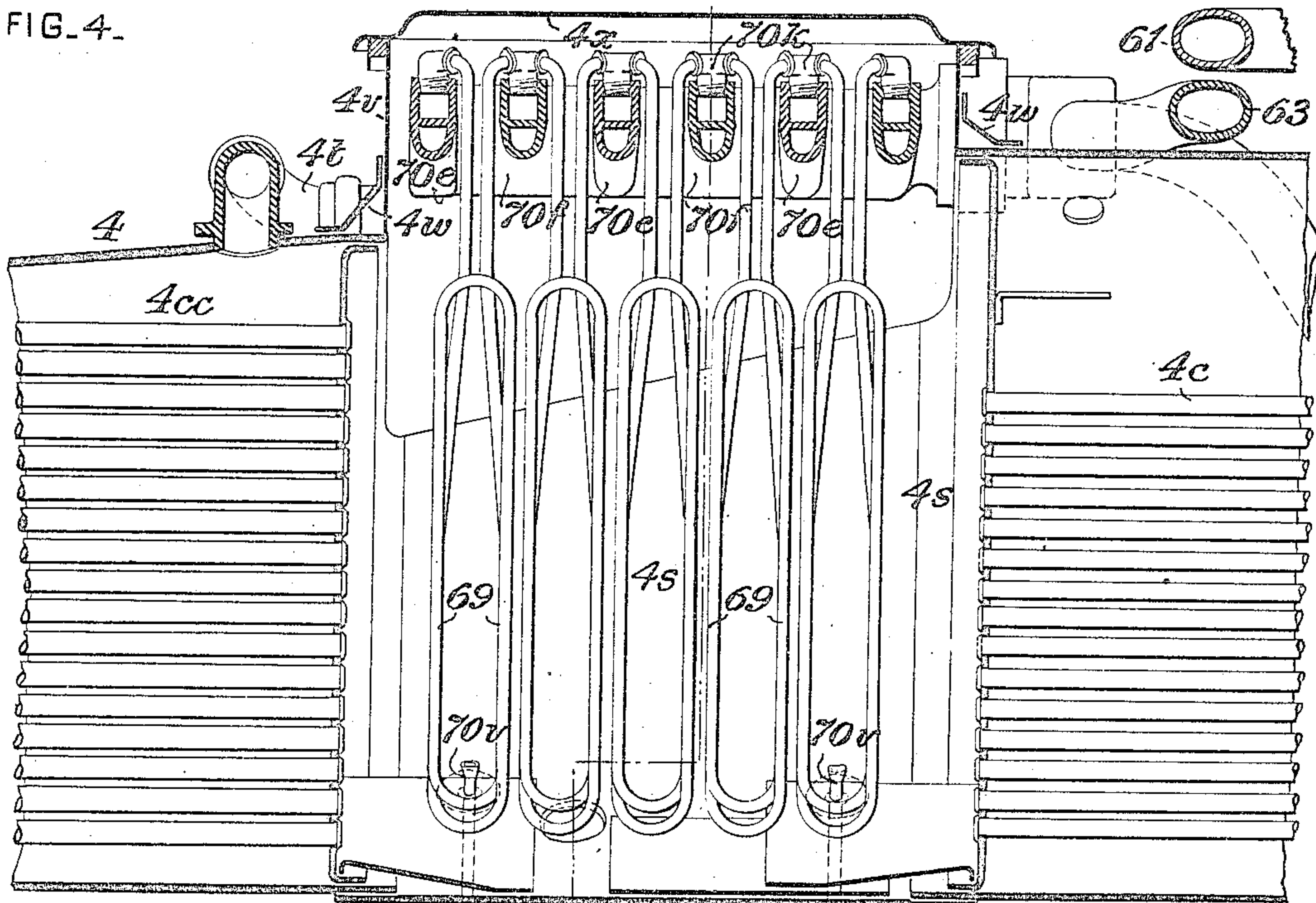
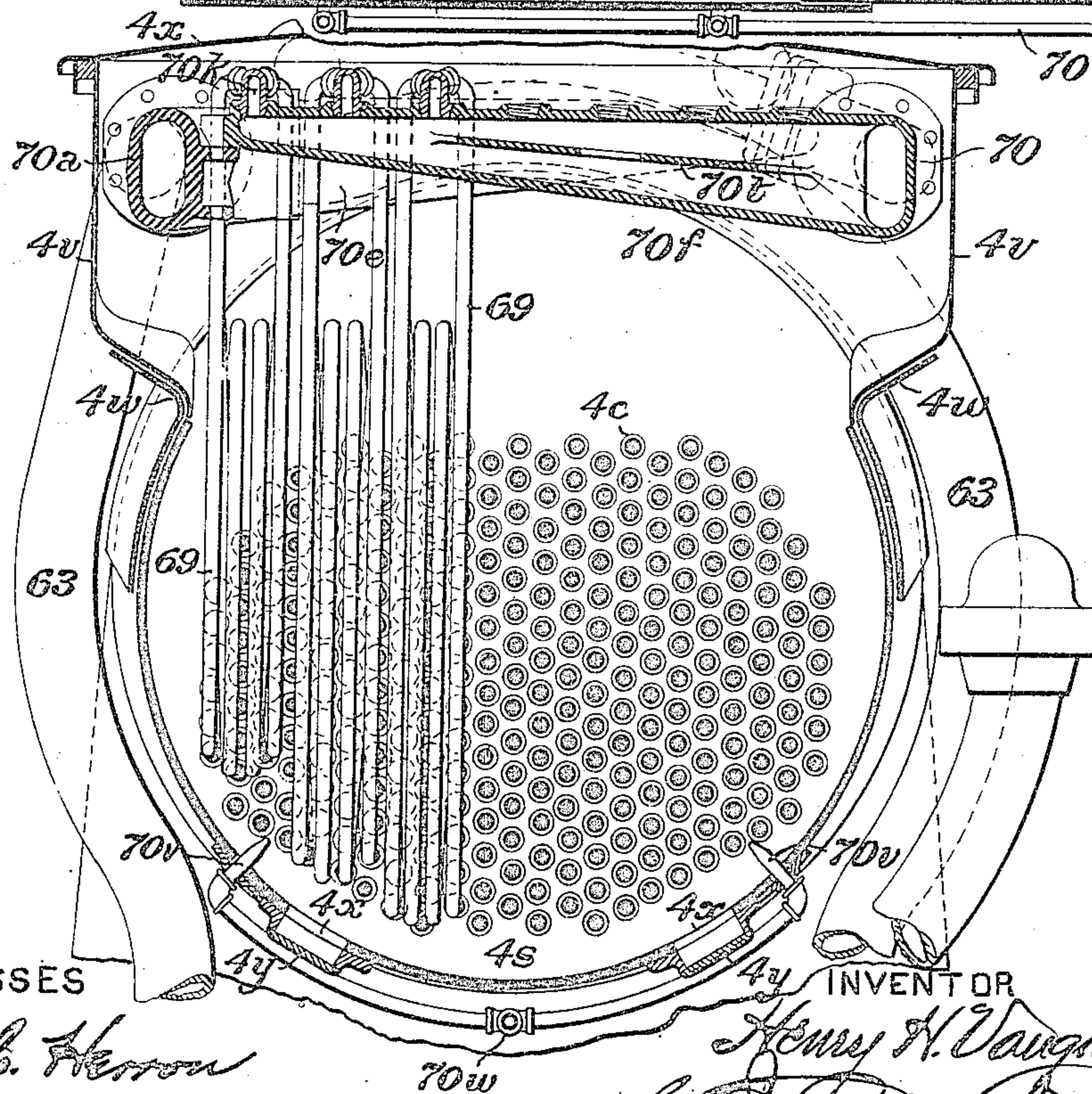


FIG. 5.



WITNESSES

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# UNITED STATES PATENT OFFICE.

HENRY H. VAUGHAN, OF MONTREAL, QUEBEC, CANADA, ASSIGNOR OF ONE-HALF TO  
LOCOMOTIVE SUPERHEATER CO., OF NEW YORK, N. Y., A CORPORATION OF NEW  
JERSEY.

## STEAM-BOILER SUPERHEATER.

994,045.

Specification of Letters Patent.

Patented May 30, 1911.

Application filed October 12, 1910. Serial No. 586,619.

*To all whom it may concern:*

Be it known that I, HENRY H. VAUGHAN, of Montreal, in the Province of Quebec and Dominion of Canada, have invented a certain new and useful Improvement in Steam-Boiler Superheaters, of which improvement the following is a specification.

My present invention relates to superheaters which are particularly designed for application in locomotive boilers in which the fire tubes are divided into a rear and a forward set, separated by an intermediate combustion chamber, a construction which has been put into practice to a considerable extent in "Mallet" locomotives.

The object of my invention is to provide, for a boiler of the type referred to, a superheater which shall present the advantages of simplicity and economy of construction, capability of removal and replacement of individual members without disturbance of others, and exemption from undue strain at points of support on the boiler, and liability to promote the collection of cinders in its inclosing combustion chamber.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a diagrammatic side view, in elevation, of a locomotive engine having my improvement applied; Fig. 2, a similar view, with the combustion chamber and superheater in section; Fig. 3, a partial plan or top view, on an enlarged scale, with the cover of the superheater casing removed; Fig. 4, a vertical longitudinal central section through the combustion chamber and superheater; and, Fig. 5, a vertical transverse section through the same.

My invention is herein exemplified as applied in connection with the boiler 4, of a locomotive engine of the "Mallet" articulated compound type, comprising a rear frame, 8, supported on a plurality of driving wheels, 1, and a front frame, 8<sup>a</sup>, supported on a plurality of driving wheels, 1<sup>a</sup>. The rear frame carries a pair of high pressure cylinders, 12<sup>a</sup>, the pistons of which are coupled to crank pins on the driving wheels, 1, and the front frame carries a pair of low pressure cylinders, 12<sup>i</sup>, the pistons of which are coupled to crank pins on the driving

wheels, 1<sup>a</sup>. The front and rear frames are coupled, in the longitudinal central plane of the locomotive, by a pivot pin, 8<sup>b</sup>.

The boiler, 4, which is secured to the rear frame, 8, is divided by a combustion chamber, 4<sup>s</sup>, located about the middle of its length, into rear and front sections, each of which is provided with an independent set of fire tubes. The rear section is the boiler proper or steam generating section, and the front section, which is of smaller diameter and contains a larger number of tubes, is continuously filled with water, and constitutes, practically, a feed water heater, from which heated water is supplied to the rear section through pipes, 4<sup>t</sup>. The tubes, 4<sup>c</sup>, of the rear section, extend from the firebox, 5, to the rear end of the combustion chamber, and the tubes, 4<sup>cc</sup>, of the front section, extend from the front end of the combustion chamber to the smoke box, 4<sup>a</sup>. The shell or wall of the combustion chamber, which is curved concentrically with those of the rear and front boiler sections, extends only to about the level of the top rows of tubes of the rear section, and is closed at its top as hereinafter described.

In the practice of my invention, I provide a superheater casing, 4<sup>v</sup>, which is of rectangular form, and is independent of the shell of the combustion chamber, and connected thereto by reinforcing plates, 4<sup>w</sup>, of lighter metal than said shell. The superheater casing is closed at its top by a removable cap plate, 4<sup>x</sup>, and the casing and cap plate consequently form the upper closure of the combustion chamber, 4<sup>s</sup>. The superheater casing constitutes a light superstructure exterior to the boiler, which incloses and supports the superheater proper, which is of the following construction.

A horizontal saturated steam header, 70, is bolted to, lugs on one side of the superheater casing, near the top thereof and consequently entirely above the boiler tubes, said header being provided with a plurality of laterally extending branches, 70<sup>i</sup>. A similar superheated steam header, 70<sup>a</sup>, is bolted to the opposite side of the superheater casing, and is provided with a plurality of laterally extending branches, 70<sup>e</sup>, which are alternated in position with the branches, 70<sup>i</sup>.



of the saturated steam header. Each of the branches of the saturated steam header is connected with the adjacent branch of the superheated steam header by a plurality of superheating pipes, 69, which are bent or looped into double return bends, as clearly shown in Figs. 4 and 5, so as to embody the maximum area of superheating surface which is obtainable within the combustion chamber, and to present vertical rows, depending, through the spaces between the header branches into the combustion chamber and extending across the line of traverse of the gases of combustion through the combustion chamber in their passage from the fire tubes of the rear section of the boiler to those of the front section. The superheating pipes do not extend entirely to the bottom of the combustion chamber, but are made of such length that a space is left below them, so that any cinders that may tend to be deposited in the combustion chamber will be drawn therefrom through the bottom rows of front tubes, 4<sup>c</sup>. By reference to Figs. 4 and 5, it will be seen that in normal position, the width of the superheating pipe elements is greater than that of the spaces between the header branches, but that when disconnected from the header branches and turned through an angle of ninety degrees, they may be passed freely through said spaces. This construction attains the important advantage in practice of enabling any one or more of the superheating pipes to be withdrawn and replaced whenever desired, without interfering with the other pipes of the set.

Steam is supplied from the boiler to the saturated steam header, 70, through pipes, 61, and after passing through, and being superheated in, the set of superheating pipes, 69, enters the superheated steam header, 70<sup>a</sup>, and is thence delivered through pipes, 63, to the cylinders of the locomotive. In the instance shown, the steam is superheated in its passage from the boiler to the high pressure cylinders, 12<sup>a</sup>, but it will be obvious that if preferred it may be arranged for the steam to pass through the superheater in its passage from the high pressure cylinders, 12<sup>a</sup>, to the low pressure cylinders, 12<sup>b</sup>, and that in general the superheater described is adapted to heat the steam that it may be desirable to pass through it.

The superheating pipes, 69, may be connected to the headers in any suitable and preferred manner. In the instance shown, detachable fittings, 70<sup>k</sup>, are screwed into the tops of the header branches, 70<sup>c</sup>, 70<sup>d</sup>, and the ends of the superheating pipes are screwed into lateral openings in the fittings. Under this construction, any of the superheating pipes may be readily removed and

replaced when desired. The header branches are strengthened by transverse diaphragms, 70<sup>i</sup>.

Cleaning openings, 4<sup>x</sup>, closed by removable caps, 4<sup>y</sup>, are formed in the bottom of the combustion chamber, and in order to remove any deposit of soot which may collect on the superheating pipes, blower pipes, 70<sup>v</sup>, having transversely enlarged nozzles, are fitted in the lower portion of the combustion chamber, said pipes being supplied with steam by a pipe, 70<sup>w</sup>, controlled by a valve, 70<sup>x</sup>, and discharging jets of steam, diagonally across the combustion chamber, among the rows of superheating pipes.

It will be seen that under the above described construction, close spacing of the vertical rows of superheating pipes, and consequent maximum area of superheating surface, is obtainable, and there is also afforded the capability, which is of material importance in practice, of disconnecting and turning around any one or more of the several pipes, so that any desired element of the piping may be withdrawn, when desired, without interference by or disturbance of other elements. The presentation of an entirely open space below the superheating pipes is also an important advantage, as it enables any deposit of cinders to be drawn through the lower front tubes and thus prevents clogging of the combustion chamber and tubes. The support of the superheater upon a light structure exterior to the body of the boiler admits of its ready insertion and replacement, and obviates the liability to straining and breakage of the header castings which would obtain if the superheater was directly connected to the heavy plates of the boiler.

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

1. The combination, with a locomotive boiler, of a superheater comprising a saturated steam header having a plurality of horizontally extending lateral branches, a superheated steam header having a plurality of similarly extending branches, alternated in position with those of the saturated steam header, said headers and branches being located entirely above the boiler tubes, and a plurality of looped or return bend superheating pipes, connected at their ends to the header branches and depending therefrom in vertical rows in the path of the gases of combustion from the tubes.

2. The combination, with a locomotive boiler having an open topped combustion chamber, of a superheater casing in the form of a light superstructure exterior to the boiler, which is located above and constitutes the top closure of the combustion cham-



ber, and a superheater supported in the casing independently of the shell of the combustion chamber.

3. The combination, with a locomotive boiler having an open topped combustion chamber, of a superheater casing in the form of a light superstructure exterior to the boiler, which is located above and connected to said combustion chamber, a removable cap plate closing said casing, and a superheater supported in said casing independently of the shell of the combustion chamber, and having a plurality of depending looped or return bend superheating pipes disposed in vertical rows in the direct path of the gases through the combustion chamber.

4. The combination, with a locomotive boiler having an open topped combustion chamber, of an independent superheater casing which is exterior to the boiler and constitutes the top closure of the combustion chamber, side connections securing said casing to said chamber, a removable cap plate closing said casing, a saturated and a superheated steam header, secured to opposite sides of said casing, and a plurality of looped or return bend superheating pipes communicating at their ends with said headers and depending in vertical rows in the direct path of the gases through the combustion chamber.

5. The combination, with a locomotive boiler having an open topped combustion chamber, of an independent superheater casing which is exterior to the boiler and constitutes the top closure of the combustion chamber, side connections securing said casing to said chamber, a removable cap plate closing said casing, a saturated and a superheated steam header, each secured to said casing, and a plurality of looped or return bend superheating pipes communicating at their ends with said headers and extending in vertical rows in the direct path of the gases of combustion from the boiler tubes, the lower ends of the superheating pipe elements being separated by a clear space from the bottom of the combustion chamber.

6. The combination, with a locomotive boiler having an open topped combustion chamber, of a superheater casing secured to the top of said combustion chamber, a removable cap plate closing said casing, a saturated steam header secured to one side of said casing and having a plurality of horizontally extending lateral branches, a superheated steam header secured to the opposite sides of said casing and having a plurality of similarly extending branches alternated in position with those of the saturated steam header, and a plurality of looped or return bend superheating pipes, connected

at their ends to the header branches and depending therefrom in vertical rows in the path of the gases of combustion from the boiler tubes.

7. The combination, with a locomotive boiler having an open topped combustion chamber, of an independent superheater casing located above said combustion chamber, reinforcing plates, of lighter metal than the shell of the combustion chamber, securing the casing to the combustion chamber, a removable cap plate closing the casing, a saturated and a superheated steam header, secured to opposite sides of the casing, and a plurality of looped or return bend superheating pipes communicating at their ends with said headers and depending in vertical rows in the direct path of the gases through the combustion chamber.

8. The combination, with a locomotive boiler having an open topped combustion chamber, of a superheater casing located above and connected to said combustion chamber, a superheater supported in said casing, and having a plurality of depending looped or return bend superheating pipes disposed in vertical rows in the combustion chamber, and a plurality of valve controlled blower pipes having their nozzles disposed to direct jets of steam across the combustion chamber among the rows of superheating pipes therein.

9. The combination, with a locomotive boiler, of a superheater comprising a saturated steam header having a plurality of horizontally extending lateral branches, a superheated steam header having a plurality of similarly extending branches alternated in position with those of the saturated steam header, said headers and branches being located entirely above the boiler tubes, a plurality of looped or return bend superheating pipes depending in vertical rows in the path of the gases of combustion from the tubes, and fittings secured removably to openings in the tops of the header branches, and having lateral openings communicating with the superheating pipes.

10. The combination, with a locomotive boiler, of a superheater comprising a saturated steam header having a plurality of horizontally extending lateral branches, a superheated steam header having a plurality of similarly extending branches, alternated in position with those of the saturated steam header, said headers and branches being located entirely above the boiler tubes, and a plurality of double looped or return bend superheating pipes connected at their ends to the header branches and depending therefrom, in vertical rows, through the spaces between the header branches, in the path of the gases of combustion from the tubes, the



upper portions of the superheating pipe elements being in two lengths of less total width than the space between two header branches, and the lower in four lengths of  
 5 greater total width than said spaces, whereby said superheating pipe elements may be separately inserted and withdrawn by being

turned at angles to their normal positions in service.

HENRY H. VAUGHAN.

Witnesses:

FRED LE GUNTER,  
 ALBERT LOVE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,  
 Washington, D. C."