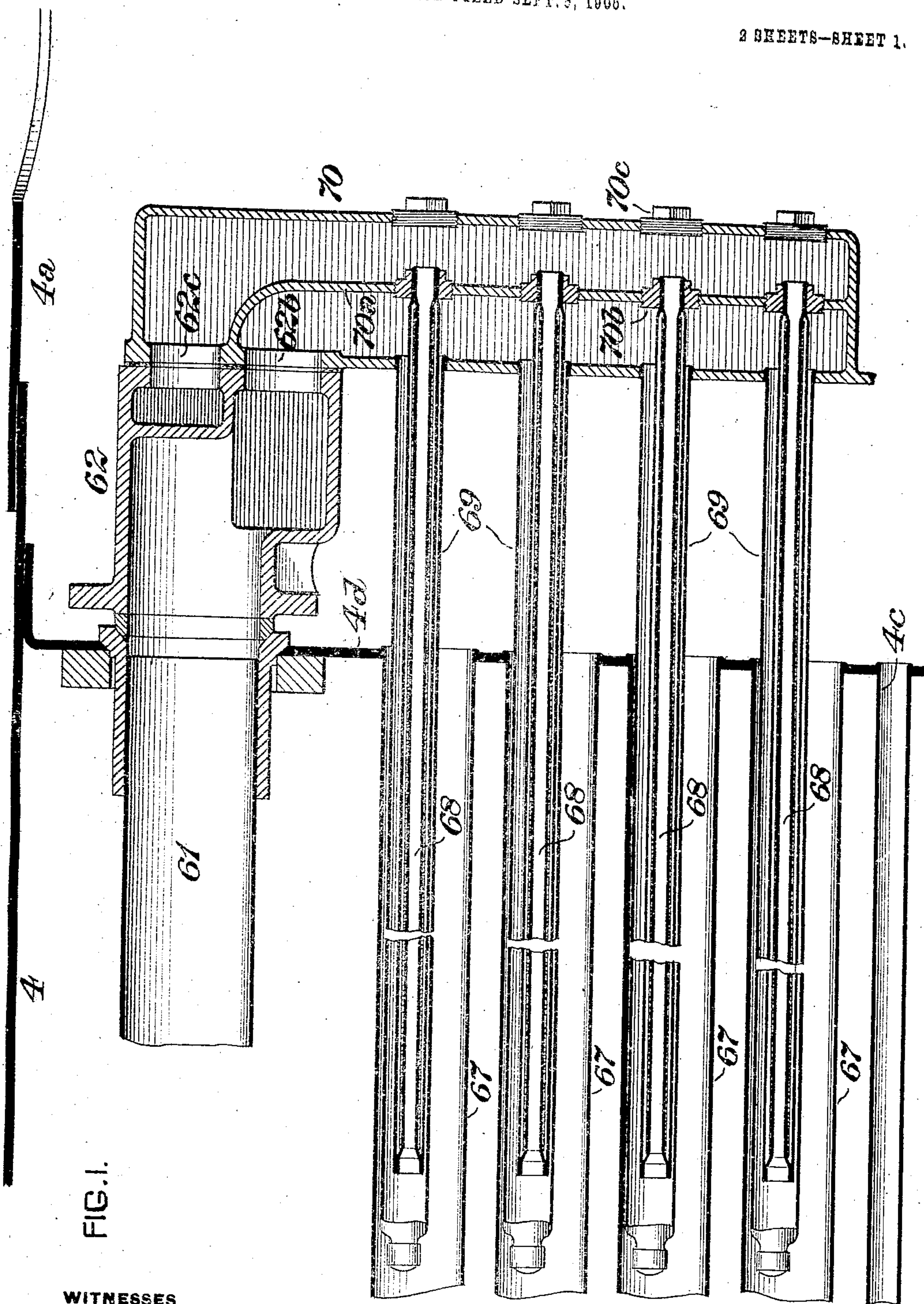


No. 810,619.

PATENTED JAN. 23, 1906.

F. J. COLE.
STEAM BOILER SUPERHEATER.
APPLICATION FILED SEPT. 5, 1906.

2 SHEETS--SHEET 1.



WITNESSES

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A

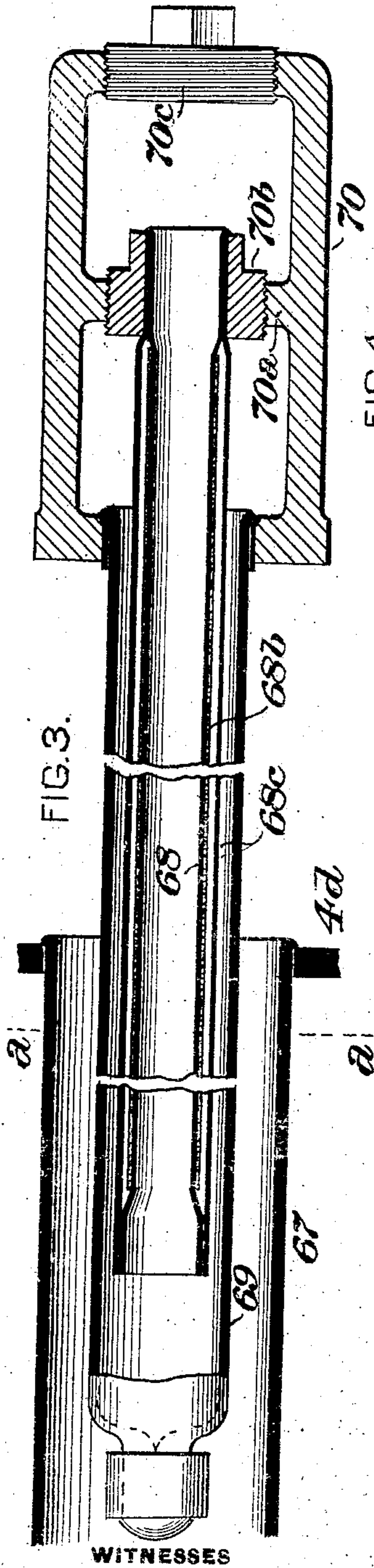
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2 SHEETS—SHEET 2.



WITNESSES
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FIG. 4.

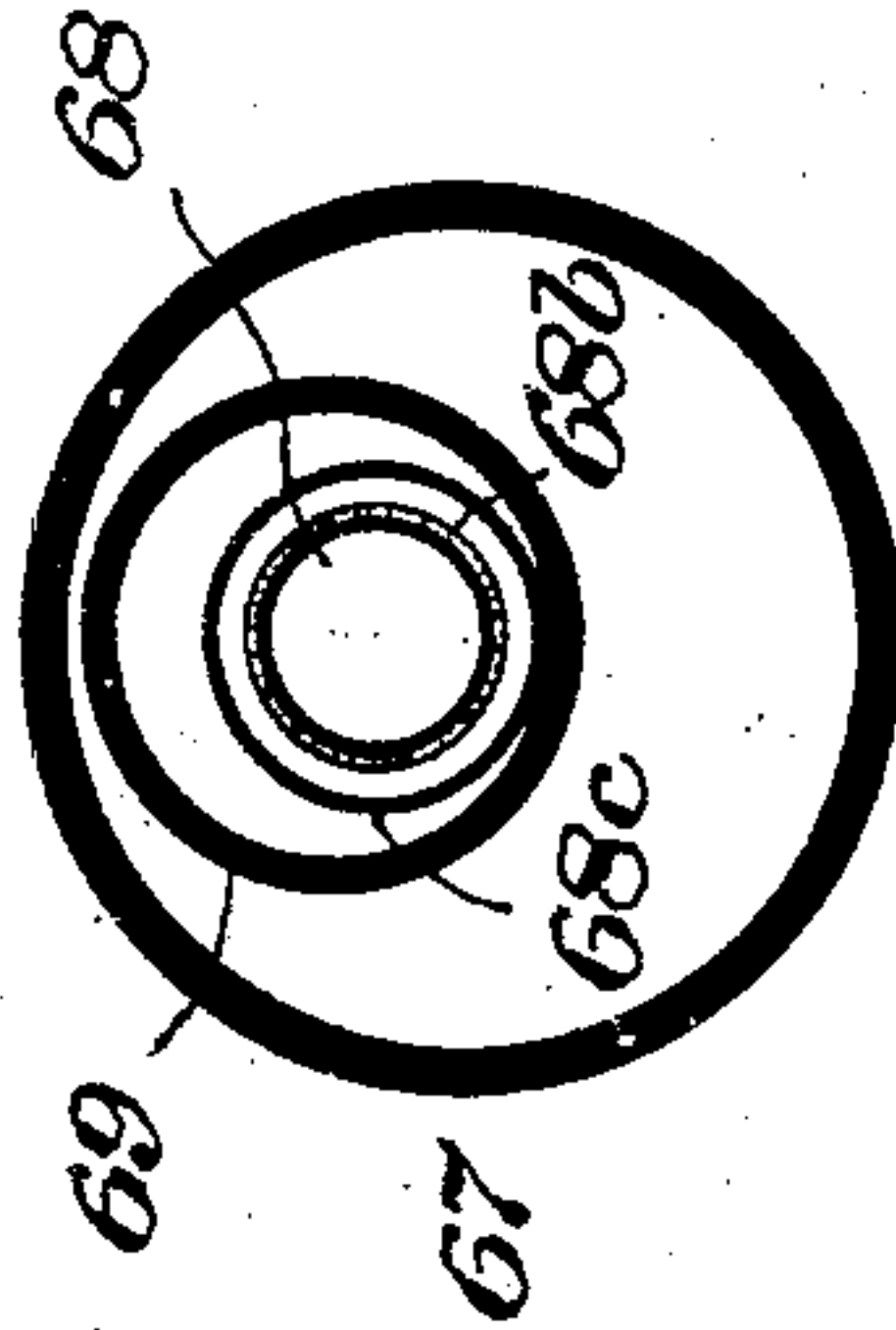


FIG. 5.

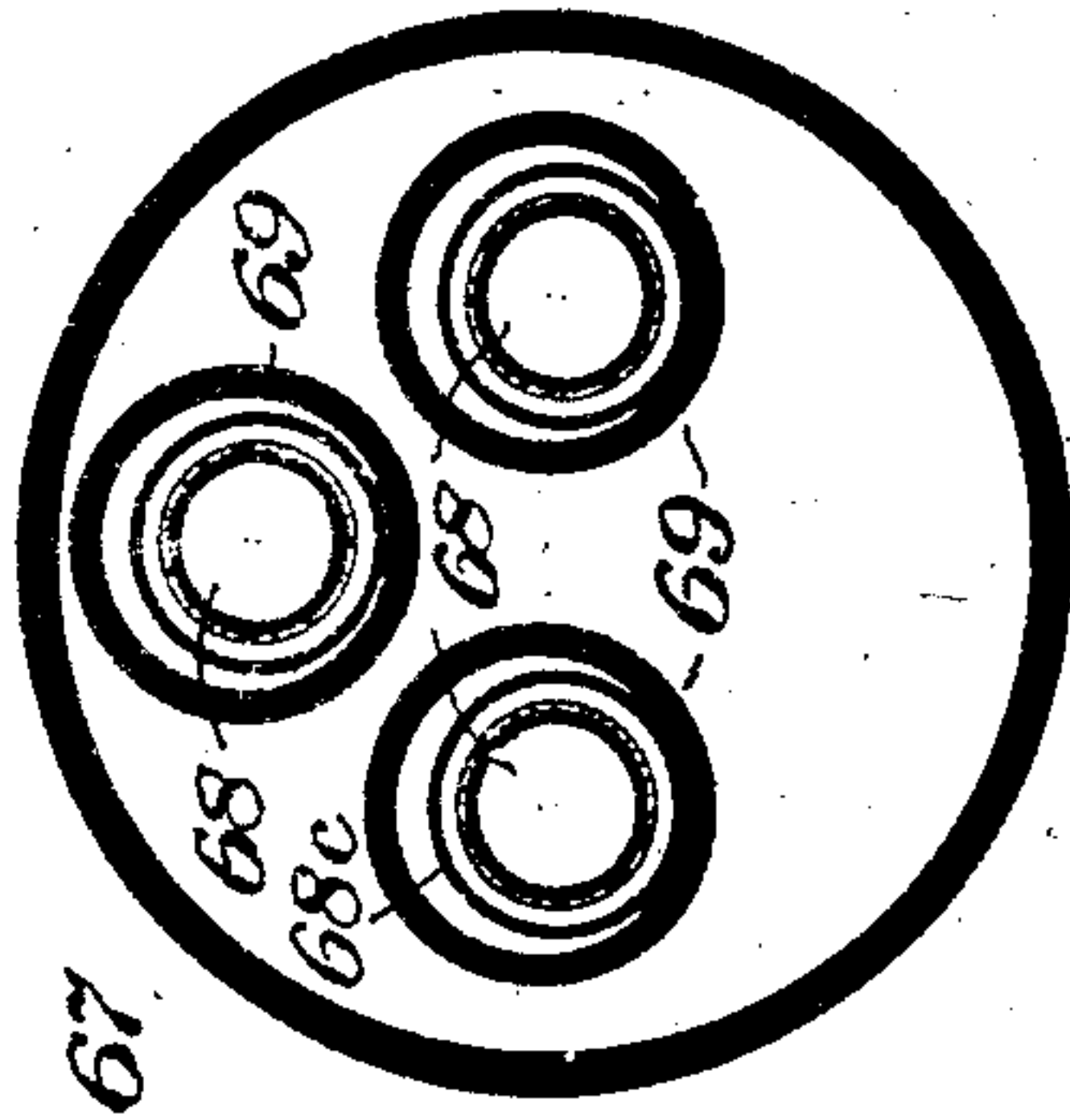


FIG. 6.

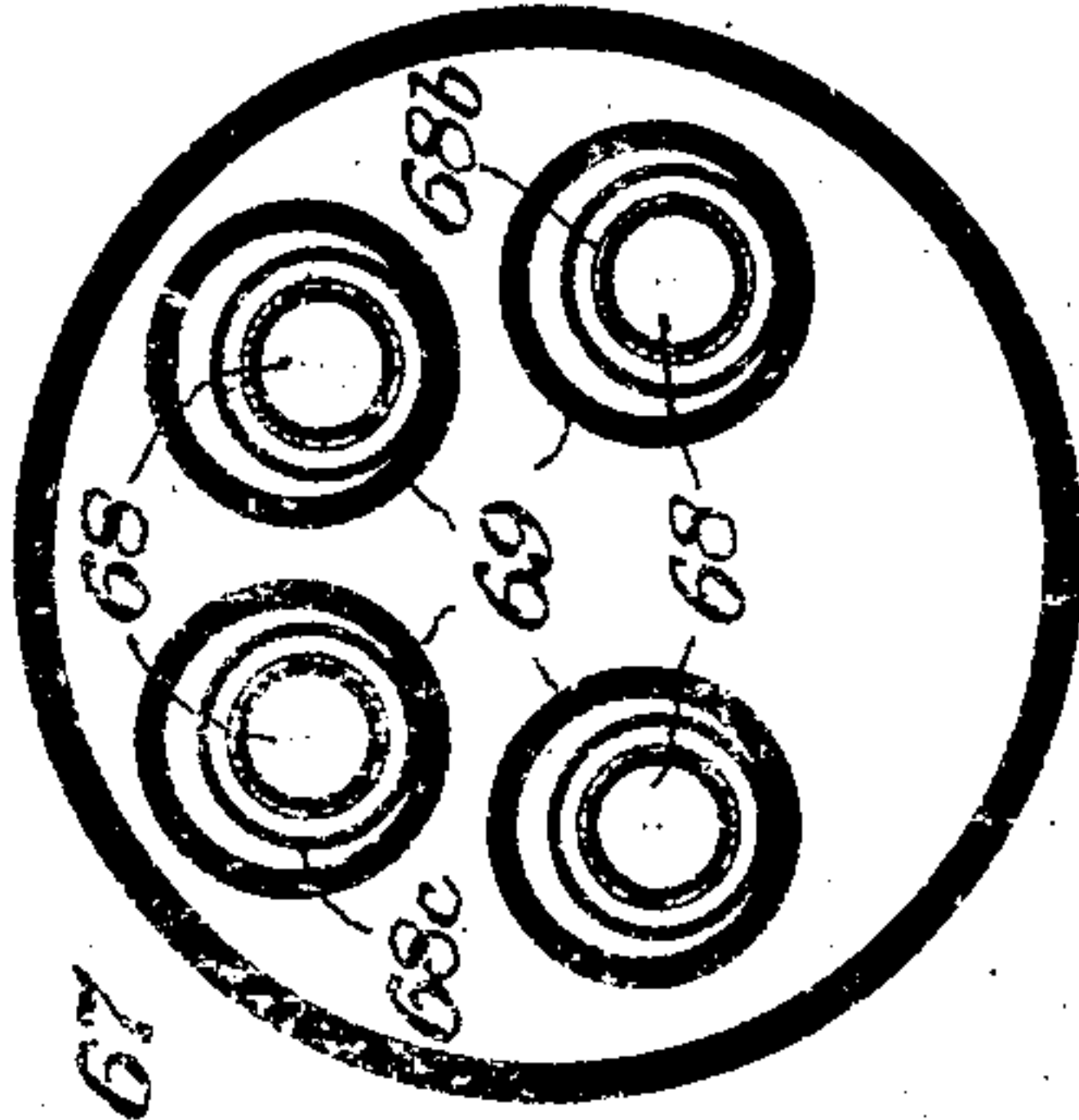
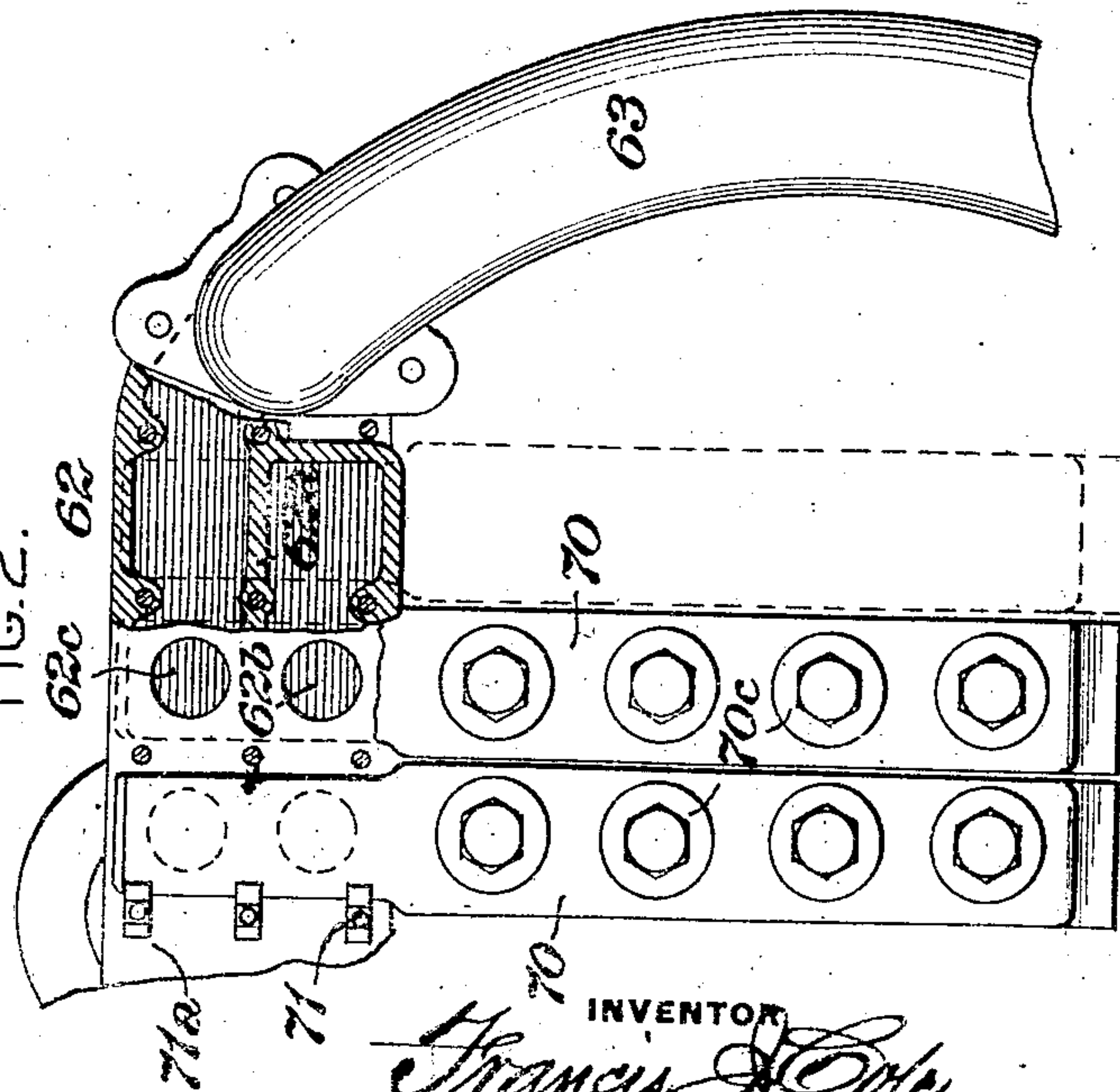


FIG. 2.



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UNITED STATES PATENT OFFICE.

FRANCIS J. COLE, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN LOCOMOTIVE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

STEAM-BOILER SUPERHEATER.

No. 810,619.

Specification of Letters Patent.

Patented Jan. 23, 1906.

Application filed September 5, 1905. Serial No. 276,955.

To all whom it may concern:

Be it known that I, FRANCIS J. COLE, of the borough of Manhattan, in the city and State of New York, 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 of the general class or type in which the superheater-pipes are located in fire-tubes of a steam-boiler; and its object is to provide a superheating appliance of such type in which the saturated steam shall be subjected to the heat of the gases passing through the superheating-tubes while traversing in reverse direction to said gases and after having been raised thereby to the maximum temperature shall be protected from loss of heat by transfer thereof to the succeeding saturated steam during its return traverse toward the steam-delivery connection.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical section through the forward portion of a locomotive-boiler, illustrating an application of my invention; Fig. 2, a front view, partly in section, of slightly more than one-half of the T-head with one of the headers detached and indicated in broken lines; Fig. 3, a horizontal central section, on an enlarged scale, through one of the headers and a superheating fire-tube and through the superheater-pipes located in said tube; Fig. 4, a transverse section on the line *a a* of Fig. 3; and Figs. 5 and 6 similar sections showing the application of a larger number of superheater-pipes in each superheating-tube.

My invention is herein exemplified as applied in connection with a locomotive-boiler 4, which is of the ordinary construction and is provided at its forward end with a smoke-box 4^a. A plurality of fire-tubes 4^c, ordinarily of comparatively small diameter, extend from the fire-box at the rear end of the boiler, which is not shown, to the front flue-sheet 4^d, and the products of combustion pass through said tubes and through other tubes which will presently be described to the smoke-box 4^a, from which they are discharged into the atmosphere through a stack in the ordinary manner. Steam is supplied from the boiler to the cylinders through a main steam-pipe

or dry pipe 61, passing through the front flue-sheet 4^d and connected in front thereof to a transverse T-head 62, from which branch steam-pipes 63, located on opposite sides of the smoke-box, lead to the cylinders.

In the practice of my invention I substitute in lieu of a number of the usual small-diameter fire-tubes 4^c in the upper and middle portion of the space within the boiler 4 which would ordinarily be occupied by such number of said tubes a correspondingly smaller number of tubes 67 of greater diameter, which will be descriptively termed "superheating-tubes," said superheating-tubes extending between and being expanded into the front flue-sheet 4^d and the rear or fire-box flue-sheet. Within each of the superheating-tubes there are located a system of superheater-pipes comprising an outer superheater-pipe 69 and an inner circulating-pipe 68, or, as hereinafter specified, a plurality of said outer and inner pipes, said pipes extending longitudinally in the superheating-tubes 67 from a vertical plane a short distance—as, say, thirty inches or thereabout—forward of the fire-box flue-sheet to vertical planes in the smoke-box forward of the T-head 62. The rear ends of the superheater-pipes 69, or those nearer the fire-box, are closed, as by being welded together or plugged, and their forward ends, as well as both ends of the circulating-pipes 68, are open. The superheating-pipes 69 are made of sufficiently smaller diameter than the superheating-tubes 67 to permit free passage of the products of combustion around them through the tubes, and their rear ends are supported therein, so as to give as much space as possible in the lower portion of the tubes. The circulating-pipes 68 are made of sufficiently smaller diameter than the superheater-pipes 69 to provide an annular channel between the pipes 68 and 69 for the traverse of saturated steam supplied to said channel from the main steam-pipe 61.

It will be obvious that, if desired, a plurality of sets of outer and inner pipes 69 68 may be located in each of the superheating-tubes 67, the latter being in such case made of correspondingly larger diameter to accommodate them. Fig. 5 illustrates the application of three sets of pipes, and Fig. 6 that of four sets of pipes in each superheating-tube.

The outer and inner superheater and circu-

lating pipes 69 68 of each vertical row are connected at their forward ends to a vertical casing or header 70, which is divided by a vertical partition 70^a into front and rear chambers or compartments. The headers 70 are set side by side and as closely together as practicable in the smoke-box 4^a a short distance in front of the superheating-tubes 67, and each header is independently insertible and removable. The forward ends of the outer superheater-pipes 69 are expanded into the rear walls of the headers, and the adjacent ends of the inner circulating-pipes 68 are correspondingly expanded into removable sleeves or sockets 70^b, screwed into the partitions 70^a of the headers, the outer and inner pipes thus communicating, respectively, with the rear and the front chambers of the headers. Openings which are closed by removable plugs 70^c are formed in the front walls of the headers, these openings providing for the insertion, examination, cleaning, and repairs of the superheater and circulating pipes. In the event of leakage at the joints the plugs can be detached and the circulating-pipes expanded, or a circulating-pipe or pipes can be withdrawn and the adjacent superheater pipe or pipes be expanded, as the case may require.

In order to prevent the loss of heat which would result from its transfer from the superheated steam passing through the circulating-pipes 68 to the saturated steam passing through the annular spaces between said pipes and the superheater-pipes 69, the circulating-pipes are jacketed or protected by an interposed non-conducting medium from direct contact with the steam in said annular spaces. In the instance shown such protection is effected by first covering the circulating-pipes 68 with casings 68^b, of asbestos paper or other material of analogous character, and thereafter inclosing them in jacket-pipes 68^c of sufficiently larger diameter to interpose annular dead-air spaces between them and the jacket-pipes, except at and near their ends, where the jacket-pipes fit closely around the casings 68^b, so as to close said dead-air spaces. The forward ends of the jacket-pipes pass through the sockets 70^b of the partitions of the headers and are expanded therein with the circulating-pipes.

The T-head 62 is divided by a horizontal partition 62^a into upper and lower chambers or compartments, the lower or supply compartment, which communicates with the main steam-supply pipe 61, having ports 62^b in its front, which register with ports at the tops of the rear chambers of the headers 70, and the upper or delivery compartment having ports 62^c in its front, which register with ports in the front chambers of the headers. The branch steam-pipes 63 are connected to nozzles at the ends of the upper compartment of the T-head. The front face of the

T-head and the rear faces of the headers, which surround the ports therein above specified, are finished so as to make tight joints, and the headers are secured removably to the T-head by bolts 71 and clamps 71^a.

In operation saturated steam from the boiler passes through the dry pipe 61 into the lower or supply compartment of the T-head and thence into the rear chambers of the headers 70, from which it passes rearwardly through the annular spaces between the superheater-pipes 69 and the circulating-pipes 68, being superheated in its traverse through said annular spaces by the hot products of combustion which pass in the opposite direction through the inclosing superheating-tubes 67. The saturated steam being admitted at the smoke-box ends of the superheater-pipes, where the temperature is lowest, is heated to its maximum when it reaches the ends nearer the fire-box, where the temperature is highest. The superheated steam then passes forwardly through the circulating-pipes 68, being protected in its traverse through the same from loss of heat by the non-conducting medium interposed between them and the surrounding annular steam-spaces, as before described, and enters the front chambers of the headers, from which it passes into the upper or delivery compartment of the T-head 62 and thence through the branch pipes 63 to the engine-cylinders for utilization therein.

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

1. The combination, with a tubular steam-boiler, of superheating-tubes, outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, an insertible and removable header, partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes of a vertical row, a steam-supply connection opening into the header-chamber of the outer pipes, and a steam-delivery connection leading out of the header-chamber of the inner pipes.

2. The combination with a tubular steam-boiler, of superheating-tubes, outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, a plurality of insertible and removable headers, each partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes of a vertical row, a T-head partitioned into a supply-compartment which is open to the main-supply steam-pipe and a delivery-compartment which is open to a delivery steam-pipe, ports in the supply-compartment communicating with the header-chambers of

the outer pipes, and ports in the delivery-compartment communicating with the header-chambers of the inner pipes.

3. The combination, with a tubular steam-boiler, of superheating-tubes, outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, an insertible and removable header, partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes of a vertical row, a non-conducting medium interposed between the inner and the outer pipes, a steam-supply connection opening into the header-chamber of the outer pipes, and a steam-delivery connection leading out of the header-chamber of the inner pipes.

4. The combination, with a tubular steam-boiler, of superheating-tubes, outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, an insertible and removable header partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes of a vertical row, cas-

ings of non-conducting material, as asbestos paper, surrounding the circulating-pipes, a steam-supply connection opening into the header-chamber of the outer pipes, and a steam-delivery connection leading out of the header-chamber of the inner pipes.

5. The combination, with a tubular steam-boiler, of superheating-tubes, outer superheater-pipes projecting thereinto and having their rear ends closed, inner circulating-pipes open at both ends and located within the outer superheater-pipes, an insertible and removable header partitioned vertically into two chambers, communicating, respectively, with the outer superheater-pipes and the inner circulating-pipes of a vertical row, casings of non-conducting material, as asbestos paper, surrounding the circulating-pipes; jacket-pipes inclosing and forming dead-air spaces around said casings, a steam-supply connection opening into the header-chamber of the outer pipes, and a steam-delivery connection leading out of the header-chamber of the inner pipes.

FRANCIS J. COLE.

Witnesses:

CHAS. H. APPS,
J. B. ENNIS.