S. M. VAUCLAIN.

ARTICULATED LOCOMOTIVE.

APPLICATION FILED AUG. 6, 1908.

912,923

Patented Feb. 16, 1909.

7 SHEETS—SHEET 1.

Fig. 1.

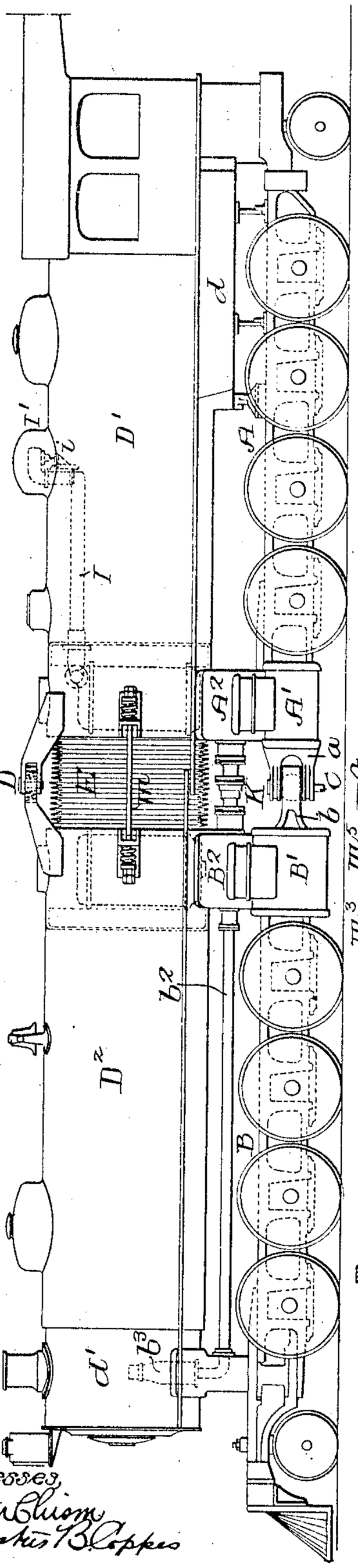


Fig. 7.

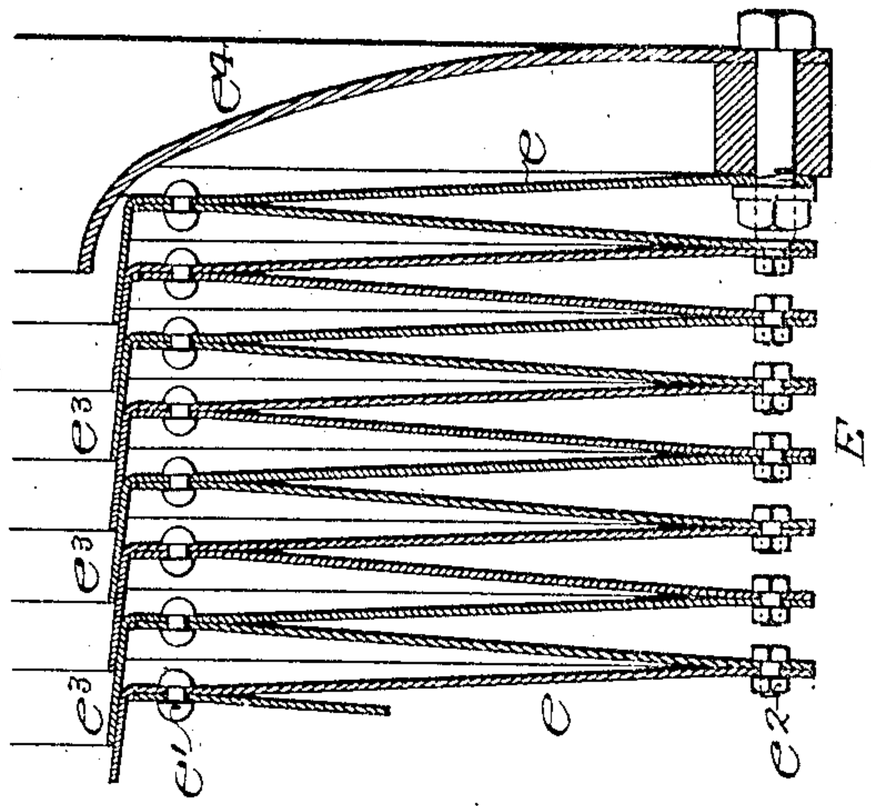
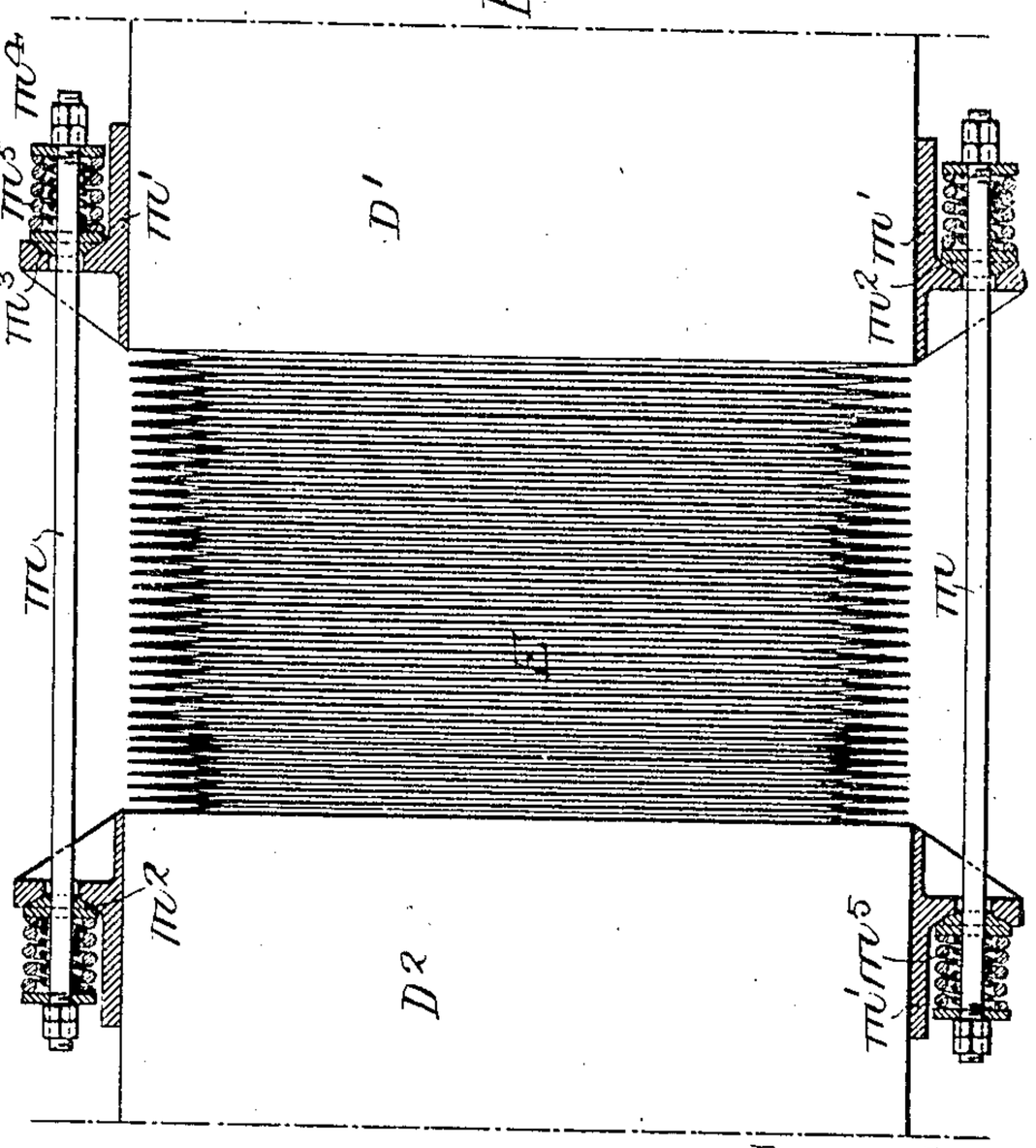


Fig. 6.



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Walter Chiosy
Augustus B. Coppes

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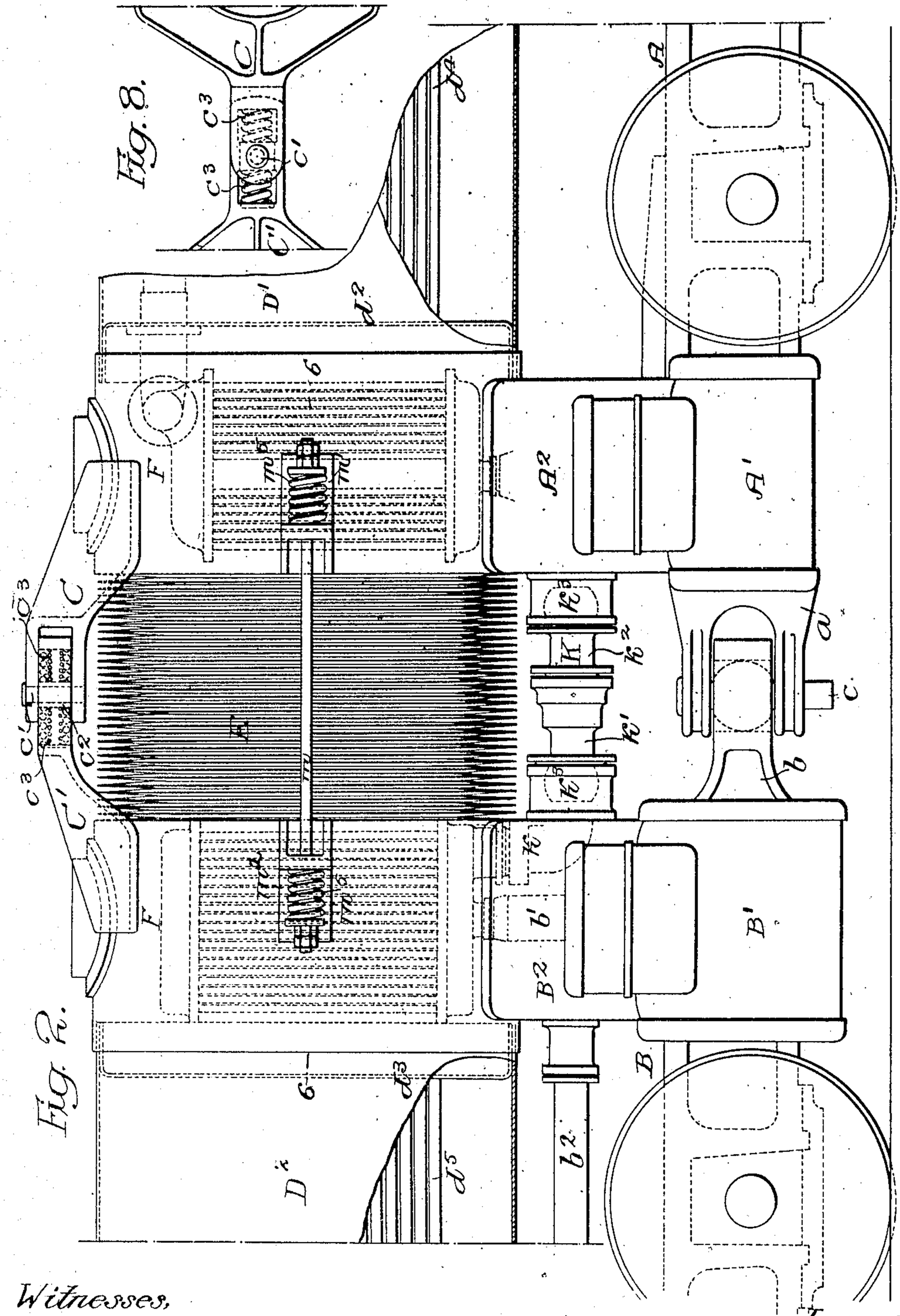
7 SHEETS—SHEET 2.

Fig. 2.



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7 SHEETS—SHEET 3.

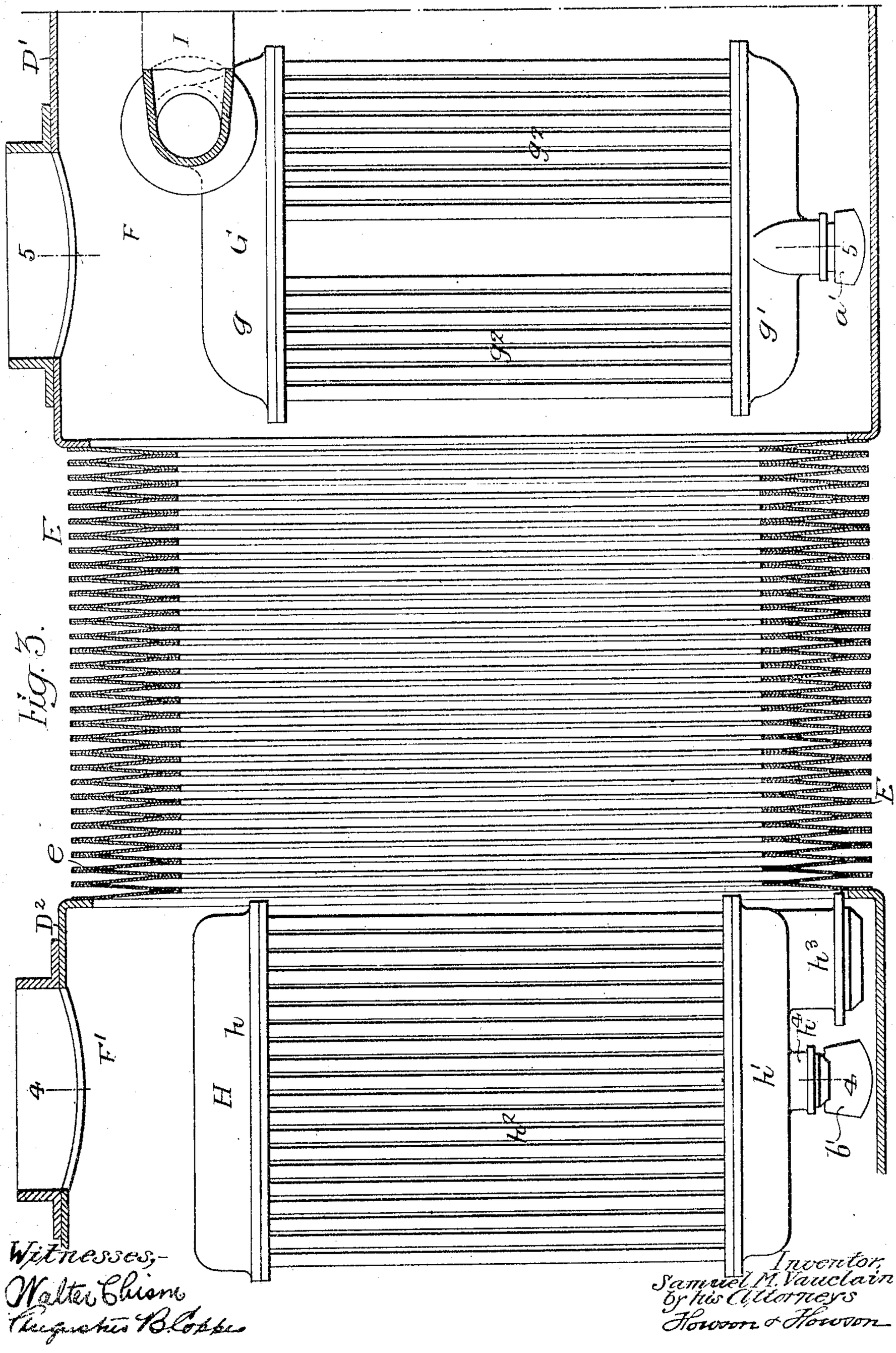

Fig. 3.

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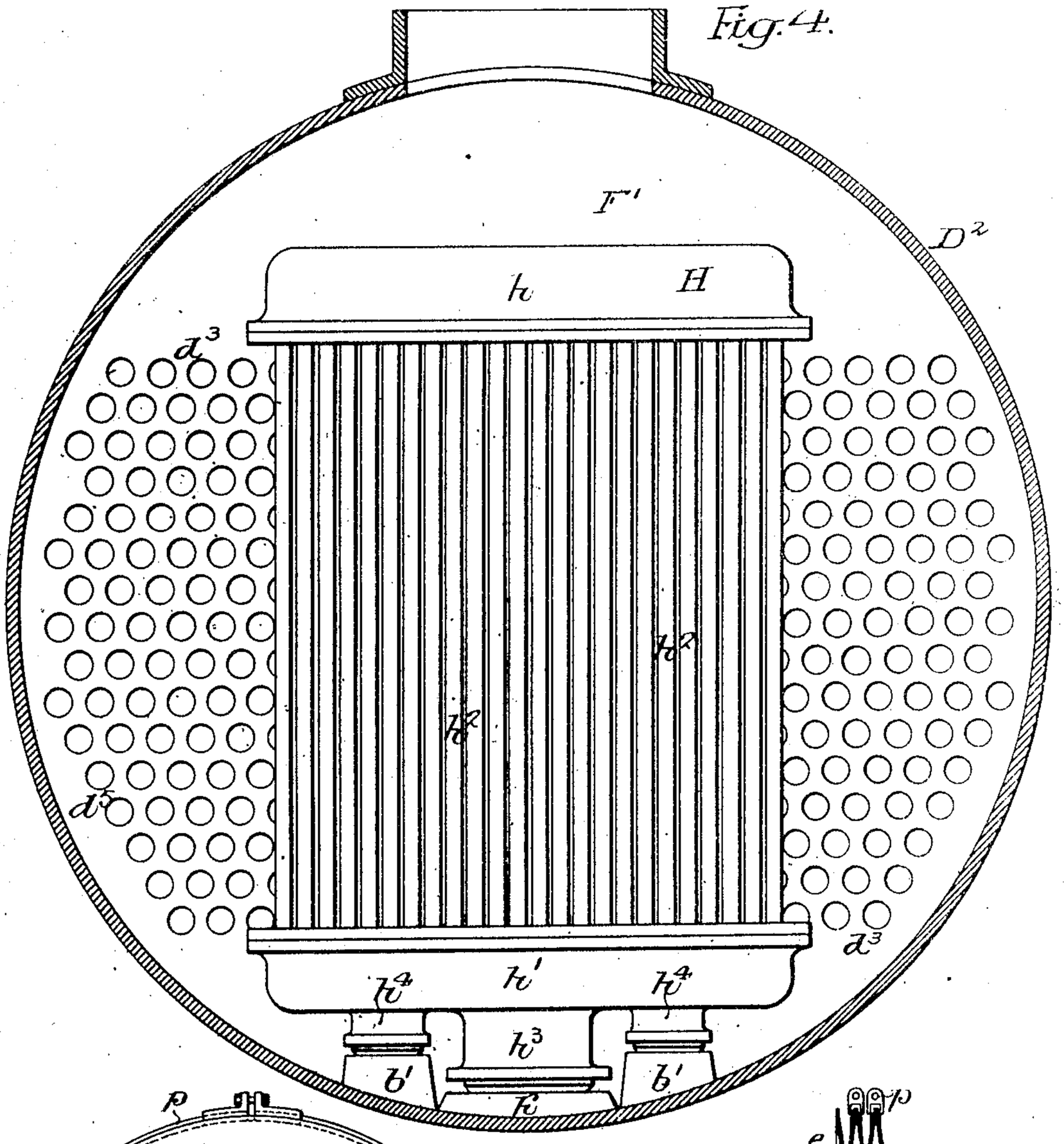
7 SHEETS—SHEET 4.

Fig. 4.



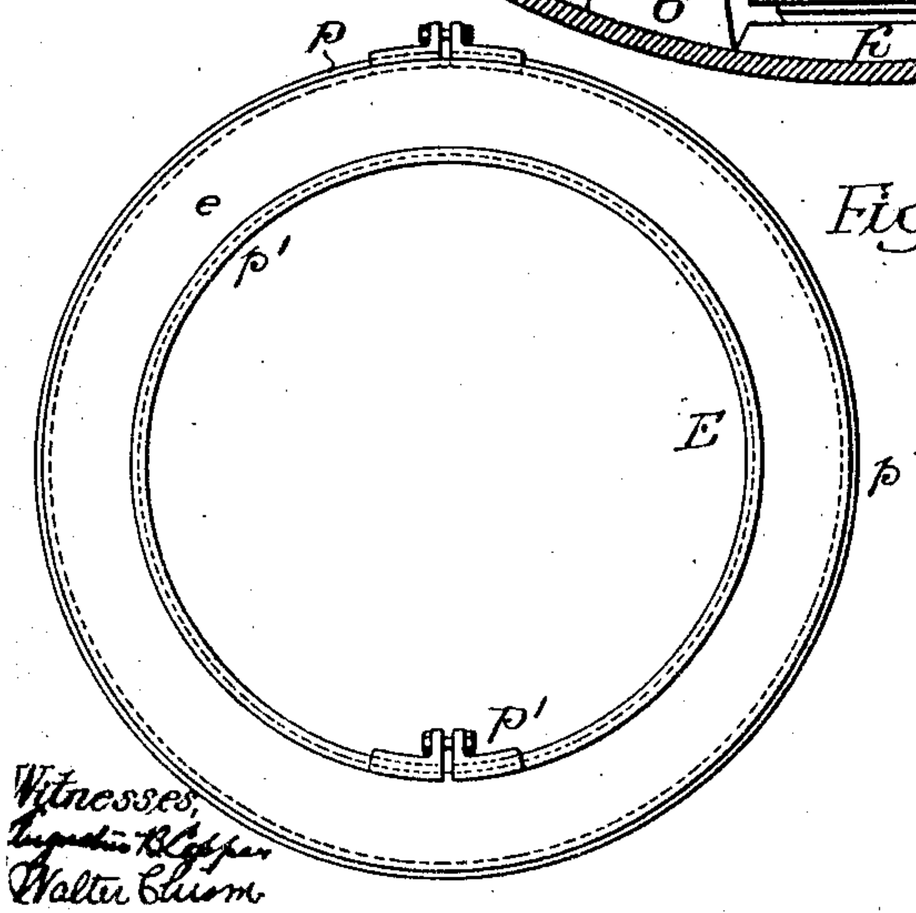


Fig. 13.

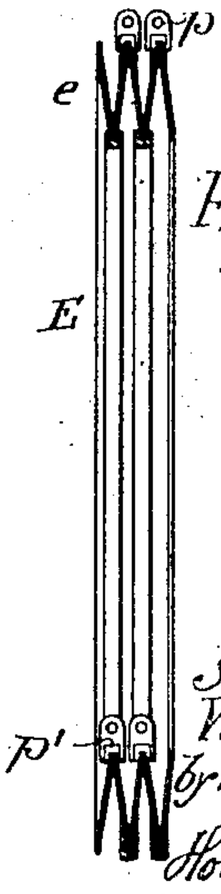


Fig. 14.

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7 SHEETS—SHEET 5.

Fig. 5

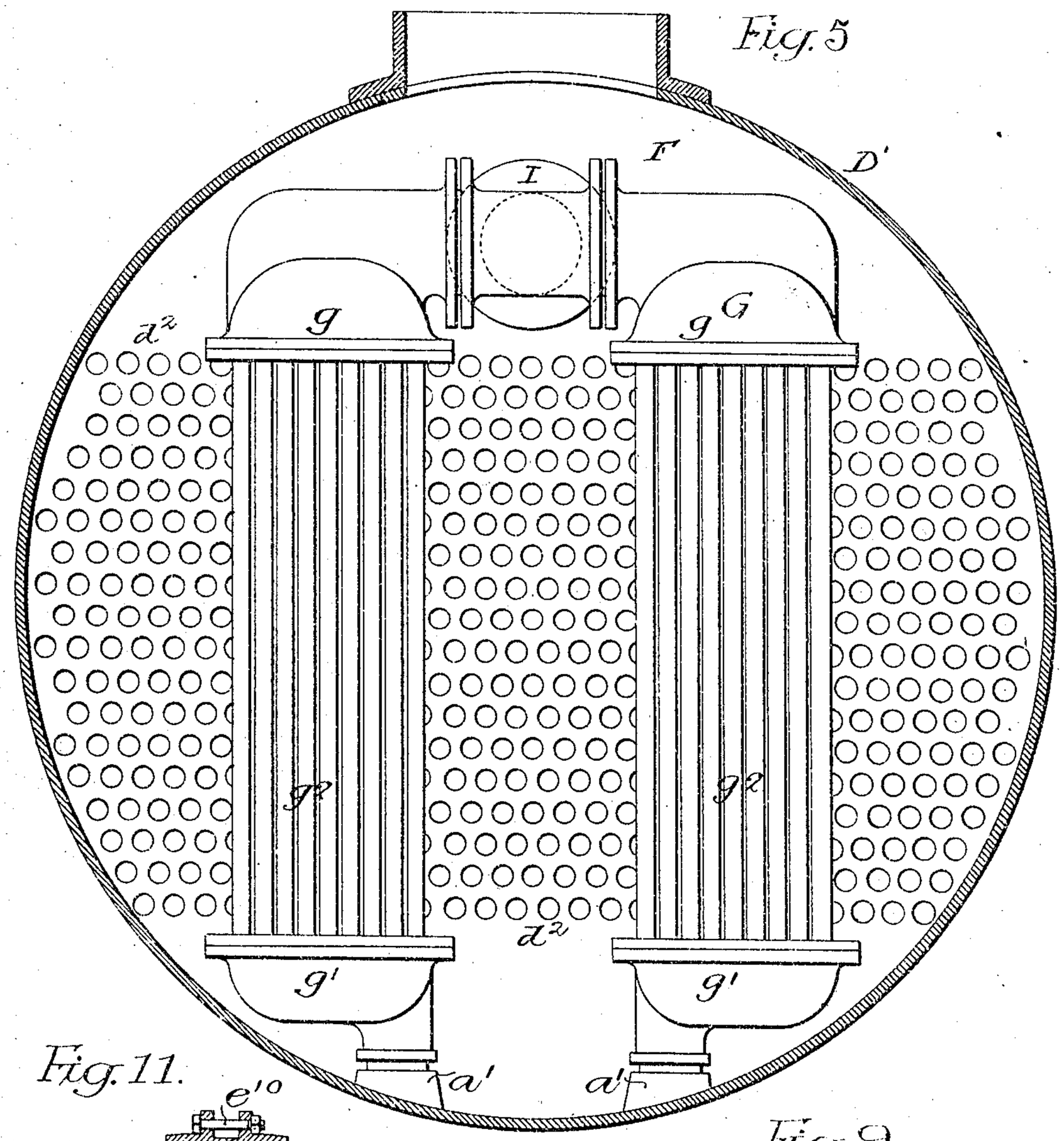


Fig. 11.

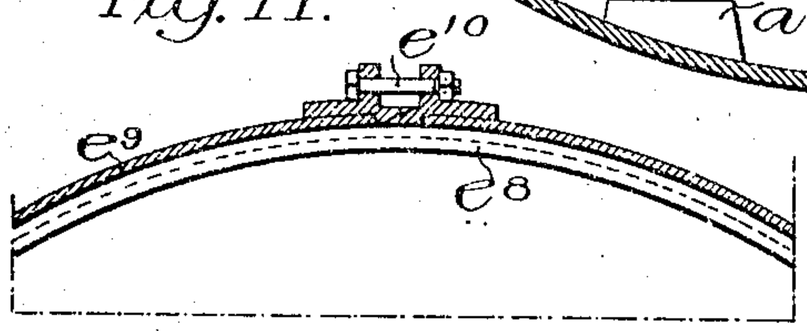


Fig. 12.

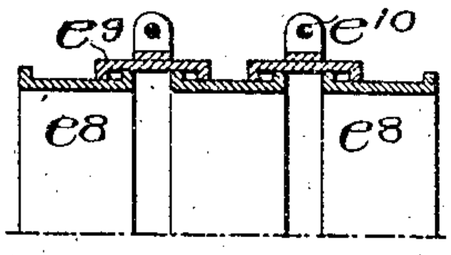


Fig. 9.

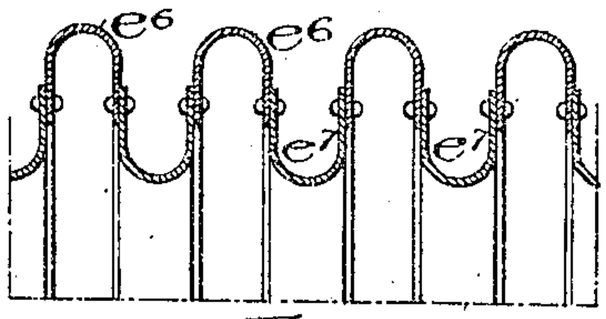
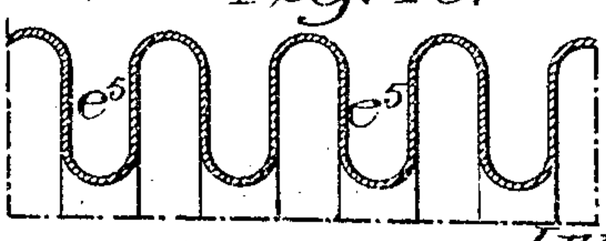


Fig. 10.



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7 SHEETS—SHEET 6.

Fig. 15.

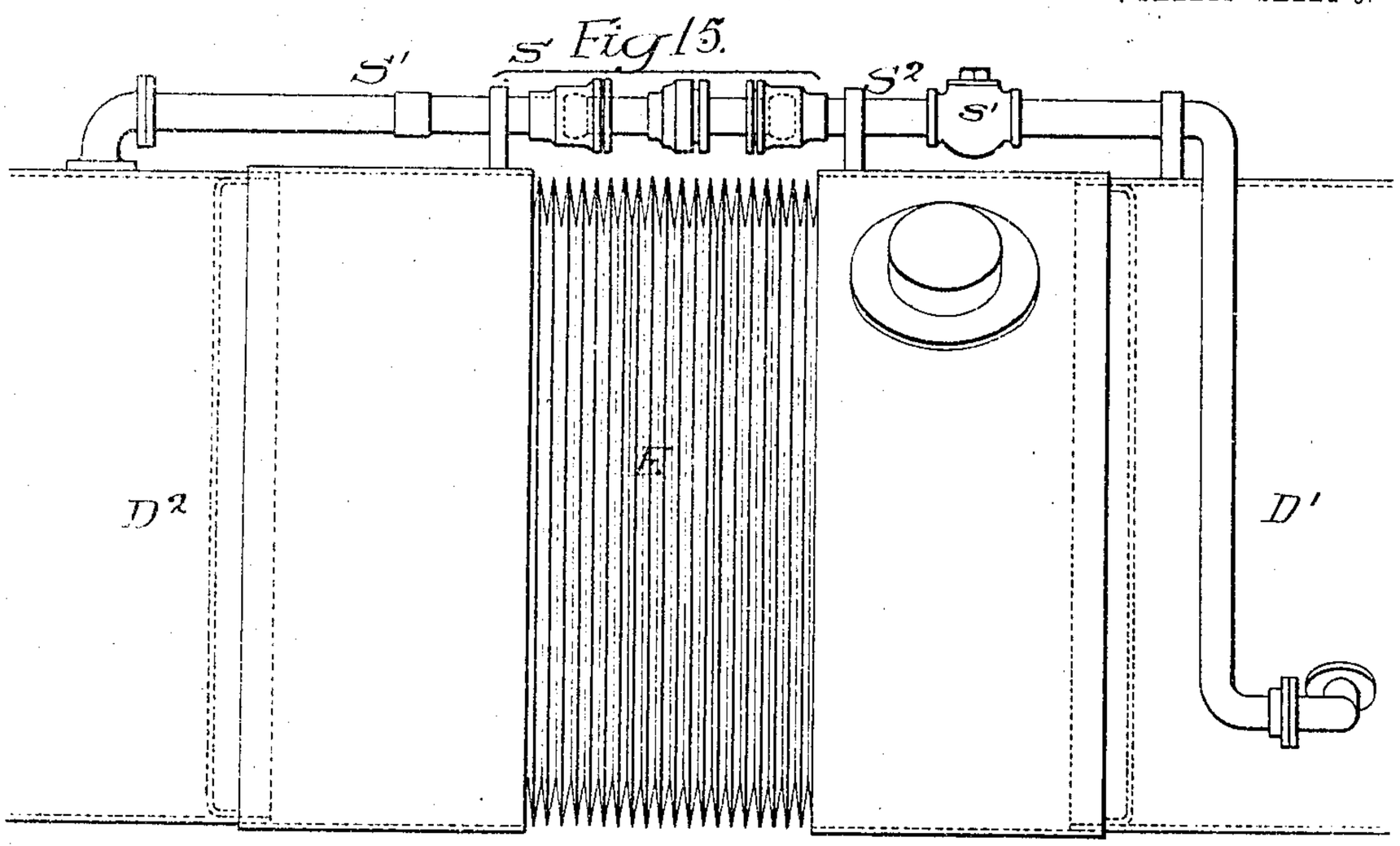


Fig. 16.

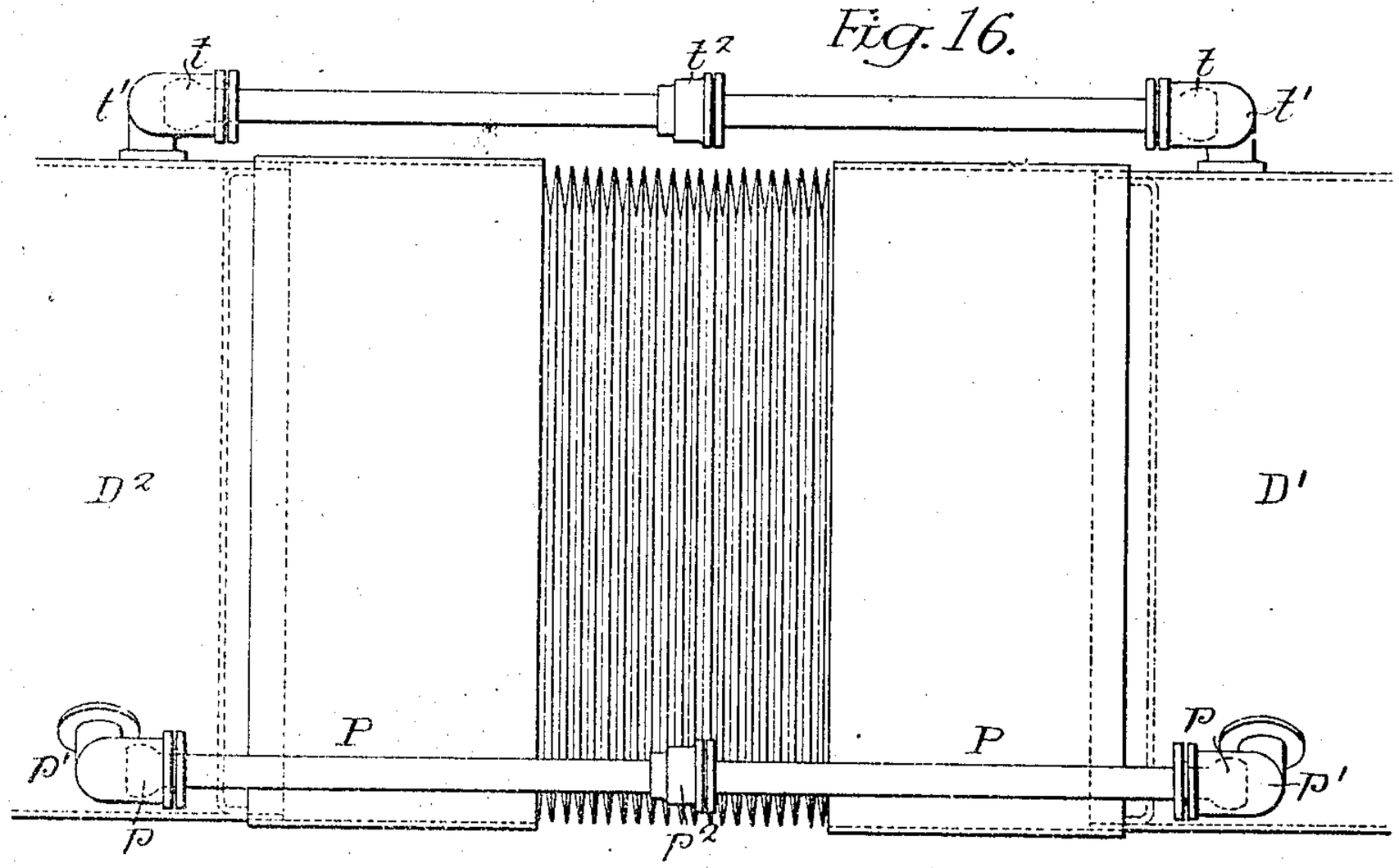
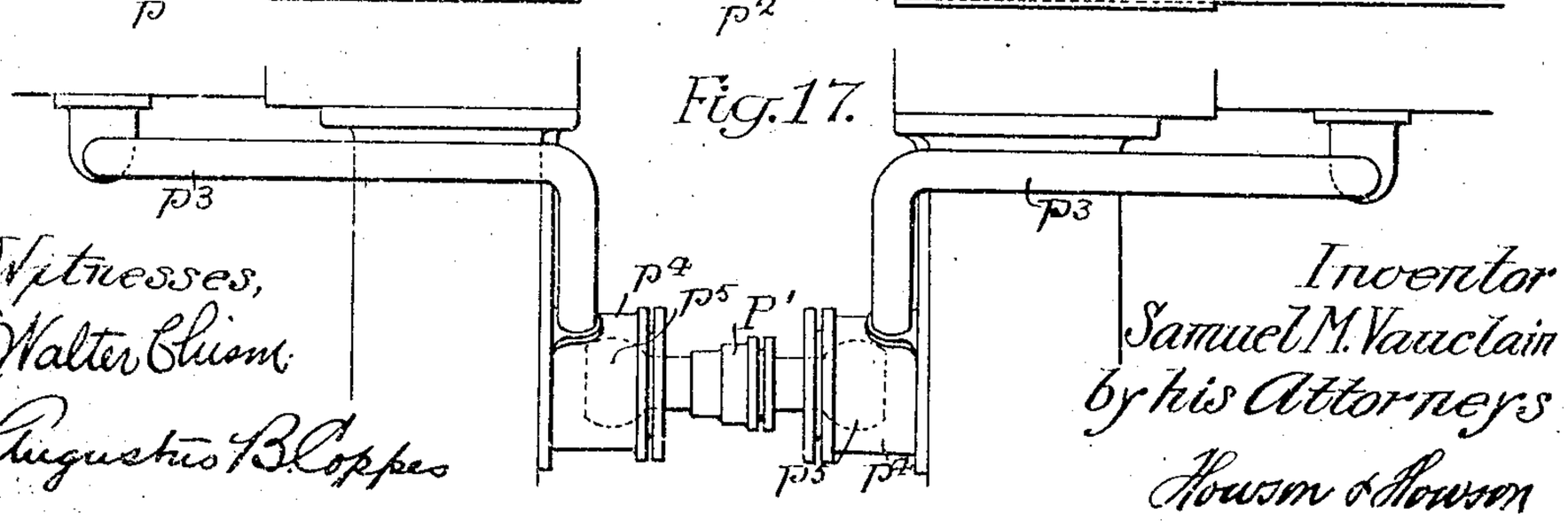


Fig. 17.



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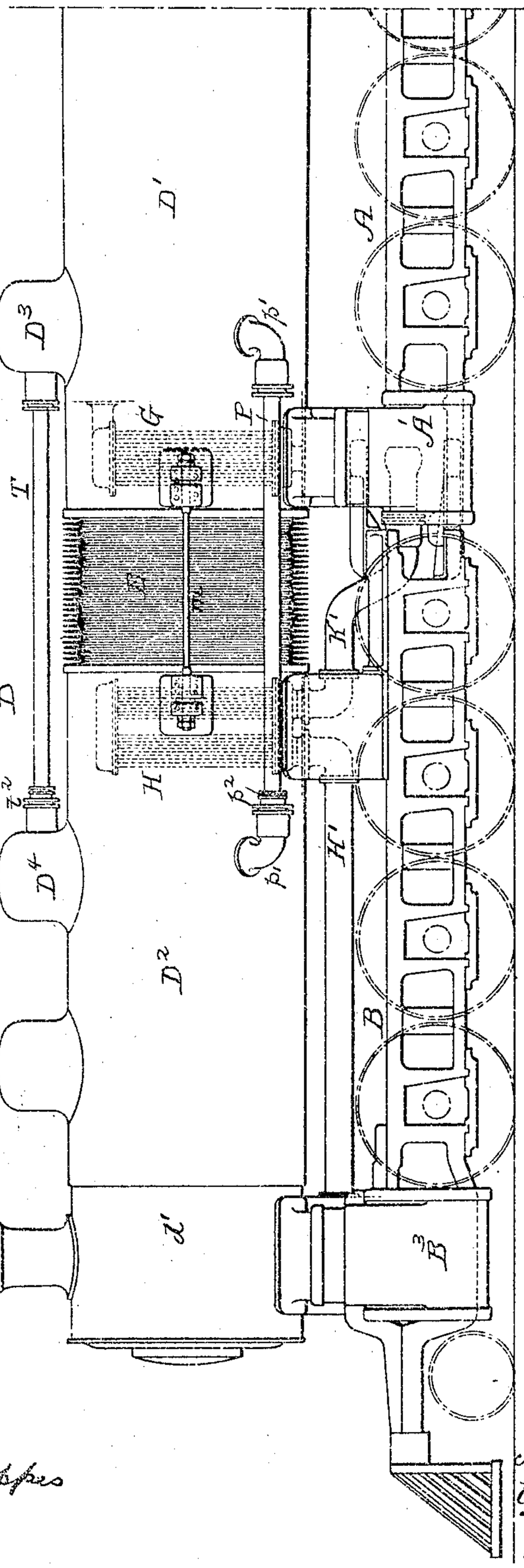
7 SHEETS—SHEET 7.

Fig. 18.



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UNITED STATES PATENT OFFICE.

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ARTICULATED LOCOMOTIVE.

No. 912,923. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed August 6, 1908. Serial No. 447,244.

To all whom it may concern:

Be it known that I, SAMUEL M. VAUCLAIN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Articulated Locomotives, of which the following is a specification.

My invention relates to certain improvements in the construction of a locomotive of the articulated type, that is, one in which there are two frames pivoted together, each frame carrying driving mechanism.

In this type of locomotive the usual practice has been to mount the boiler rigidly on one frame and allow it to overhang the other frame, providing suitable supports for the overhanging portion.

The main object of my invention is to so construct a locomotive of this type that the boiler will be supported rigidly on both frames, and to accomplish this I make the boiler in two sections and couple the sections together by a flexible joint.

A further object of the invention is to so design the boiler as to utilize the flexible connecting section as a secondary combustion chamber, and mount the superheaters at this point within the boiler.

A still further object of the invention is to utilize one section of the boiler as a feed water heater, the other section as the boiler proper, or to use both sections as the boiler proper.

In the accompanying drawings:—Figure 1, is a side view of an articulated compound locomotive illustrating my invention; Fig. 2, is an enlarged side view of the center portion of the locomotive, with portions broken away to illustrate the tubes; Fig. 3, is an enlarged longitudinal sectional view on the line 3—3, Fig. 4, of the center portion of the boiler; Fig. 4, is a transverse sectional view on the line 4—4, Fig. 3; Fig. 5, is a transverse sectional view on the line 5—5, Fig. 3; Fig. 6, is a sectional plan view on the line 6—6, Fig. 2; Fig. 7, is an enlarged view showing the preferable form of the flexible joint between the two sections of the boiler; Fig. 8, is a plan view of the pivot coupling between the two sections of the boiler illustrated in Fig. 2; Figs. 9 to 14, inclusive, are views showing different modifications of the flexible coupling; Fig. 15, is a side view showing the arrangement of piping between the two sections of boiler when one section is used as a feed water heater and the other as the boiler proper; Fig. 16, is a side view showing the arrangement of parts when both sections are used as the boiler; Fig. 17, is a view of a modification of the arrangement of the lower piping when both sections are used as the boiler proper; and Fig. 18, is a side view of a locomotive illustrating my invention, the locomotive being of the type in which the low pressure cylinders are at the front end of the forward frame, and the high pressure cylinders at the middle of the driving grouping.

A is the rear frame of an articulated compound locomotive and B is the front frame, each supported by a set of driving wheels and coupled together by a pin *c;* the pin extending through openings in brackets *a* and *b* projecting from the frames A and B respectively.

Supported on the frame A and rigidly secured thereto is a section D′ of the boiler D and supported rigidly on the frame B is a section D^2 of the boiler. The section D′ has a fire box *d* and the section D^2 has a smoke box *d′*. Both sections are rigidly supported on their frames and are connected together by the flexible section E. This section can be constructed in many different ways, but allowance must be made for sufficient movement to permit the locomotive to pass around curves of the ordinary radius.

Referring to Fig. 3, the section E is made up of a series of rings *e* alternately secured to each other at their inner and outer edges, as clearly shown; these rings are made of comparatively thin metal and there is enough spring in the metal to allow one section of the boiler to move out of line with the other section without opening the joints. These rings may be secured together in any manner, but I preferably secure the inner edges by rivets e', and secure the outer edges by bolts e^2, as illustrated in Fig. 7.

In order to prevent the soot and cinders entering the spaces between the rings I form internal flanges e^3 on each alternate ring and these flanges overlap each other, as illustrated in Fig. 7, closing the space between the rings and preventing the accumulation of soot or cinders in the narrow spaces. A curved flame plate e^4 may also be provided

so as to direct the flame away from the ring, if found desirable. This flame plate is clearly illustrated in Fig. 7, although omitted from the other figures of the drawings to avoid confusion.

In order to provide space for superheaters I do not extend the tubes of the sections of the boiler to the end of the sections, but place the tube sheets d^2, d^3, some distance away from the flexible section E, so as to form chambers F, F′ for the reception of superheaters G and H; these superheaters can be of any type desired.

In the present construction of locomotive, as shown in Fig. 1, the high pressure cylinders A′ are at the forward end of the frame A and the low pressure cylinders B′ are at the rear end of the frame B, so that the high and low pressure cylinders are consequently close together. The cylinder casting A^2 supports the forward end of the section D′ of the boiler and the cylinder casting B^2 supports the rear end of the section D^2 of the boiler.

I have found it preferable to superheat the steam before it enters the high pressure cylinder and to re-superheat it as it leaves the high pressure cylinder and before it enters the low pressure cylinder, and in the construction shown in the drawings, for instance Figs. 2 and 3, G is the superheater situated between the boiler and the high pressure cylinder and H is the superheater situated between the high pressure cylinder and the low pressure cylinder.

The superheater G consists of two headers g, g at the top, and two headers g', g' at the bottom; connected together by vertical tubes g^2, and the headers g, g are connected to the steam supply pipe I leading from the steam dome I′ in the section D′ of the boiler. This pipe is provided with the usual throttle valve i. The lower headers g' are connected through passages a' to the high pressure cylinders A′, one on each side of the locomotive.

The superheater H consists of an upper header h and a lower header h' connected by a series of vertical tubes h^2. The lower header has three necks, the center neck h^3 connects with the exhaust passage k from the high pressure cylinders A′ through the flexible pipe K, and the necks h^4 communicate with the passages b' leading to the low pressure cylinders B′. The exhaust from the low pressure cylinders passes through the pipe b^2 to the exhaust nozzle b^3 in the smoke box d' of the locomotive.

The connecting pipe K consists of two sections k', k^2; the section k^2 is adapted to slide within a stuffing box in the section k' and the free end of each section is in the form of a ball adapted to a socket k^3 firmly secured one to the cylinder casting A^2 and the other to the cylinder casting B^2.

It will be understood that the particular form and arrangement of the superheater may be modified without departing from the essential features of my invention, as any type of superheater may be used.

If it is found desirable, I may couple the two sections of the boiler at the top by a pin connection, as illustrated in Figs. 2 and 8, the pin c' alining with the main coupling pin c which connects the two sections, as illustrated in Fig. 1, and this pin passes through projections or brackets C, C′; the bracket C being secured to the upper portion of the section D′ and the bracket C′ being secured to the upper portion of the section D^2. The pin c' passes through plain openings in the bracket C and through a block c^2, and this block rests in a cavity in the bracket C′, and the block is held centrally by two coiled springs c^3 also mounted in the cavity, as illustrated in Fig. 8, so that while the pin c' acts as a pivot there is a certain amount of give to the pivot, owing to the construction of the springs c^3.

In order to stiffen the connection between the two sections D′ and D^2 of the boiler, I provide rods m, m, one on each side of the boiler; these rods pass through the brackets m' on the section D′ and brackets m^2 on the section D^2. Each bracket has a concave seat to receive the convex portion of a block m^3, and between this block and the washer m^4 on the rod is a spring m^5, so that the rod m is under tension at all times, but the holes in the brackets are of sufficient size to allow the rod to play when the section E is flexed, but when the engine is on a straight track the rods tend to keep the two sections firmly in line.

Instead of the flexible section E made up of a series of ring plates, as illustrated in Fig. 3, I may make the sections of a corrugated plate as shown at e^5 in Fig. 10, or make it of a series of rings U-shaped in cross section, the rings e^6, e^7 alternating with each other and riveted together as illustrated in Fig. 9. Or the ring section e^8 may be used having external flanges at each edge and extending over the flanged ends of these rings are other rings e^1 having internal flanges, and each ring is drawn tightly onto the rings e^8 by bolts e^{10}, as illustrated in Figs. 11 and 12.

Figs. 13 and 14 show plate rings similar to those illustrated in Fig. 3, with the exception that clamping rings p, p' are used to hold the edges of the abutting rings together.

Other means of forming the flexible section E may be resorted to without departing from the essential features of the invention.

As illustrated in Figs. 2, 4 and 5, it will be noticed that the tubes d^4 extend from the tube sheets d^2 of the section D′ of the boiler to the tube sheets at the fire box end, and the tubes d^5 extend from the tube sheet d^3 of the section D^2 to the tube sheet at the smoke box end of the boiler, and the tubes d^5 are less in number but greater in diameter than

the tubes d^4. This construction is particularly advisable when the section D^2 is used as a feed water heater, the section D′ being the boiler proper. When both sections are used as a boiler then the tubes may be of the same diameter and of the same number, or the tubes in the section D′ may be greater in diameter than the tubes in the section D^2.

When the section D^2 is used as a feed water heater then I prefer to couple the sections as illustrated in Fig. 15. Water is pumped into the feed water section D^2 (by a donkey engine) at a low point, and this will displace an equal quantity of water which is already in the section and which will be forced through a pipe S connecting the upper portion of the feed water section D^2 with the steam section D′. As shown in Fig. 15, the pipe S is made in two sections S′, S^2, the section S′ is attached to the upper portion of the section D^2 of the boiler and the section S^2 is connected to the lower portion of the section D′ of the boiler, and the two sections of the pipe are connected by a sliding ball and socket coupling *s* similar to that which couples the exhaust pipe of the high pressure cylinder to the superheater, as illustrated in Fig. 2; the coupling has balls at each end adapted to sockets in the sections S′, S^2 of the pipe S, and is made in two portions, one portion adapted to slide in the other.

A check valve *s′* is used so as to keep steam from crossing to the feed water heater, but this check valve is not absolutely necessary as if the heater section D^2 is always kept entirely full of water no siphonic action would be possible.

When both sections of the boiler are used for the generation of steam, then I prefer to couple them together, as illustrated in Fig. 16 or Fig. 18, by equalizing pipes P and T. The pipe P is connected to both sections below the water line, preferably as near the bottom as possible, and this pipe has balls at each end adapted to sockets in the elbows *p′* which are attached to the boiler sections, and this pipe P is made in two sections, one adapted to slide in a head p^2 on the other so that it will accommodate itself to any movement of one section independently of the other.

The pipe T is the steam equalizing pipe and is coupled to the upper portion of each section as shown, and at each end of this pipe are balls *t t* adapted to sockets in the elbows *t′* (Fig. 16), or the domes D^3, D^4, (Fig. 18) and this pipe T is also made in two sections, one section having a head t^3 into which the other extends, so that this pipe will accommodate itself to the independent movement of the sections of the boiler.

In Fig. 17 I have illustrated a modification of the arrangement of the lower pipe P, and in this instance the pipes p^3 extend from each section of the boiler to heads p^4 secured to the cylinder castings or the frame of the engine, and formed in these heads are sockets for the reception of the ball ends p^5 of the pipe P′, which is made in two parts, one part having a head into which the other extends so as to attain the same result as attained in Fig. 16, namely to allow the pipe to accommodate itself to the movement of the two sections of the boiler.

The arrangements shown in Figs. 15, 16 and 17 may be modified without departing from the essential features of the invention.

In Fig. 18 I have shown a locomotive in which the low pressure cylinders B^3 are located at the front end of the forward frame B and coupled to a pipe H′ leading from the superheater H, and having a short couple to the nozzle in the smoke box; a curved supply pipe K′ leads from the high pressure exhaust passage to the saddle H^2 supporting the rear end of the boiler section D^2 and the superheater H.

It will be seen by the above description that I am enabled to make a boiler in two sections, one flexibly connected to the other so that it can be adapted for use in the construction of articulated locomotives which are very long and which require a boiler of a large capacity.

By my invention as above described, I secure each section of the boiler rigidly to its frame and pivot the frame together and flexibly connect the two sections of the boiler, which will allow the frames free movement, thus dispensing with the objectionable overhanging features of the boilers in this type of locomotive. Furthermore, I provide a central combustion chamber which in many instances is desirable for the proper combustion of fuel.

I claim:—

1. A boiler made in two sections, one section flexibly connected to the other.

2. A boiler made in two sections, a combustion chamber between the two sections, the casing of the combustion chamber being flexible.

3. The combination in a locomotive boiler, of two sections, one arranged in advance of the other on the same longitudinal line, with an intervening flexible section coupling the two sections together.

4. The combination in a locomotive boiler, of two sections, one arranged in advance of the other on the same longitudinal line and spaced apart, and an intervening flexible section coupling the two sections together and forming a combustion chamber, with tubes in each section.

5. The combination in an articulated locomotive, of two frames pivoted together, a boiler extending over both frames and made in two sections, one section rigidly secured to one frame and the other section rigidly secured to the other frame, and a flexible sec-

tion coupling one section of the boiler to the other so that the boiler will accommodate itself to the movement of the two frames.

6. The combination in a boiler made in two sections, each section having independent tubes, with a flexible connecting section coupling the tubular sections of the boiler, the space at the flexible connection being free of tubes and forming a combustion chamber.

7. The combination in a boiler consisting of two sections coupled together by an intervening flexible section, independent tubes in each section, the coupling section being free of tubes and forming a combustion chamber so that the products of combustion will pass through the tubes of one section, through the combustion chamber and through the tubes of the other section.

8. The combination in a boiler, of two sections coupled together by an intervening flexible connection, each section having a tube sheet at each end and tubes extending from one tube sheet to the other, with a pipe connecting the interior of one section with the interior of the other section.

9. The combination in a boiler, of two sections, a flexible coupling connecting one section to the other, tube sheets in each end of each section, tubes extending from one tube sheet to the other in each section, two pipes coupling the sections together, one pipe connected to the top of each section and the other pipe connected to each section near the bottom, each pipe being flexible.

10. The combination in an articulated locomotive, of two frames coupled together, a boiler made in two sections, one section rigidly secured to one frame and the other section rigidly secured to the other frame, a flexible section coupling the two sections of the boiler, each section having independent tubes therein, and a flexible pipe coupling the interior of one section with the interior of the other section.

11. The combination in an articulated locomotive, of two frames, a boiler mounted above the frames made in two sections, one section rigidly secured to one frame and the other section being rigidly secured to the other frame, a flexible connecting member connecting the two sections and forming a combustion chamber, tube sheets in each section arranged some distance from the end, a superheater mounted in the end of each section, high pressure cylinders on one frame and low pressure cylinders on the other frame, one superheater communicating with one section of the boiler and with the high pressure steam passage, the other superheater connected to the low pressure steam passage and to the exhaust passage leading from the high pressure cylinders.

12. The combination in a locomotive of the articulated type, of two frames pivoted together, a boiler extending over both frames and made in two sections flexibly connected, one section rigidly mounted on one frame and the other section rigidly mounted on the other frame, high pressure cylinders carried by one frame, low pressure cylinders carried by the other frame, two superheaters one connected to the boiler and to the supply pipe leading to the high pressure cylinders, the other superheater connected to the exhaust pipe of the high pressure cylinder and to the supply pipe of the low pressure cylinder, the exhaust pipe between the high pressure cylinder and the superheater being flexible so as to accommodate itself to the movement of the engine frames.

13. The combination in an articulated locomotive, of two frames pivoted together, a boiler extending over both frames, said boiler being made in two sections, a flexible member coupling the two sections and forming a combustion chamber, tubes in each section, a fire box forming part of one section of the boiler, a smoke box forming part of the other section of the boiler, and a flexible pipe connecting the water space of one section of the boiler with the water space of the other section of the boiler.

14. The combination in a boiler made in two sections, a coupling member con cting the two sections, said coupling member being made up of a series of rings attached alternately at their inner and outer edges.

15. The combination in a boiler made in two sections spaced apart, a coupling member occupying the space between the sections, said coupling member being made up of a series of flat rings attached alternately at the inner and outer edges forming a flexible connection, with overlapping flanges on some of the plates forming a protecting shield.

16. The combination in a boiler made in two sections spaced apart, a connecting member consisting of a series of rings secured together alternately at the inner and outer edge, and a deflecting flame plate at a point where the flexible member is coupled to one of the sections, so as to direct the flame away from the connecting plates.

17. The combination in a locomotive, of two frames pivoted together, a boiler extending over both frames and made in two sections, one section rigidly attached to one frame, the other section rigidly attached to the other frame, a flexible member connecting the two sections of the boiler, two brackets, one extending from one section of the boiler and the other extending from the other section of the boiler, and a pivot pin connecting the two brackets.

18. The combination in a locomotive, of two frames pivoted together, a boiler extending over both frames and made in two sections, one section rigidly attached to one

frame, the other section rigidly attached to the other frame, a flexible member connecting the two sections of the boiler, two brackets, one extending from one section of the boiler and the other extending from the other section of the boiler, a pivot pin connecting the two brackets, said pivot pin passing through holes in one bracket and through a block carried by the other bracket, and springs at each end of the block.

19. A boiler made in two sections, a flexible coupling connecting the two sections, and a rod at each side flexibly attached to the said sections.

20. The combination in a locomotive of the articulated type, of two frames pivoted together, a boiler extending over both frames and made in two sections, one section rigidly attached to one frame, the other section rigidly attached to the other frame, a flexible member coupling the two frames, brackets on each side of each section of the boiler, rods at each side of the boiler extending through the brackets, and springs between the ends of the rods and the brackets forming a flexible auxiliary coupling.

21. The combination in an articulated locomotive, of two frames pivoted together, a boiler extending over both frames and made in two sections, one section carried by one frame and the other section carried by the other frame, a flexible member connecting the two sections of the boiler, brackets on each section at each side and each bracket concaved to form a socket, a rod at each side of the boiler extending through both brackets at each side, a block at each bracket having a convex portion adapted to the sockets in the bracket, and a spring mounted between the head of the rod and the blocks, the rods forming auxiliary connecting members.

22. The combination in a boiler made in two sections, a flexible member connecting the two sections, independent tubes in each section, one section forming the boiler proper and the other forming the feed water heater, and a pipe leading from the upper portion of the feed water section of the boiler to the lower portion of the boiler section proper, said pipe being flexible.

23. The combination in a boiler made in two sections, of a flexible member connecting the two sections, independent tubes in each section, a pipe connecting the upper portion of one section to the upper portion of the other section, and a pipe connecting the lower portion of one section to the lower portion of the other section, both pipes being flexibly connected.

24. The combination in an articulated compound locomotive, of two frames pivoted together, high pressure cylinders on the rear frame, low pressure cylinders on the forward frame, driving wheels for each frame, a boiler extending over both frames and made in two sections, a flexible member coupling the two sections of the boiler, the rear section of the boiler having the fire box and recessed at its forward end for the reception of a superheater and having independent tubes, the forward section having a smoke box at its forward end and recessed at its rear end for the reception of a superheater and having independent tubes, a superheater in the recess in the forward end of the rear section of the boiler, said superheater being connected to the steam space in said section and to the steam supply pipe of the high pressure cylinders, a superheater in the recess in the rear end of the forward section and coupled to the exhaust passage leading from the high pressure cylinder and coupled to the inlet passage leading to the low pressure cylinder, and an exhaust pipe extending from the low pressure cylinder to the smoke box.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

SAMUEL M. VAUCLAIN.

Witnesses:

GRAFTON GREENOUGH,

CHAS. A. WIGGINS.