No. 620,408. Patented Feb. 28, 1899.

W. E. BERRY.
WATER TUBE BOILER.

(Application filed Dec. 30, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 2

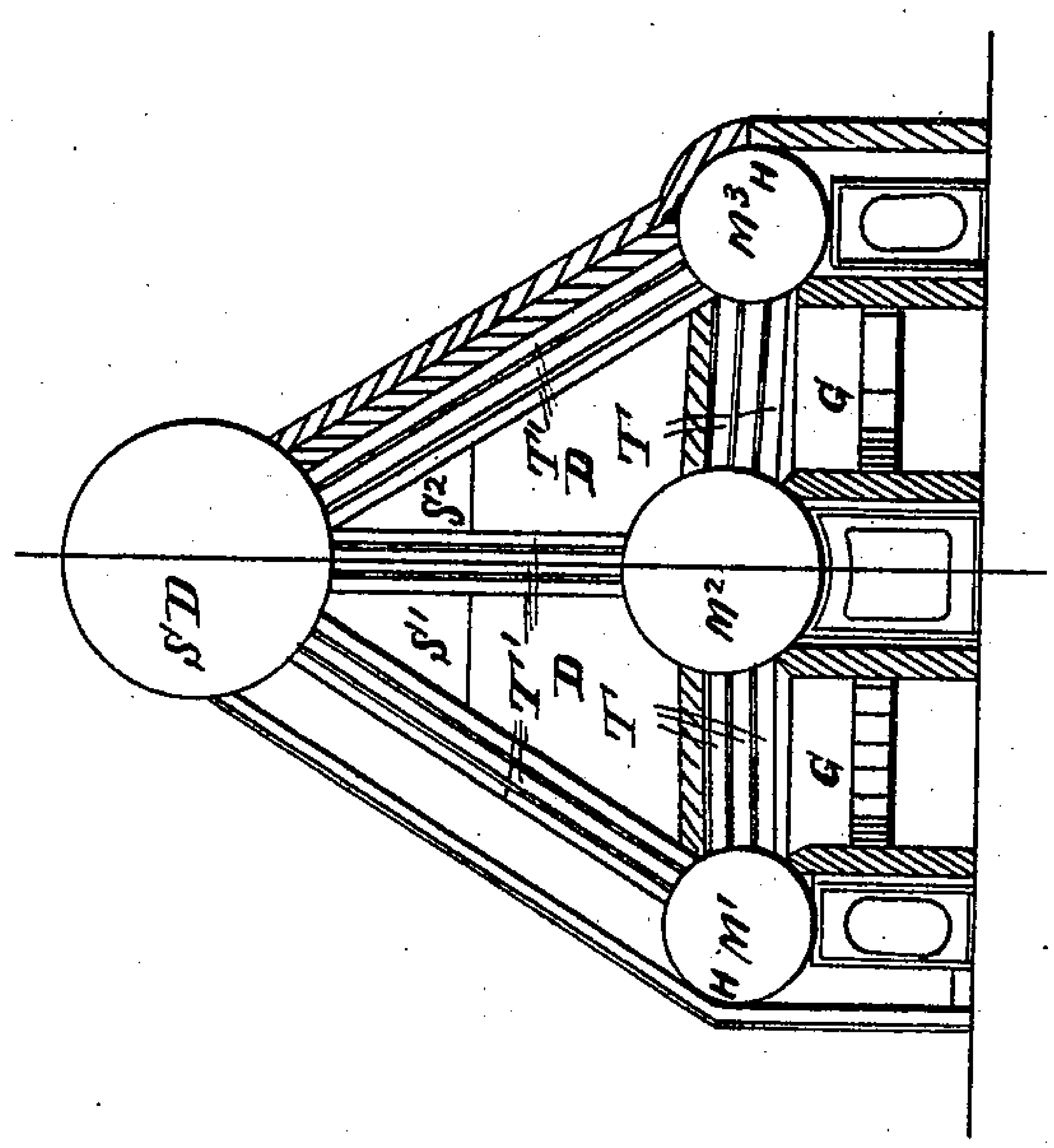
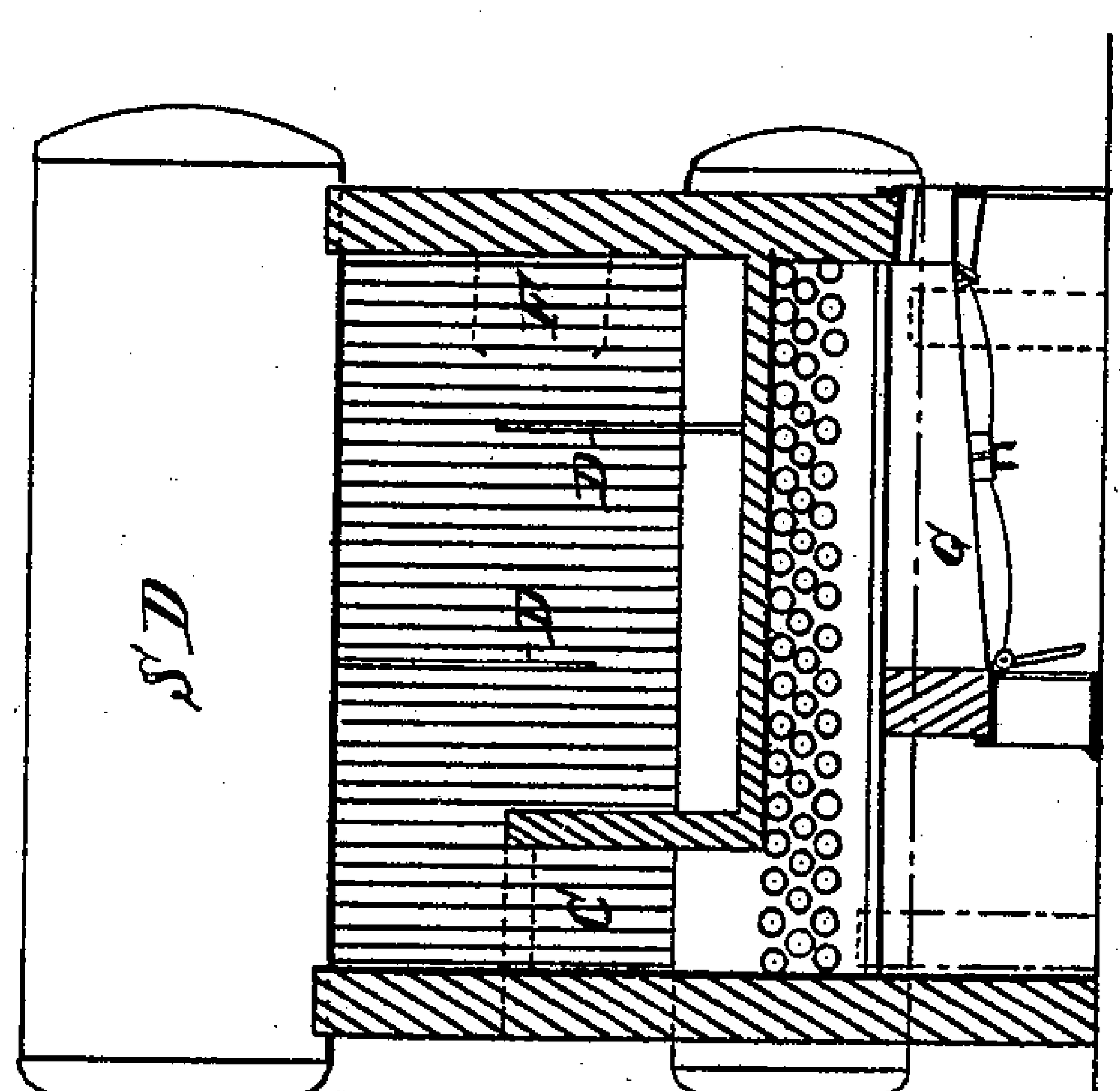


Fig. 1



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig 4

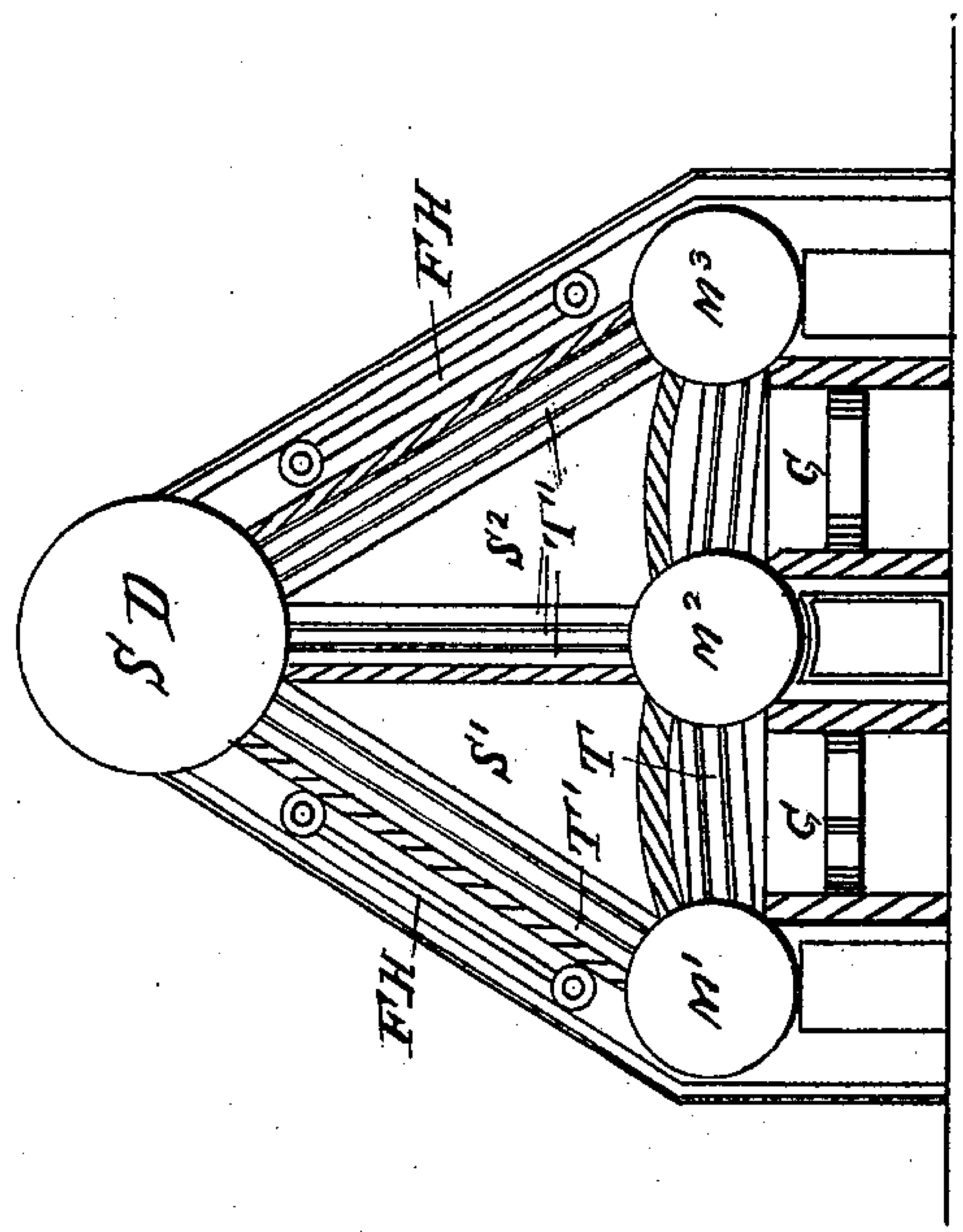

Fig. 3

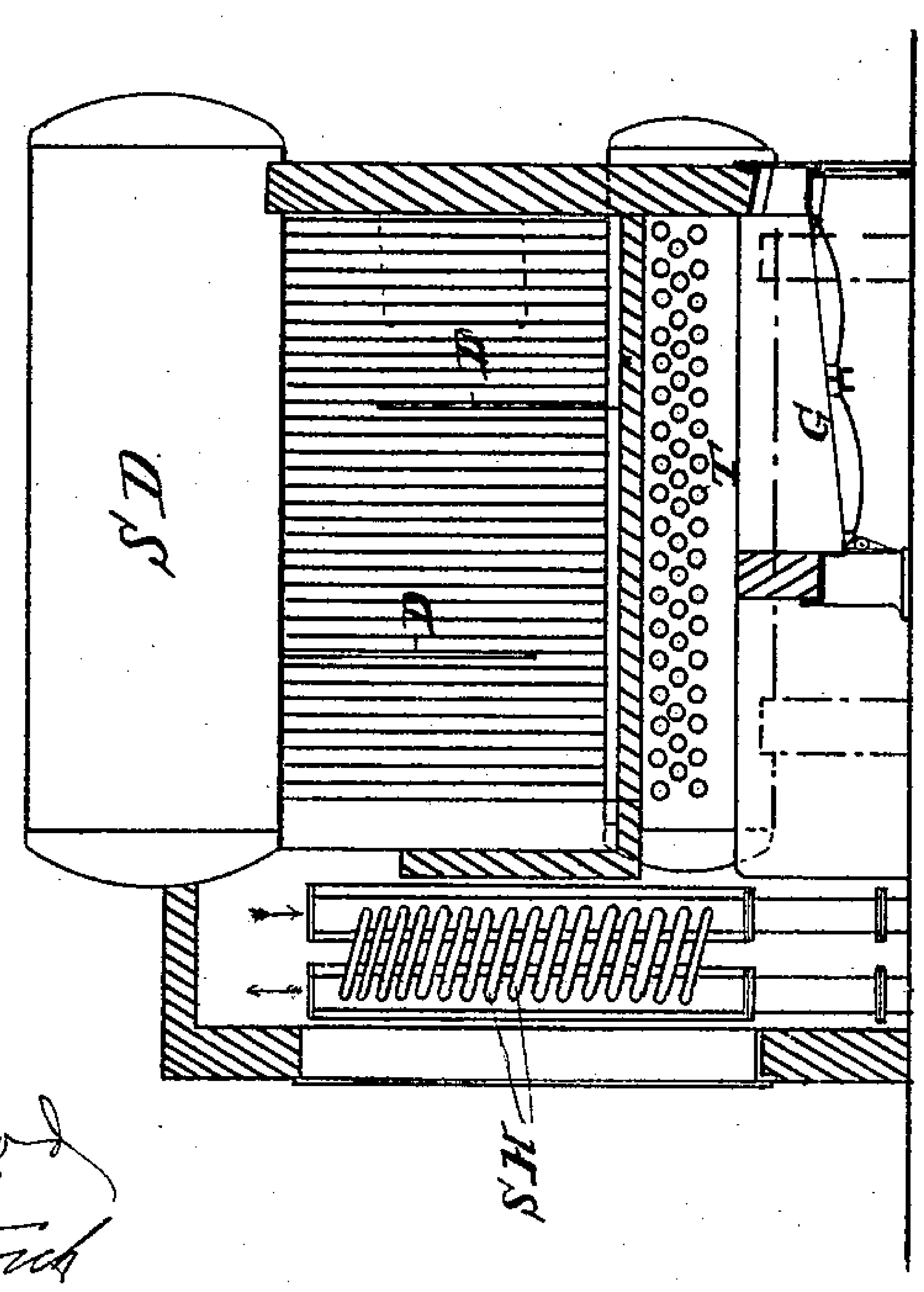

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Fig. 6.

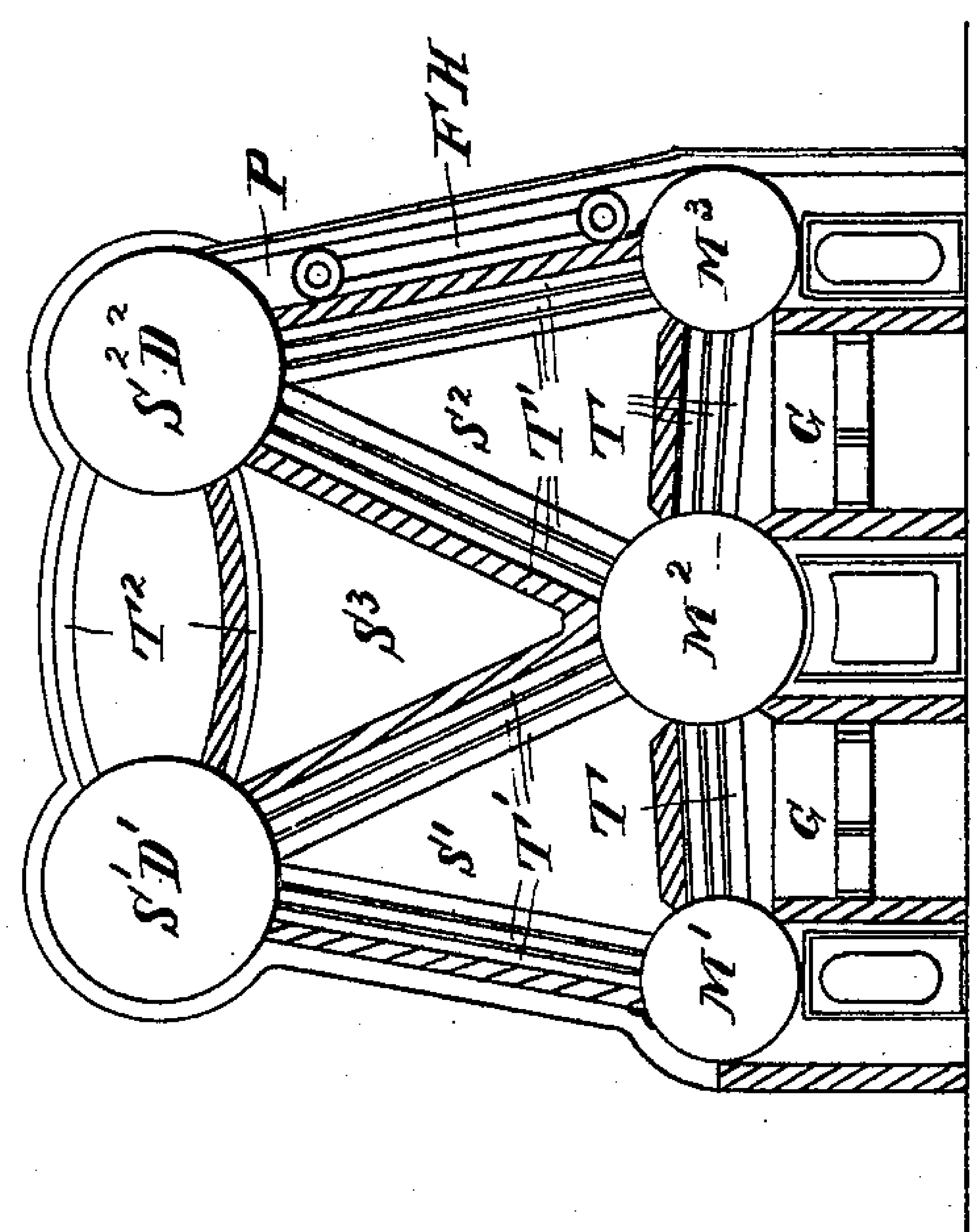
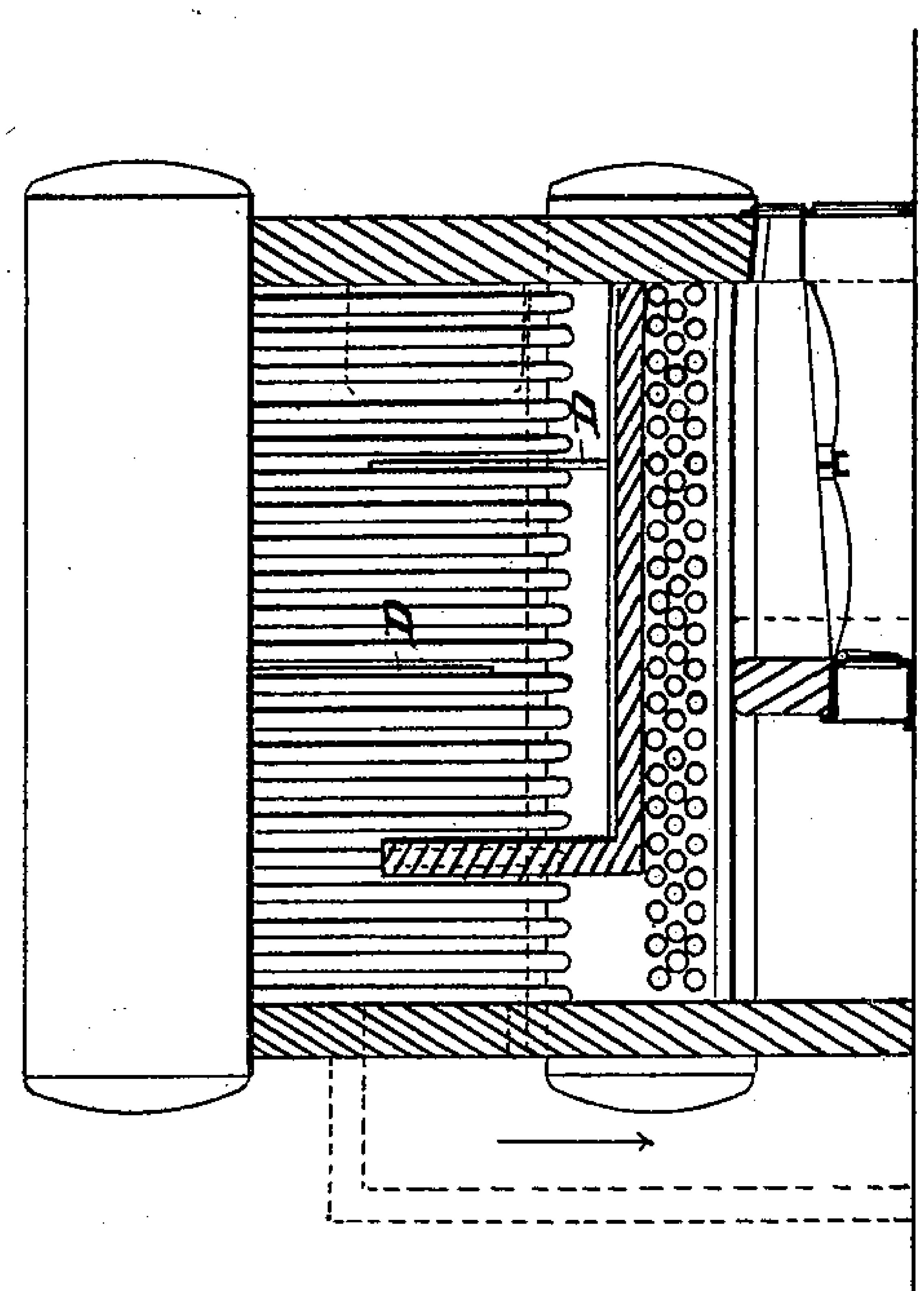


Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

Fig. 8.

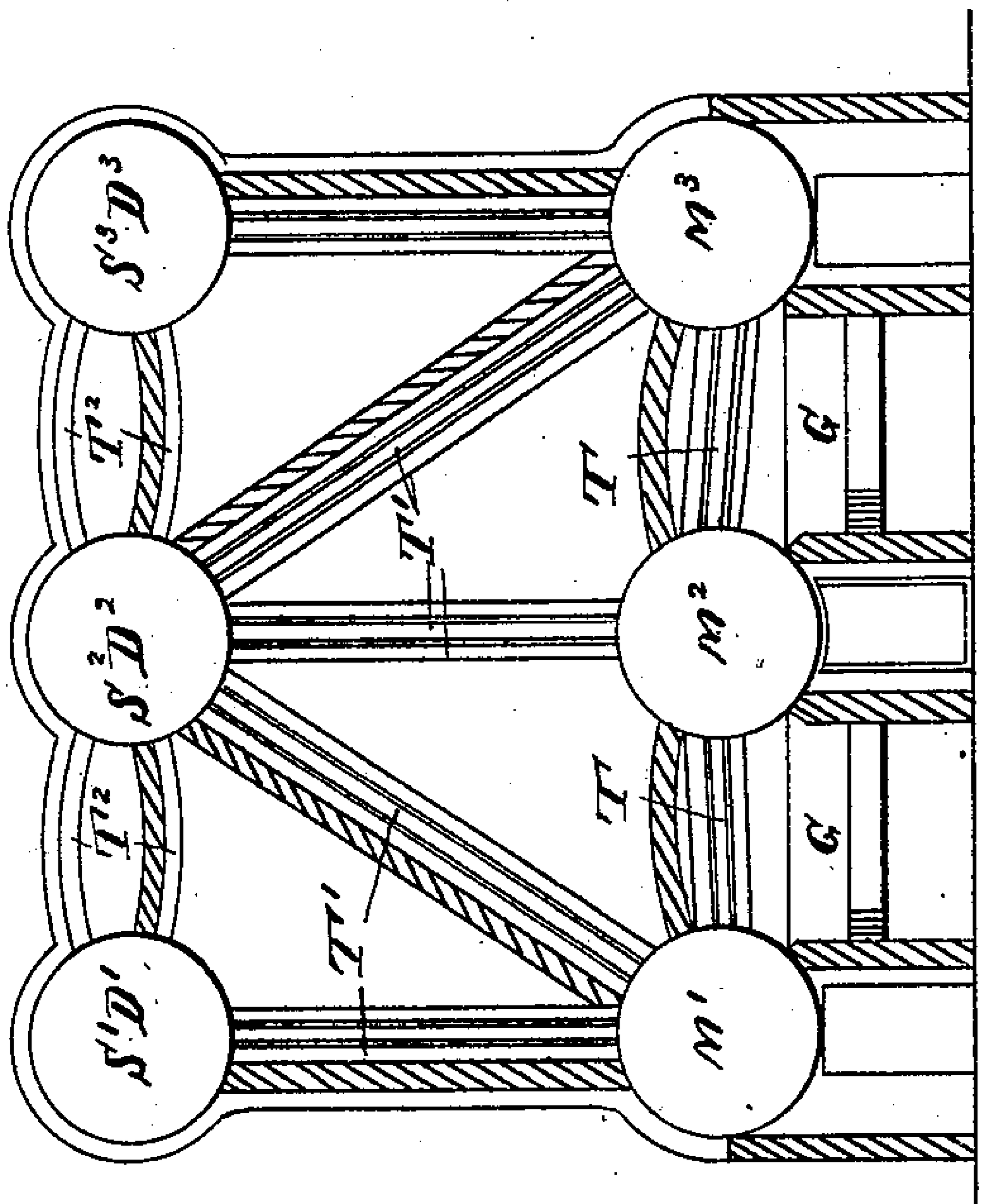
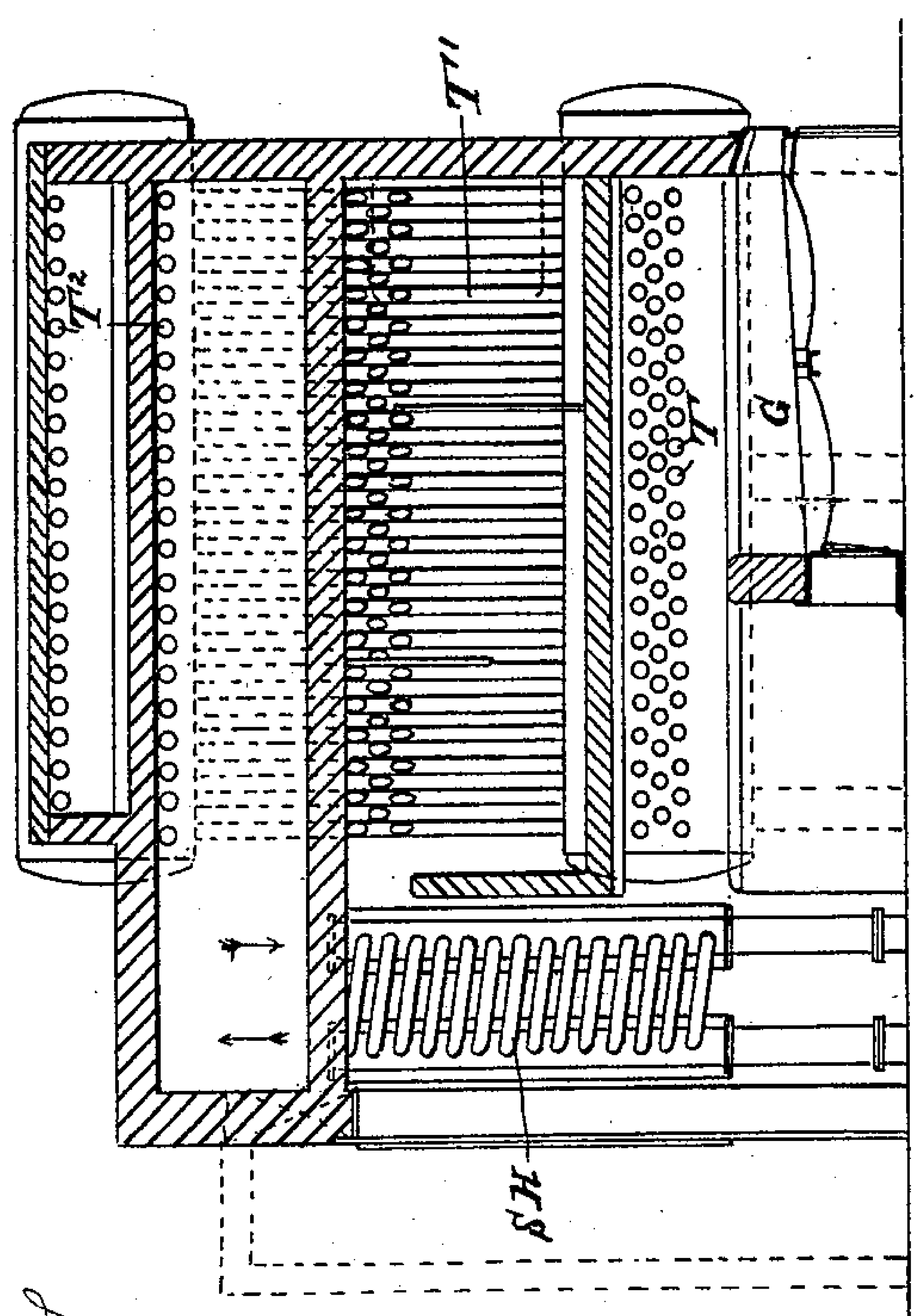


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM EDGAR BERRY, OF MANCHESTER, ENGLAND.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 620,408, dated February 28, 1899.

Application filed December 30, 1897. Serial No. 664,655. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM EDGAR BERRY, a subject of the Queen of the United Kingdom of Great Britain and Ireland, residing at 172 Great Clowes street, Higher Broughton, Manchester, England, have invented an Improved Water-Tube Boiler, (patented in Great Britain and Ireland January 27, 1897, No. 2,186,) of which the following is a specification.

This invention relates to an improved water-tube boiler; but in order that my said invention may be more readily understood and easily carried into effect I will proceed to describe the same with reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation; Fig. 2, a sectional end elevation. Figs. 3 and 4 are similar views of the boiler, but having the mud-drums all of the same or nearly the same diameters and the addition of a superheater and feed-water heater. Figs. 5 and 6 are similar views of a modification, and Figs. 7 and 8 are similar views of a further modification.

Referring to Figs. 1 and 2 of the said drawings, the boiler is composed, fundamentally, of three mud-drums M′ M^2 M^3, mounted at some distance apart and connected to each other by one or more rows of tubes T T, preferably straight. These three mud-drums M′ M^2 M^3, which may be of different diameters, are connected to one common steam-drum S D, as shown in Figs. 1 and 2, the connections between the steam and the mud drums being made by tubes T′ T^2, preferably straight. The grates G G, which are two in number, are placed at the proper distance below the tubes T T, connecting to the three mud-drums M′ M^2 M^3, thus overcoming the principal objection to the use of water-tube boilers for marine and land work—viz., the amount of water-storage above the parts immediately exposed to the action of the fires—and at the same time adding to the efficiency of the boiler by taking fuller advantage of the convection currents. The tubes T T by reason of their position are more liable to require replacement than the rest of the tubes in the boiler. Special arrangements are therefore made for replacing them expeditiously. The middle mud-drum M^2 may be made of such a diameter that the tubes T T can be withdrawn into it and replaced from it, access to this mud-drum being provided in the usual way by means of a manhole placed, preferably, in either end of it.

The products of combustion are led from the grates G G among the tubes to the back end of the boiler. Deflectors D D, of suitable material, may be placed, as shown, to obstruct the passage of the gases—*i. e.*, to lengthen the time in which the gases will be in contact with the heating-surfaces. In other cases where economy is a consideration the products of combustion may pass to the back end of the boiler to a small chamber C, Fig. 1, having an opening to one of the spaces S′ S^2, formed by the tubes connecting the three lower drums to the steam-drum S D, so that the gases may pass to the front of the boiler along that space and return to the back end by the other and thence to the chimney. Either space may be used for conveying the gases to the front end of the boiler, depending upon local requirements, suitable brickwork being erected for this purpose. The intercepting tubes or deflectors will also be used with this form of draft.

The first method or direct draft and the second method or wheel draft may be combined by placing suitable dampers so that either method may be used at will to suit the requirements of steam-raising.

The chief losses in water-tube boilers are those due to radiation and in the escape of gases at a comparatively high temperature to the chimney or funnel. A superheater S H, Figs. 3 and 4, is provided to reduce the former. The radiant heat may be further absorbed by providing a sheet-metal covering to the boiler, as shown on the left-hand portion of sectional end elevation, Fig. 2. The whole of the passage P, which might be provided on the other side of the boiler as well, is utilized for the heating of the air supplied to the furnaces. In Figs. 3, 4, 5, and 6 only part of the space provided is used, while to reduce the temperature of escaping gases feed-heaters F H, Figs. 3, 4, 5, and 6, may be fitted.

As a modification the boiler may consist, as shown in Figs. 5 and 6, of three mud-drums M′ M^2 M^3, mounted at some distance apart and connected to each other by one or more rows of tubes T T, preferably straight. The

three mud-drums M′ M^2 M^3 are connected to two steam-drums S′ D′ S^2 D^2. The connections between the steam and the mud drums are made by tubes T′ T′, preferably straight, while the steam-drums are connected together both on the steam and water sides by tubes T^2 T^2. The mud-drums may be made all of one size or of different sizes, as fully set forth with regard to Figs. 1 to 4. The draft may also be arranged on the same principle as therein described on the direct and also on the wheel draft system, in which case the gases may be brought to the front of the boiler by the spaces S′ S^2 and returned to the back by the central space S^3, or vice versa, or on the combination method, while a superheater and feed-water may be applied to reduce the losses previously described. The air supplied to the furnaces may be also heated, as previously described.

A further modification of my improved water-tube boiler consists of three mud-drums M′ M^2 M^3, as shown in Figs. 7 and 8, mounted as previously described and connected with tubes to three steam-drums S′ D′ D^2 S^2 S^3 D^3, these steam-drums being connected together by one or more rows of tubes on the steam sides and water sides. The mud-drums M′ M^2 M^3 may be all of one size or of different sizes, as before. The draft may be arranged on the system first described, and a superheater, feed-water heater, and arrangement made for the heating of the air may also be applied, if desired.

I claim—

1. In a water-tube boiler or steam-generator, the combination of the mud-drums connected together by a series of tubes and a single steam-drum connected by tubes to each of the mud-drums, the two furnaces in proximity to the cross-tubes between the drums but underneath them and means for conducting the furnace-gases between the tubes, substantially as described and for the purpose set forth.

2. A water-tube boiler consisting essentially of three mud-drums connected together and to a steam-drum mounted above the mud-drums and coaxial, the furnaces arranged below and between the mud-drums, a steam-superheater, a feed-water heater and provision for heating the air supplied to the furnaces and means for conducting the furnace-gases to the aforesaid tubes and heaters, substantially as described.

3. A water-tube boiler or steam-generator consisting fundamentally of three mud-drums connected together by a series of tubes and further connected by a series of tubes to two steam-drums, these upper drums being further connected on the steam and water sides, the furnaces below the cross-tubes between the mud-drums and means for conducting the furnace-gases past said tubes.

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Witnesses:
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