Maudslay & Field,

Reciprocating Steam Engine,

No. 2,668, Patented June 11, 1842.

Fig. 1

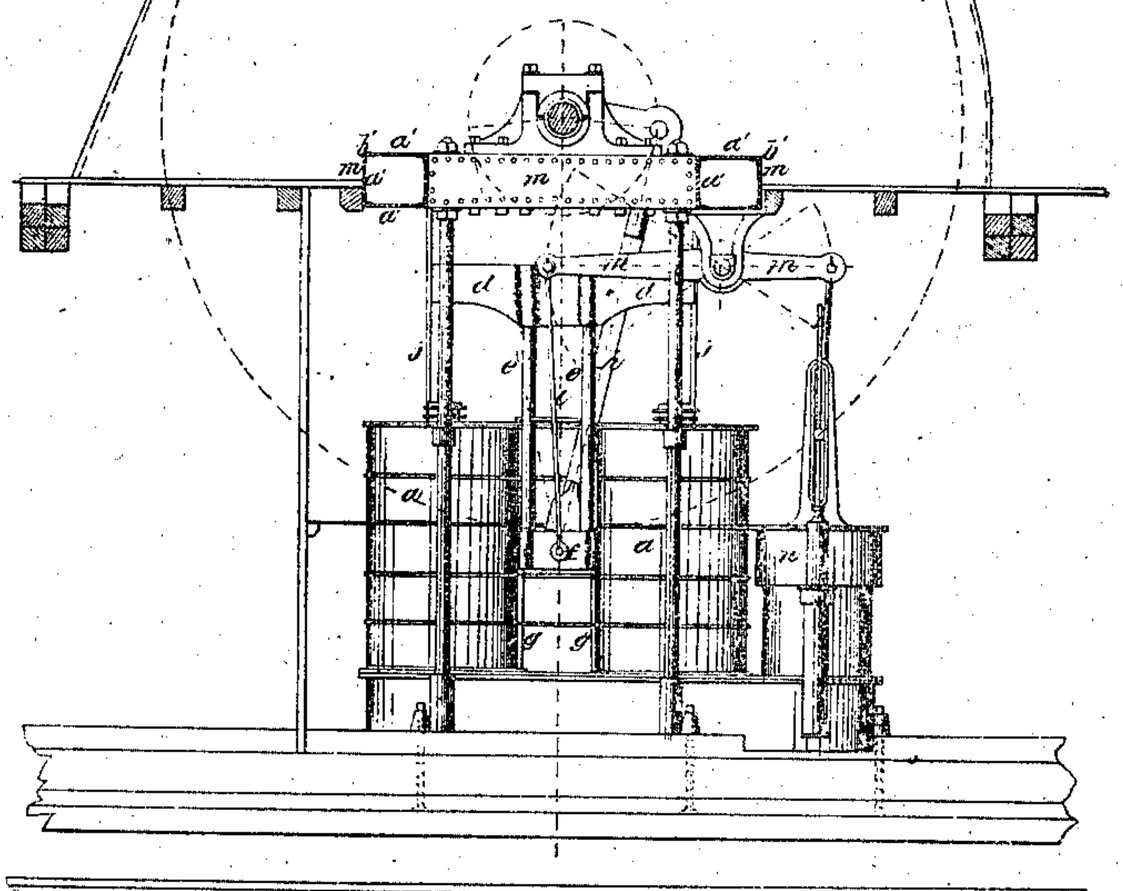
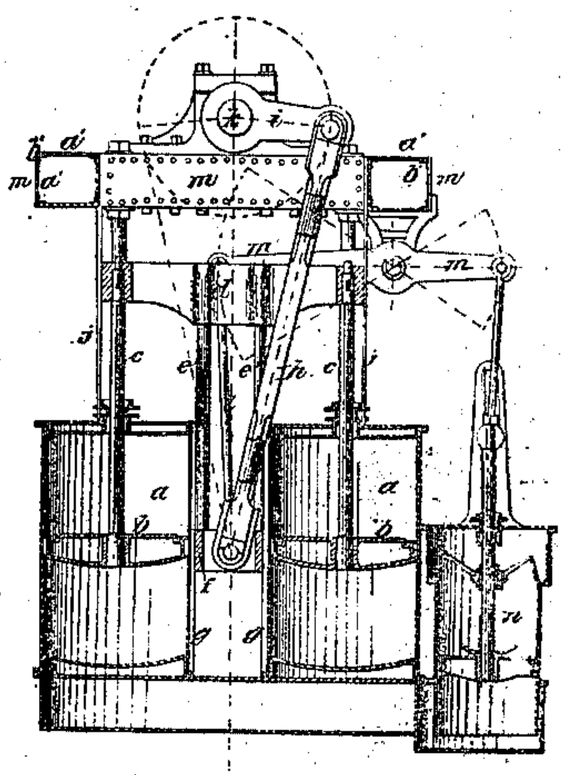


Fig. 2



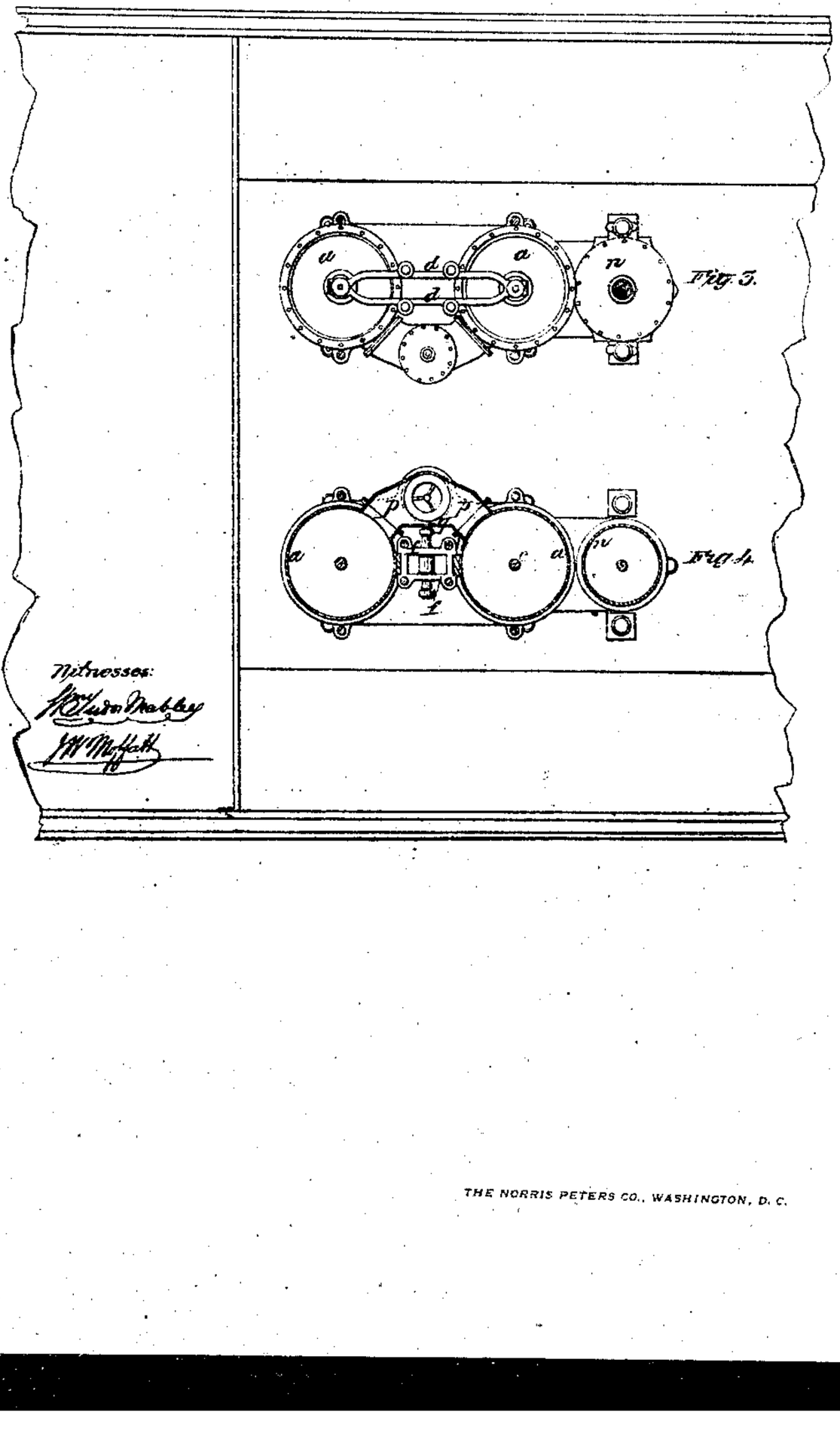


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Fig. 5.

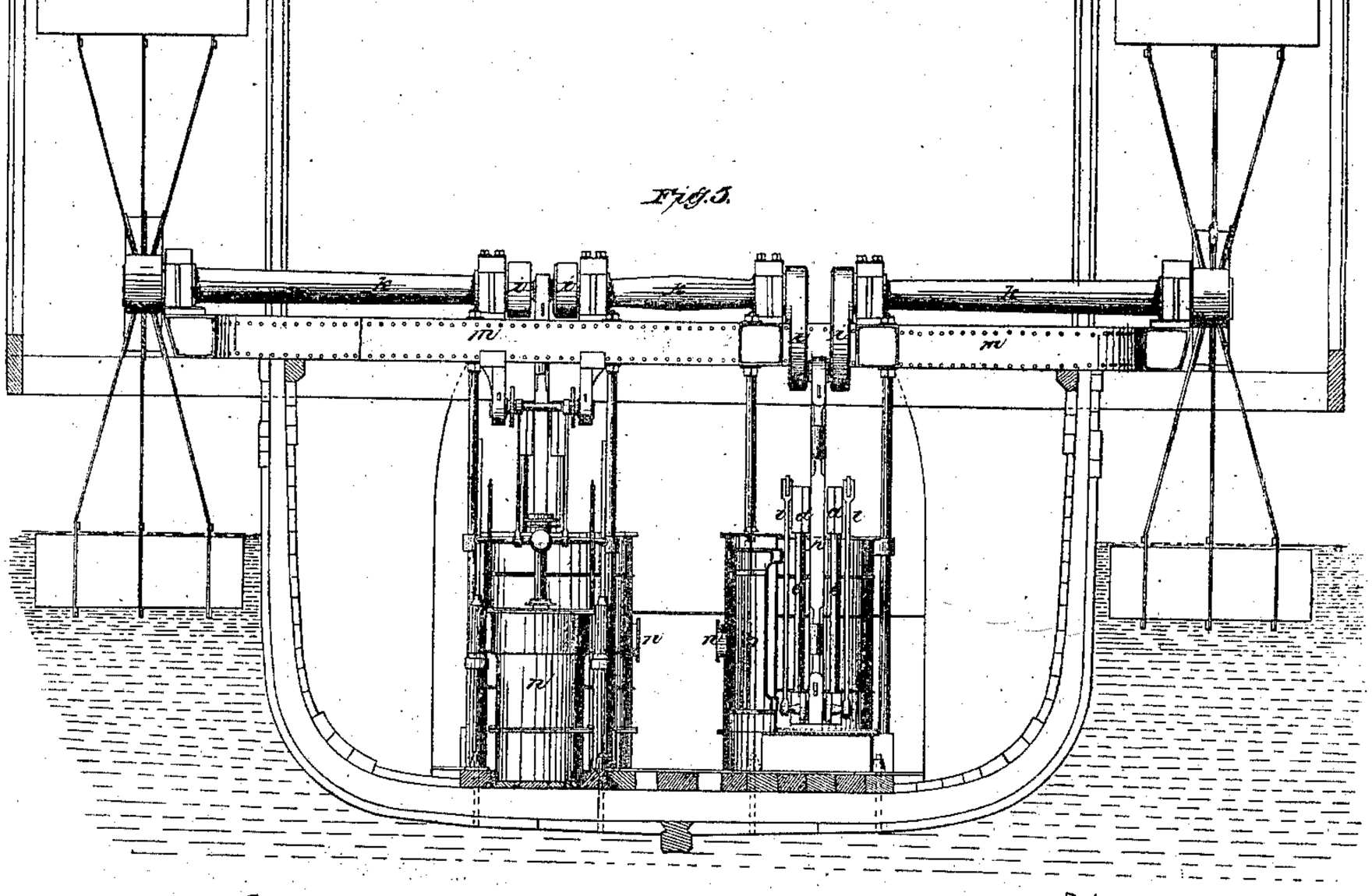

Fig. 6.

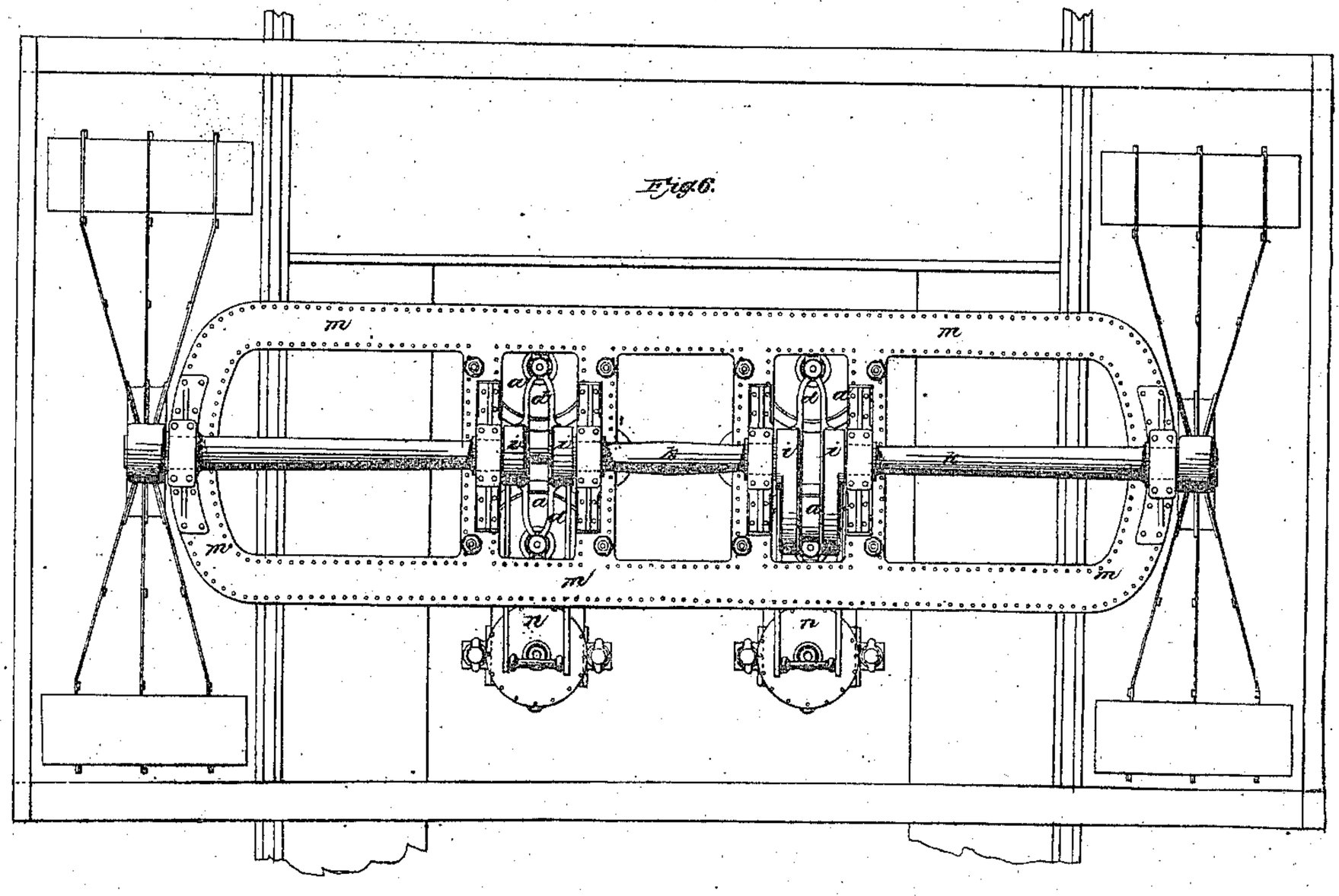

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Fig. 7.

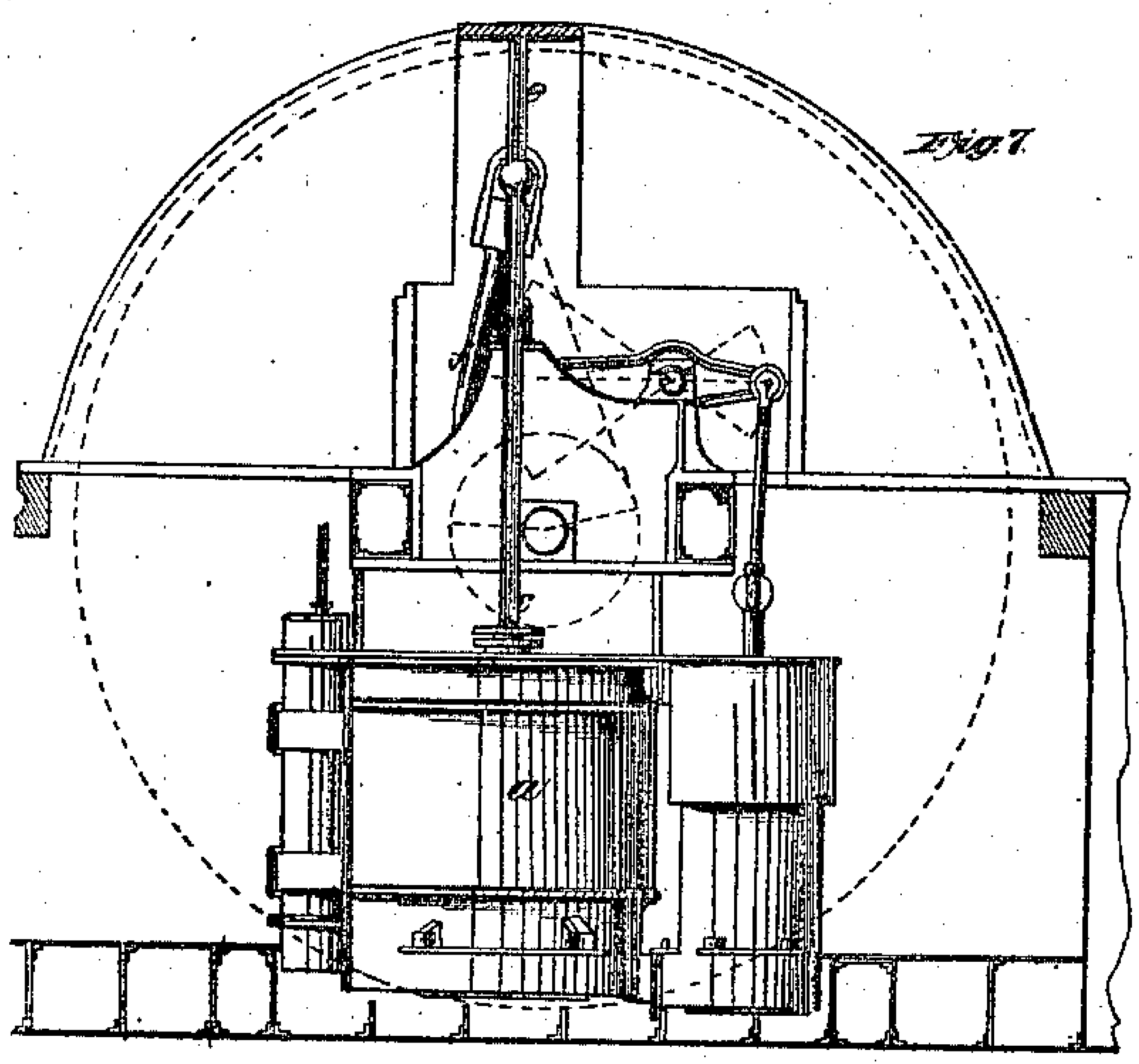


Fig. 8.

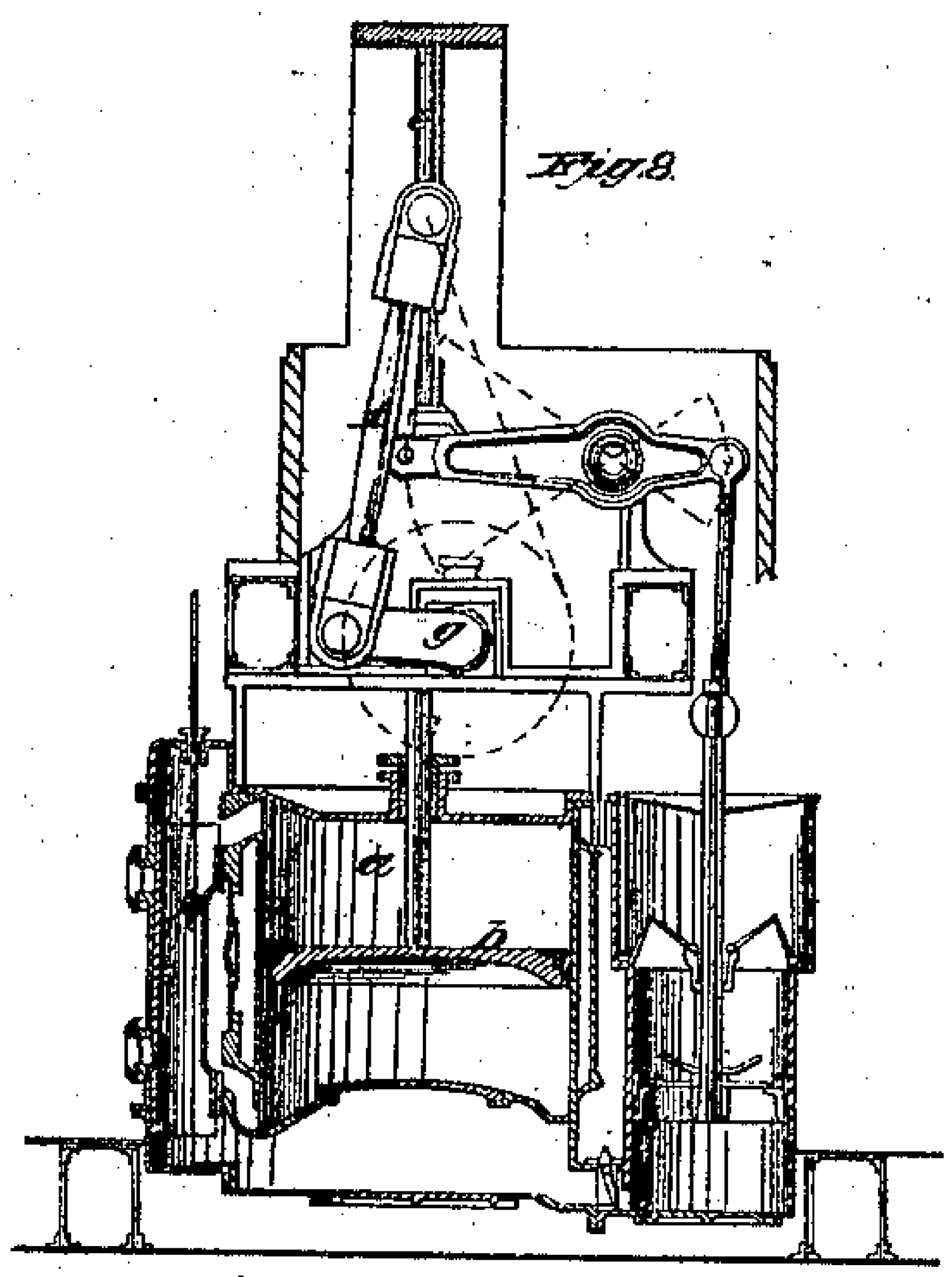
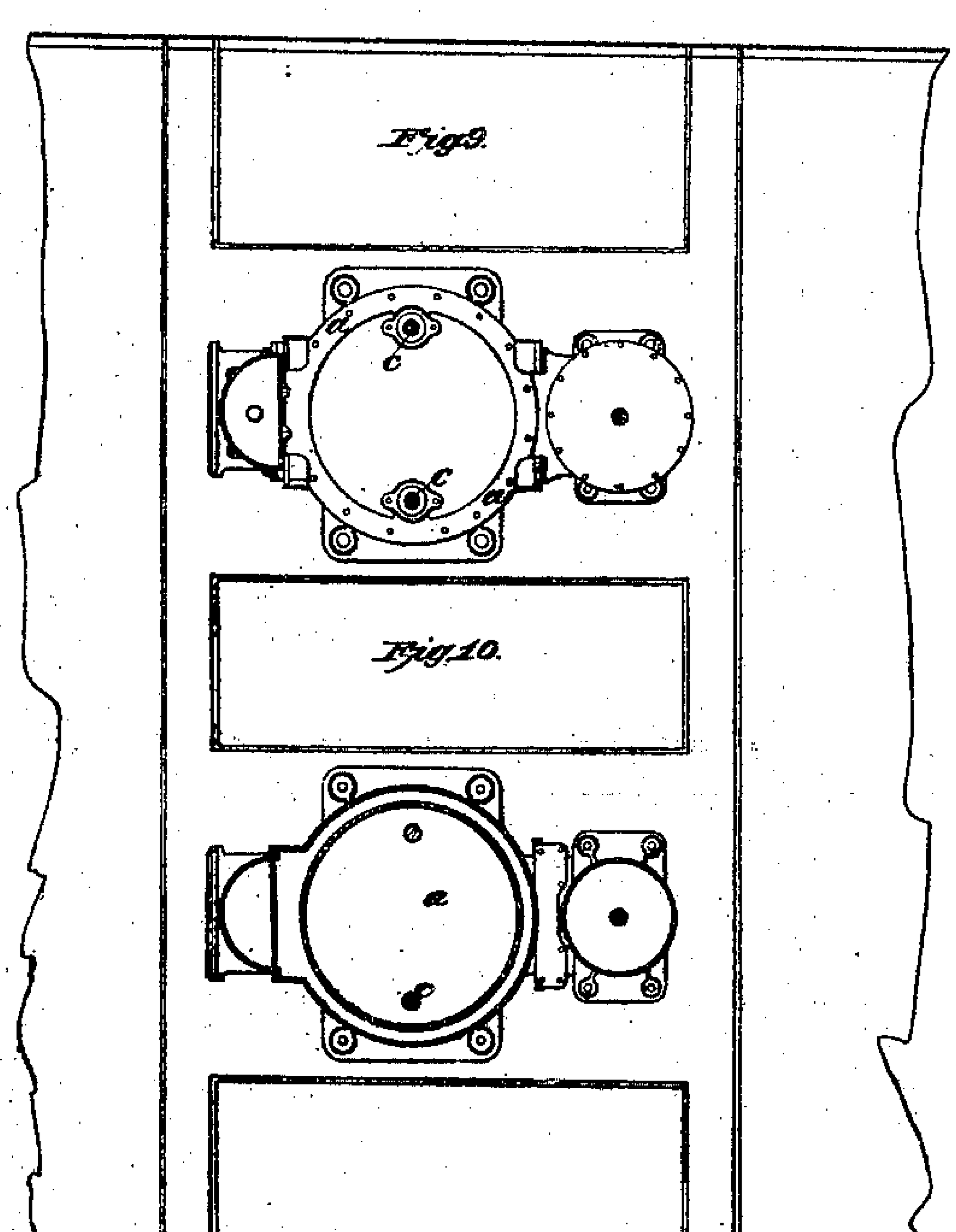


Fig. 9.

Fig. 10.



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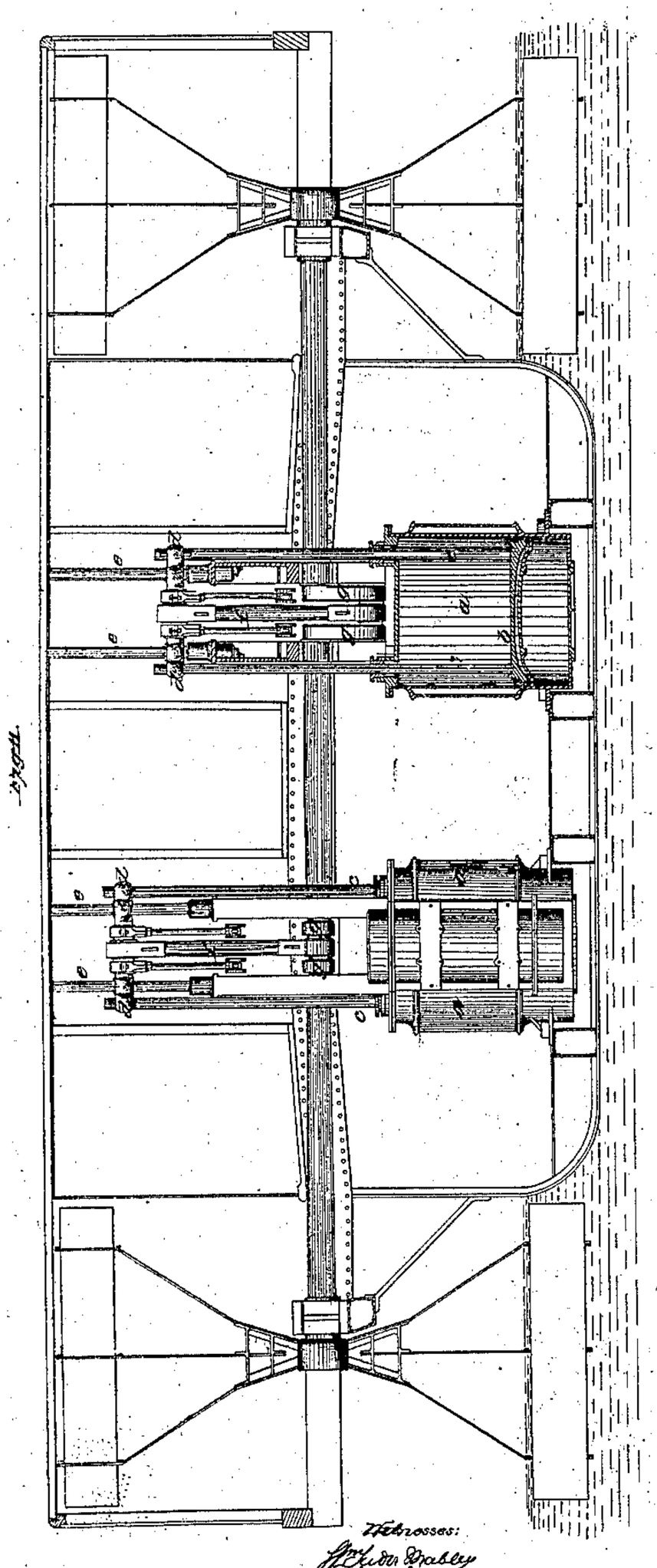

Fig. 1.

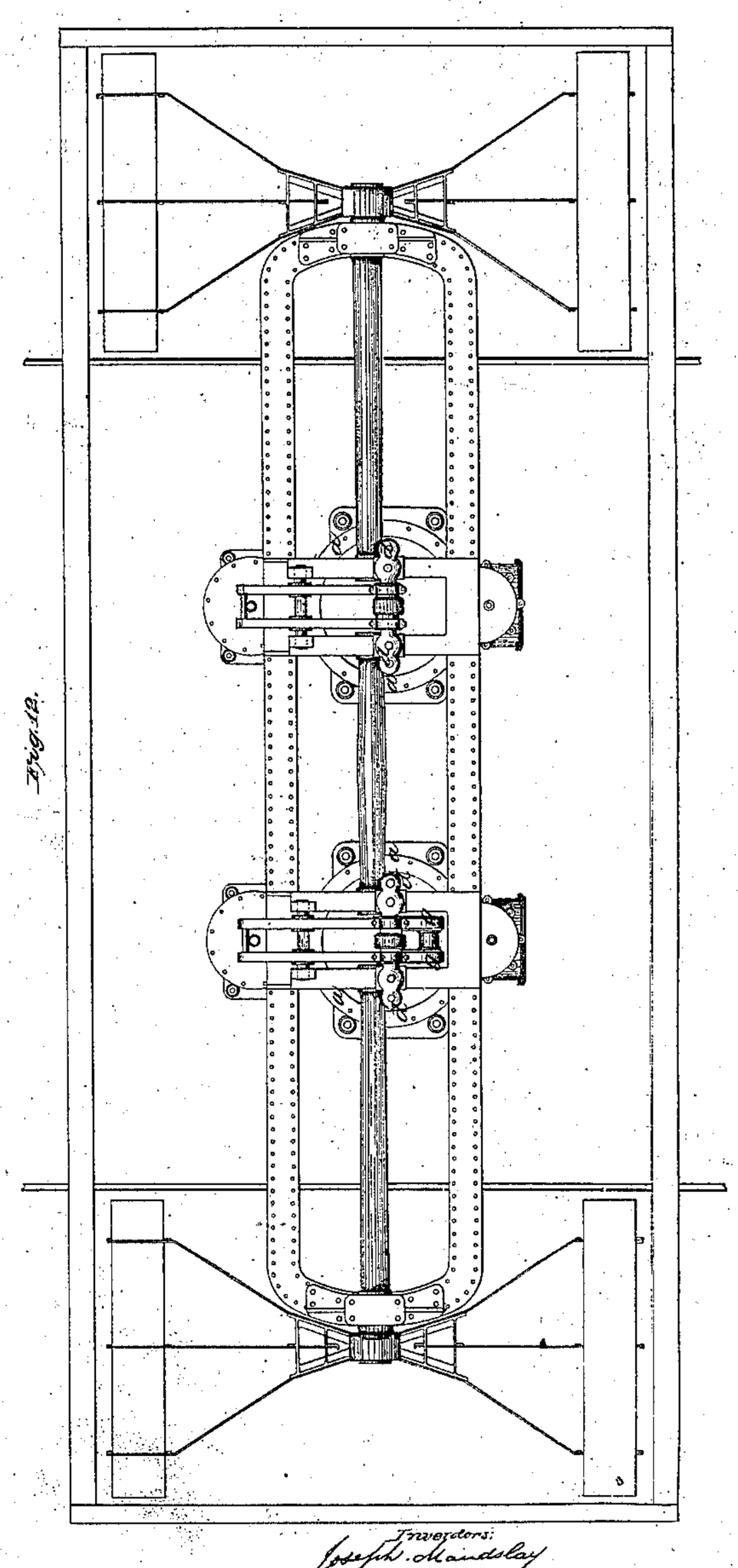

Fig. 2.

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Fig. 16.

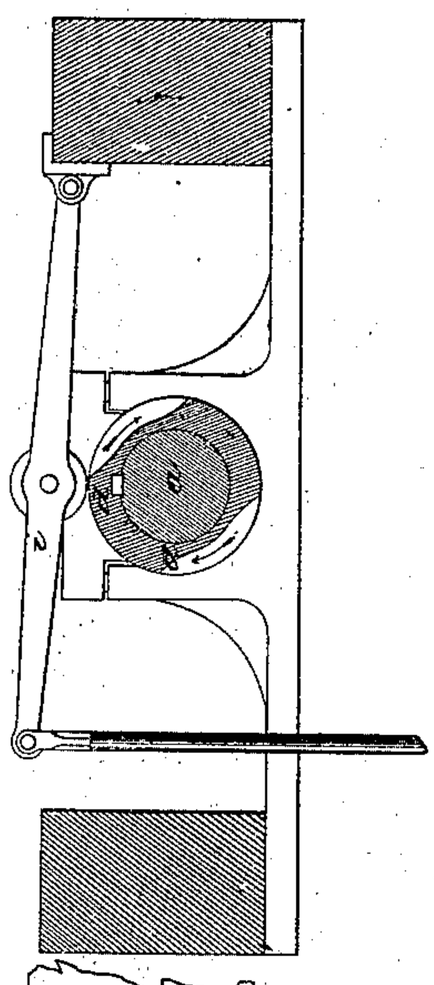


Fig. 15.

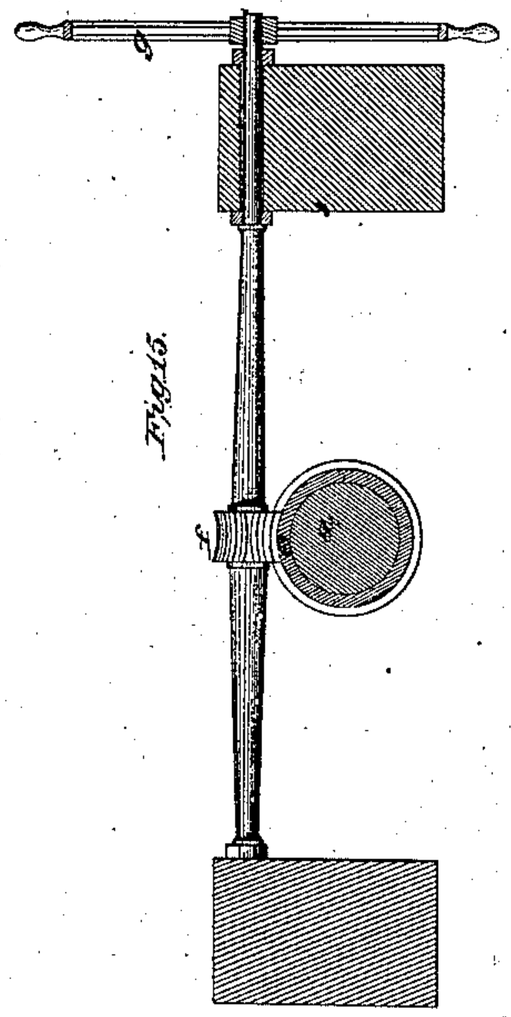


Fig. 17.

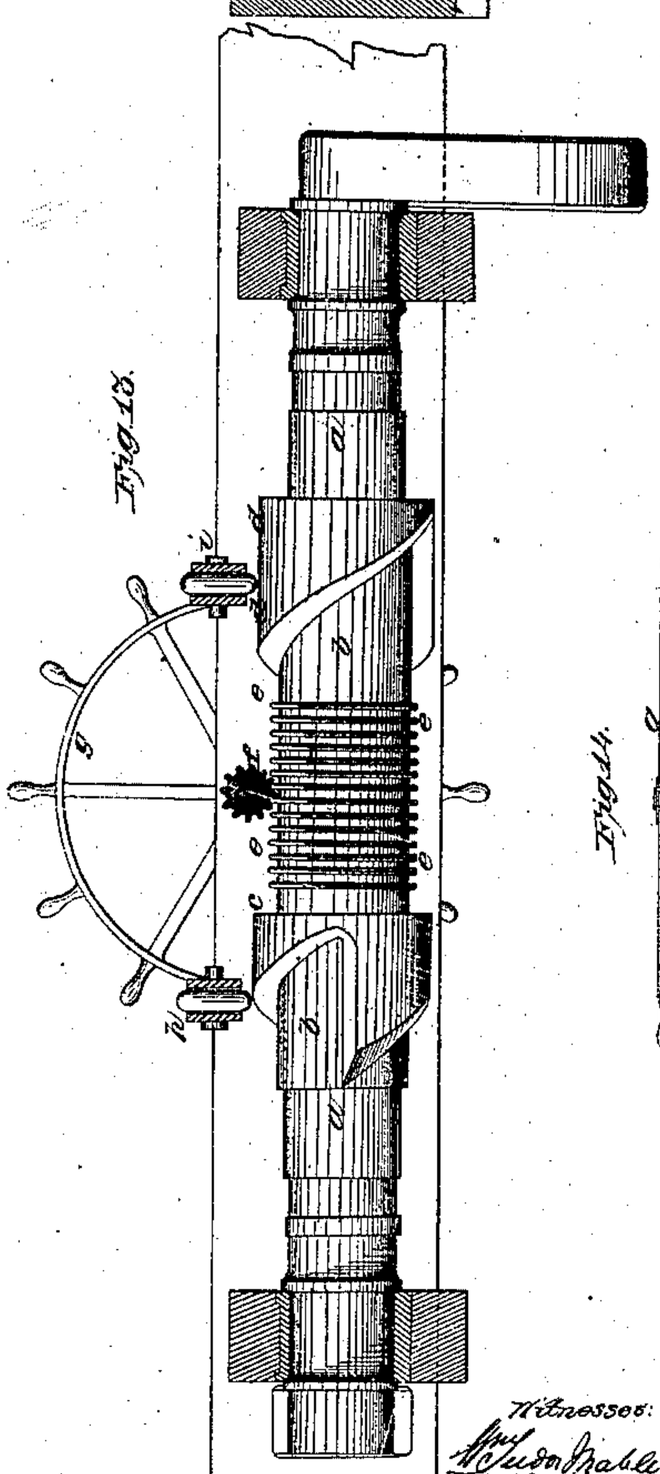
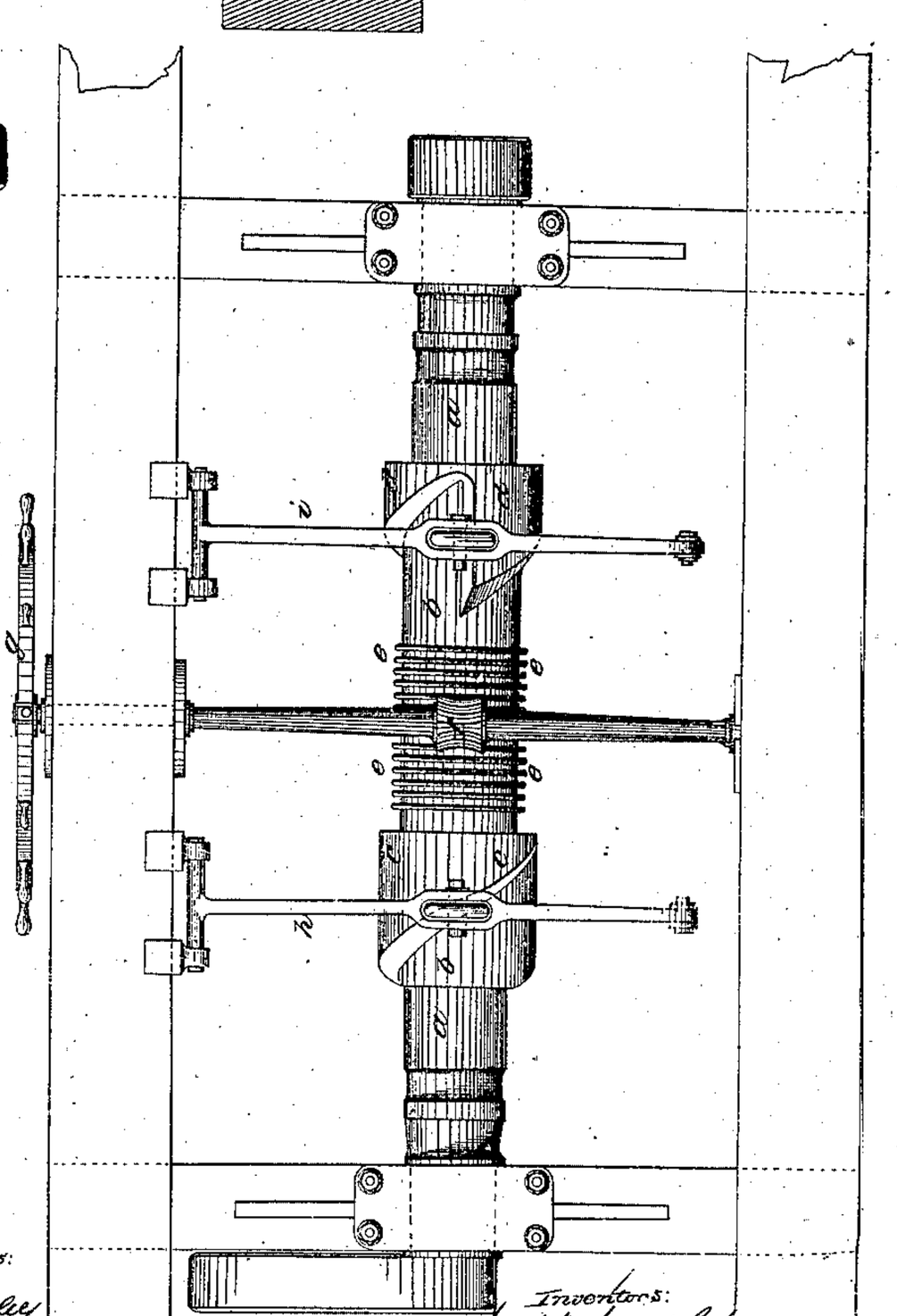


Fig. 14.



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UNITED STATES PATENT OFFICE.

JOSEPH MAUDSLAY AND JOSHUA FIELD, OF LAMBETH, ENGLAND.

CONSTRUCTION OF MARINE STEAM-ENGINES.

Specification of Letters Patent No. 2,668, dated June 11, 1842.

To all whom it may concern:

Be it known that we, JOSEPH MAUDSLAY and JOSHUA FIELD, of the firm of Maudslay Sons and Field, subjects of the Queen of Great Britain, and now residing at Lambeth, in the county of Surrey and Kingdom of England, engineers, have invented or discovered a new and useful Invention of Improvements in the Construction of Marine Steam-Engines which are Particularly Applicable to Steam-Engines of the Largest Class; and we do hereby declare that the following is a full and exact description thereof.

These improvements in the construction of marine steam engines are particularly applicable to those of the larger class and are designed principally for the purpose of producing and applying a greater amount of steam power than has heretofore been available within a given space or area on ship boards. This is effected by different constructions, arrangements and proportions of the parts of low pressure engines allowing a more perfect application of the expansive force of steam without increasing the weight of the whole machinery.

The first feature of our improvements consists in adapting two steam cylinders to one engine in such a way that the steam shall act simultaneously upon both pistons in order that they may be made to rise or fall together; the piston rod of each being attached to one horizontal cross-head and thereby the combined action of both pistons applied to one crank of the paddle shaft.

The second feature of our improvement applies more particularly to engines for river navigation and consists in the adaptation of a piston with two rods working in a steam cylinder of large area both piston rods being connected to one cross-head above, which gives motion to the crank below it by a single connecting rod.

The third feature of our improvement consists of a method of adjusting the expansion valves of combined engines by which the period for shutting off the steam at any part of the stroke may be regulated in both engines at once by a single movement while the engines are working.

The fourth feature of our improvement is the peculiar construction of the main beams of the framing that carry the plumber blocks of the main crank shaft to which the paddle wheels are attached. These beams we form as hollow trunks by the combination of wrought iron plates attached to bars of angle iron in the same way as ordinary boilers are made and we are enabled by that means to construct beams of the largest dimensions of unlimited strength and of comparatively small weight. These improvements will be more fully understood by reference to the accompanying drawings and the following description thereof in which—

Figure 1 is an elevation taken longitudinally representing an engine with two cylinders constructed upon the plan described as the first feature of our improvement. Fig. 2 is a vertical section of the same taken through the cylinders. Fig. 3 is a horizontal section of a vessel in which the situation of the engine shown at Fig. 1 is seen as it would appear when looking upon it from above, and Fig. 4 is a corresponding engine placed at the other side of the vessel but represented in section cut horizontally through the cylinders. Fig. 5 is a vertical section taken transversely through a steam vessel showing the positions of two engines as in Figs. 3 and 4 the one engine being in section the other an external view seen upon a plane in advance of the former, and Fig. 6 is a plan or horizontal view of a portion of the steam vessel with the engines and their appendages and also the framing by which the crank shafts of the paddle wheels are supported, similar letters referring to the same parts of the machinery in all the preceding figures.

The two connected working cylinders are shown at *a a* their pistons at *b b*, and the piston rods at *c c*, the upper ends of which rods are affixed by keys to the cross head *d*, four vertical rods *e*, *e*, *e*, *e*, affixed at top to the cross-head *d*, are connected at bottom to a slider *f* which slider is enabled to move up and down on the guide ribs *g*, *g*, formed on the outer surfaces of the cylinders. To this slider *f*, one end of a connecting rod *h*, is attached, the other end of that rod being attached to the crank *i*, of the propelling shaft. From this arrangement it will be perceived that by the simultaneous ascent and descent of the two pistons *b*, *b*, in their working cylinder *a*, *a*, the rods *c*, *c*, will cause the cross-head *d*, to move perpendicularly up and down between its guide bars *j*, *j*, and in so doing to raise and depress the slide *f*, with the connecting rod *h*, which rod will by that means be made

to give rotary motion to the crank *i*, and thereby cause the paddle wheel shaft *k*, to revolve a rod *l*, connected to the slide *f*, will at the same time work the lever *m*, to which the rods of the air pump *n*, is attached.

The mode of adopting the steam valve of the combined cylinders *a*, *a*, is best seen in Figs. 3 and 4. The steam is admitted to and withdrawn from these cylinders by one slide valve *o*, Fig. 5, common to both through a pipe *n*, seen in Fig. 5. From this pipe *n*, the steam proceeds through a slide valve *o*, of the ordinary construction and through the curved passages or tubes *p*, *p*, into both cylinders. There is also a narrow passage of communication always open at *q*, by which the steam is allowed to pass from one cylinder to the other for the purpose of keeping the pressure equal at all times in both cylinders.

The expansion valve is on the steam pipe *n*, at the entrance to the slide valve. The slide is moved by an eccentric in the ordinary way; and the expansion valve is regulated by the means described hereafter under the third feature of our invention.

The advantages proposed by this arrangement are simplicity of construction, more direct action on the crank, saving of space and weight of material offering easy means of giving larger area of cylinder whereby a given amount of steam can be used more expansively than in former arrangements and consequently yield more power and economize fuel; with the further advantage at sea that when the engine is reduced in the number of its strokes by deep lading with coal as at the commencement of a voyage, or by head winds more steam may then be given the cylinders and under such circumstances more speed to the vessel, all the steam generated in the boiler being usefully applied.

The second feature of our invention (viz.) the improved construction of steam engine having two piston rods working in one cylinder is represented in the accompanying drawings at Figs. 7, 8, 9, 10, 11, and 12. Fig. 7 is an elevation of the engine Fig. 8 a section of the same taken vertically through the cylinder to the slide valve and the air pump. Fig. 9 is a horizontal view of the top of the cylinder valve box and air pump of these improved engines and Fig. 10 is a horizontal section taken through the cylinder of a similar engine on the other side of the vessel. Fig. 11 is a section taken transversely through a steam vessel showing the positions in elevation of the two engines mentioned in the preceding figures, the cylinder of one being in vertical section the other an external view taken upon a plane in advance of the former with the crank shaft and paddle wheels and Fig. 12 is a horizontal view as seen from above of the two engines and their appendages, the same letters of reference pointing out similar parts of the machinery in all the six last mentioned figures.

The cylinders of large area are shown at *a*, *a*, and *b*, are their pistons *c*, *c*, are two perpendicular rods inserted into each piston and working through stuffing boxes in the lid of the cylinder *d*, is a cross-head to which the two piston rods are keyed at top and *e*, *e*, are the guide rods fixed on cast iron supports upon which rods the cross-head *d*, slides up and down. The connecting rod *f*, is attached above the cross-head and below to the crank *g*, *g*, on the paddle shaft. The other parts of the engines will appear so obvious from inspecting the drawings as not to require further description. It will be perceived that by this arrangement of the parts of the engine motion is given to the crank shaft below the cross-head by a single connecting rod.

The advantage resulting from this improvement are that a paddle shaft placed at a given height from the bottom of the vessel will be enabled to receive a longer stroke of the piston than by any other arrangements now in use; a more compact and firm connection of the cylinder with the crank shaft bearings is effected, and a cylinder of much greater diameter may be applied by which the principle of working steam expansively may be more fully carried out and a more direct action of the steam power on the crank obtained with a less weight of materials and a greater economy of space than has heretofore been obtained by any of the arrangements of marine engnies in use.

The third feature of our invention (viz.) the method of adjusting the expansive valves of combined engines will be seen by reference to the drawings Figs. 13, 14, 15 and 16. In these figures 13 represents the central portion of the double crank shaft of a steam vessel with the parts appended by which the above object is effected as they would appear in elevation. Fig. 14 is a horizontal view of the same. Fig. 15 is an elevation taken at the right angles to Fig. 13 above the middle of the shaft which is here shown in section and Fig. 16 is an elevation also at right angles to Fig. 13 showing one of the cams upon the shaft in section by which the lever and rod of the expansion valve is worked, the respective letters referring to the same parts of the machinery in these last mentioned figures.

The central part of a double crank shaft is shown at *a*, *a*, supposed to be adapted to a pair of engines *b*, *b*, is a tube or socket sliding horizontally upon the shaft but prevented from turning upon it by a rib on the shaft taking into a long groove on the socket. This tube or socket has two snail cams *c*,

and *d*, affixed to it or cast upon it and in the center between the cams a series of rings or flutes *e*, *e*, are also formed upon the tube. A spindle placed at right angles to the main crank shaft has a pinion *f*, the teeth of which take into the rings or flutes *e*, *e*, (shown also detached at Fig. 15) and turning this spindle and pinion *f*, (which may be done by a hand wheel *g*,) the tube *b*, *b*, with its snail cams will be slidden upon the main crank shaft to the right or left as may be required.

Upon the periphery of the snail cams *c*, and *d*, the antifriction rollers in the levers *h*, and *i*, are intended to work (as shown also in the detached Fig. 16). The rods from these levers *h*, and *i*, are connected to the expansion valves of the two engines below and hence by the action of the cams *c*, and *d*, against the levers *h*, and *i*, as the main shaft *a*, revolves, the expansion valves are opened and closed.

Let it be supposed that by turning the pinion *f*, the tube or socket *b*, *b*, (seen in Figs. 13 and 14) has been slidden toward the left as far as it will go then as the main shaft revolves the uninterrupted circular periphery of the cams *c*, and *d*, will act against the levers *h*, and *i*, so as to keep them in their elevated positions, consequently the expansion valves will under those circumstances remain open. If however it is desirable to shut off the steam during a part of the rotation of the main shaft we turn the pinion *f*, so as to slide the tube *b*, *b*, with the cams *c*, and *d*, toward the right in Figs. 13 and 14. When this is done only a portion of the periphery of each cam will be enabled to act in holding up the levers; for as the main shaft with the cams revolve the rollers of each lever *h*, or *i*, will when the snail or curved edge of the cam comes under the roller allows the lever to fall and by so doing to close the expansion valve and shut off the steam from the working cylinder until the roller rises again up the opposite edge of the snail and gets on to the larger radius of the cam when the lever will be raised and the expansion valve opened allowing a free passage to the steam. In this way the cams may be slid still farther to the right and cause so small a portion of the larger radius of the cams to act against the levers as to shut off the steam during the greater part of the rotation of the main shaft. By this apparatus we are enabled to regulate the flow of steam into both engines at once by one simple movement of the spindle and pinion and without interrupting for a moment the working of the engines, such a means of adjustment being highly important in bringing into operation the full effect of steam applied upon the expansive principle in economizing fuel and adapting the power of engines to the varying circumstances at sea between light and heavy lading and between strong head wind and scudding before the gale.

The peculiar construction of main beams for supporting the crank shafts mentioned in the fourth feature of our invention are formed by combining long flat plates of rolled iron *a′ a′* which we unite to long bars of iron *b′ b′* turned up at right angles or what is commonly called angle irons the plates are firmly attached to these bars by rows of rivets in the ordinary way of making wrought iron boilers, such beams may be extended to any length and made into any form required and applied as at *m*, *m*, *m*, in Figs. 1, 2, 5, and 6 and the bearing and other parts of the engines may be attached to these beams as shown in the drawings. These beams may be made of unlimited strength and with a comparatively small weight of material.

In conclusion we desire to be understood that the particular features of novelty claimed by us under this patent are:

1. The adaptation of two steam cylinders to one engine in the way above described in order that the steam may act simultaneously in both cylinders and the pistons be made to rise and fall together so that the combined action of both pistons may be applied to one crank on the paddle shaft.

2. The construction and adaptation of a piston with two rods working in one steam cylinder of large area both piston rods being connected to one cross-head above in combination with the described arrangement which gives motion to the crank below by a single connecting rod.

3. The method above described of adjusting the expansion valves of combined engines.

4. The mode of constructing the beams of the framing of steam engines as hollow tubes by the combination of plates connected by bolts or rivets.

In witness whereof we the said JOSEPH MAUDSLAY and JOSHUA FIELD have hereunto set our hands this tenth day of December in the year of our Lord one thousand eight hundred and thirty-nine.

JOSEPH MAUDSLAY.
JOSHUA FIELD.

Witnesses:
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WM. TUDOR MABLY.