

No. 630,024.

Patented Aug. 1, 1899.

C. W. BAKER.
STEAM SEPARATOR.

(Application filed Dec. 29, 1897. Renewed Dec. 19, 1898.)

No Model.)

3 Sheets—Sheet 1.

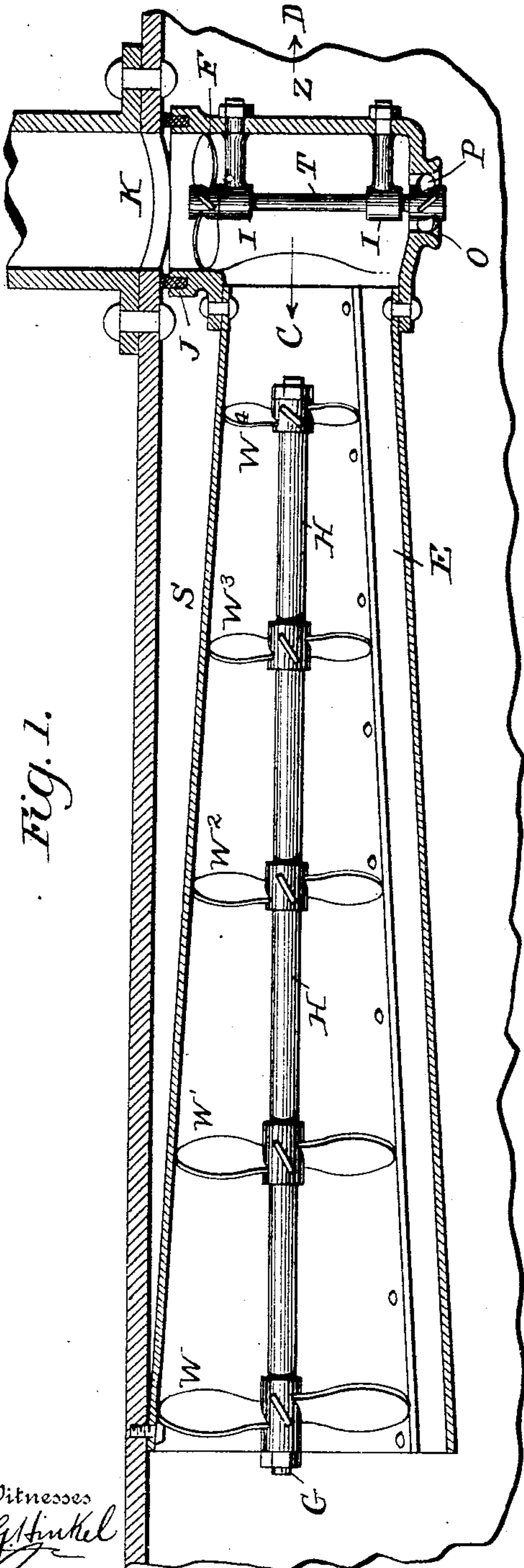


Fig. 1.

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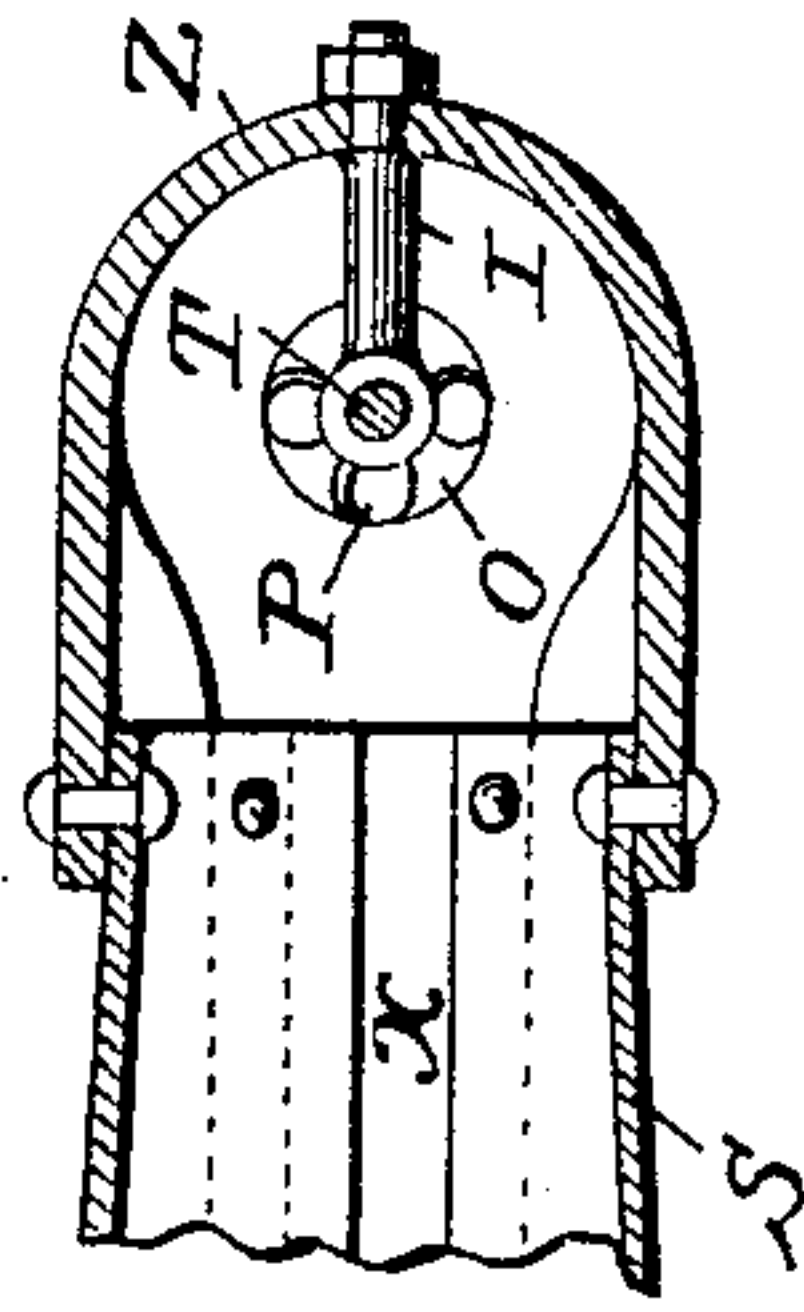


Fig. 3.

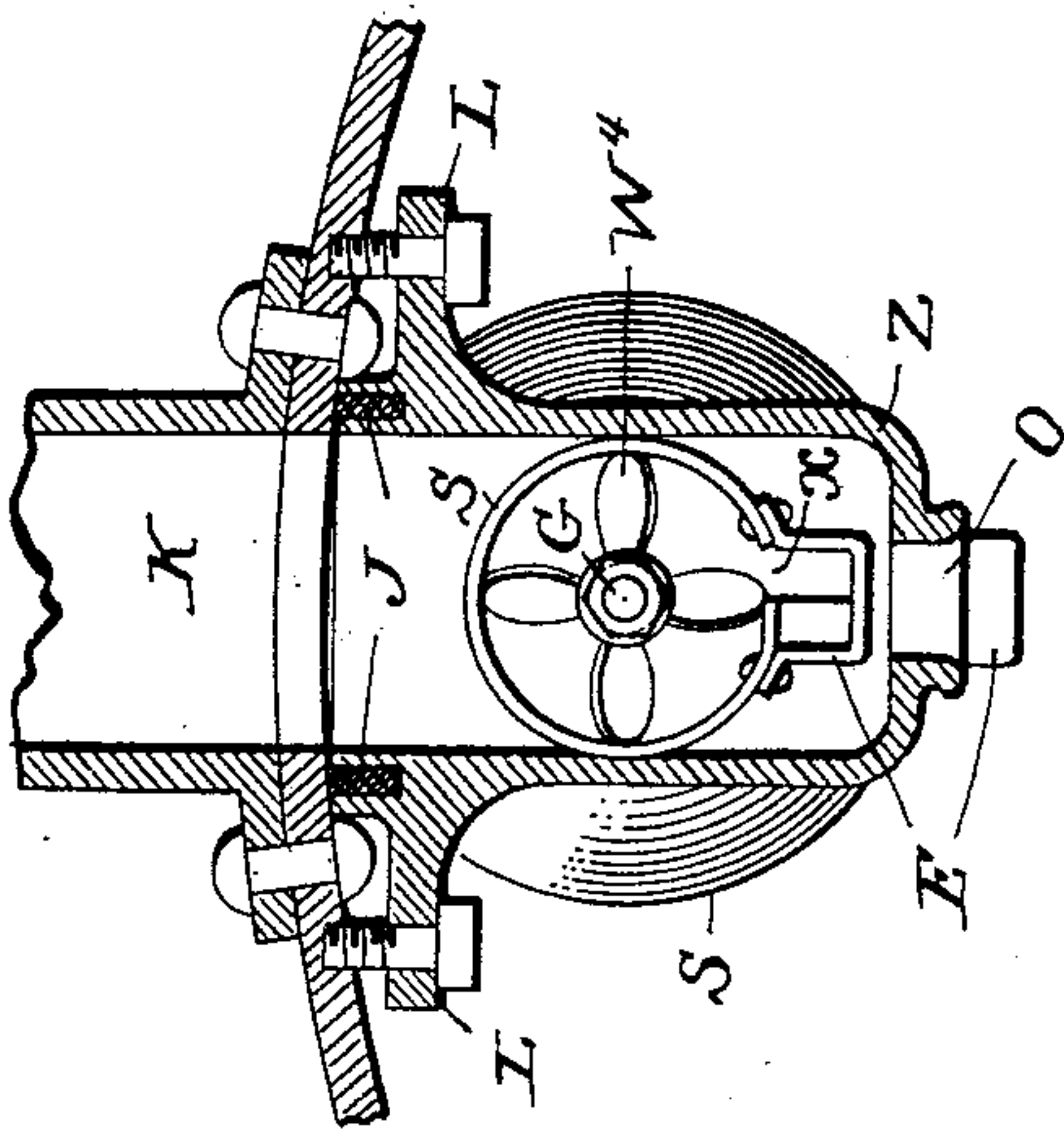


Fig. 2.

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Fig. 4.

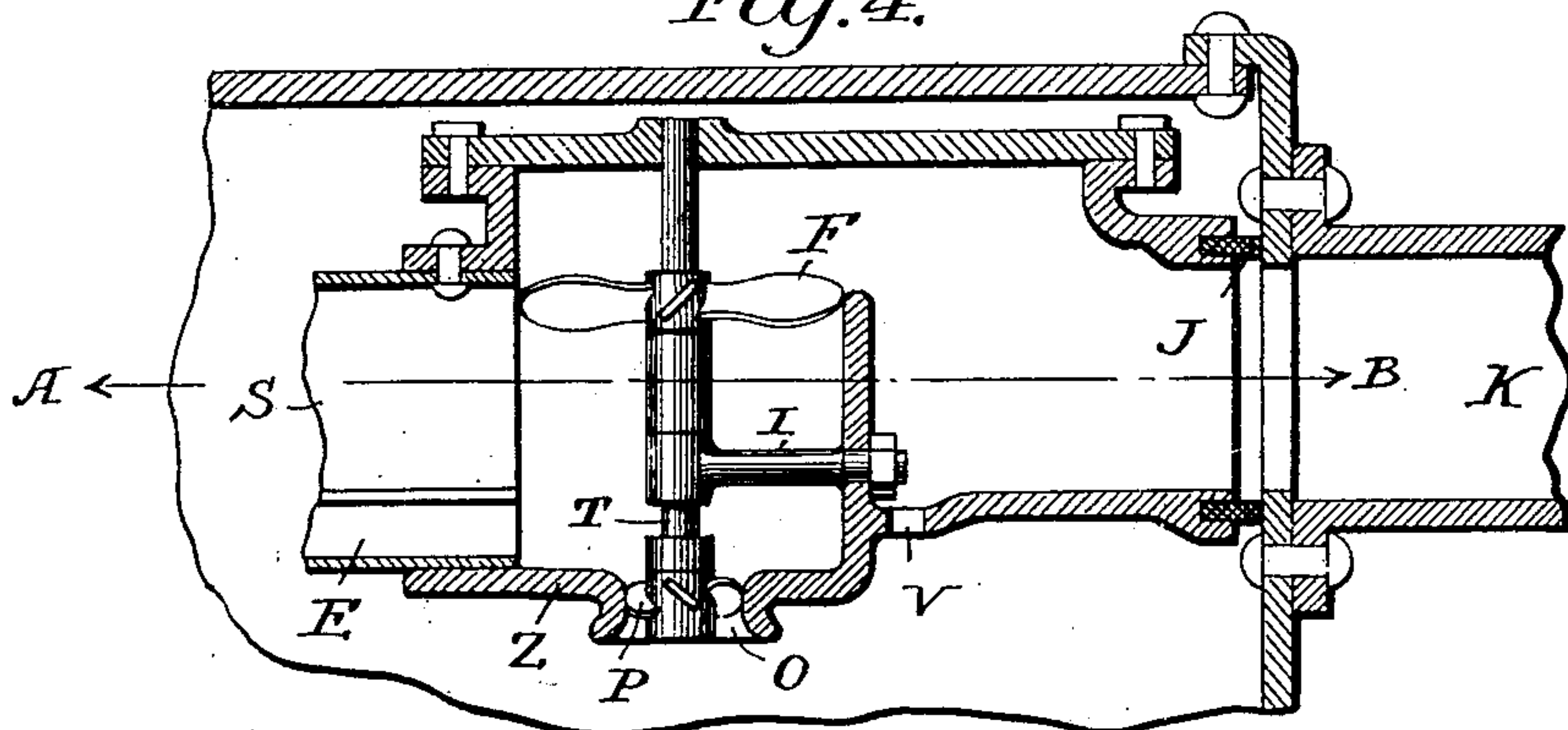


Fig. 5.

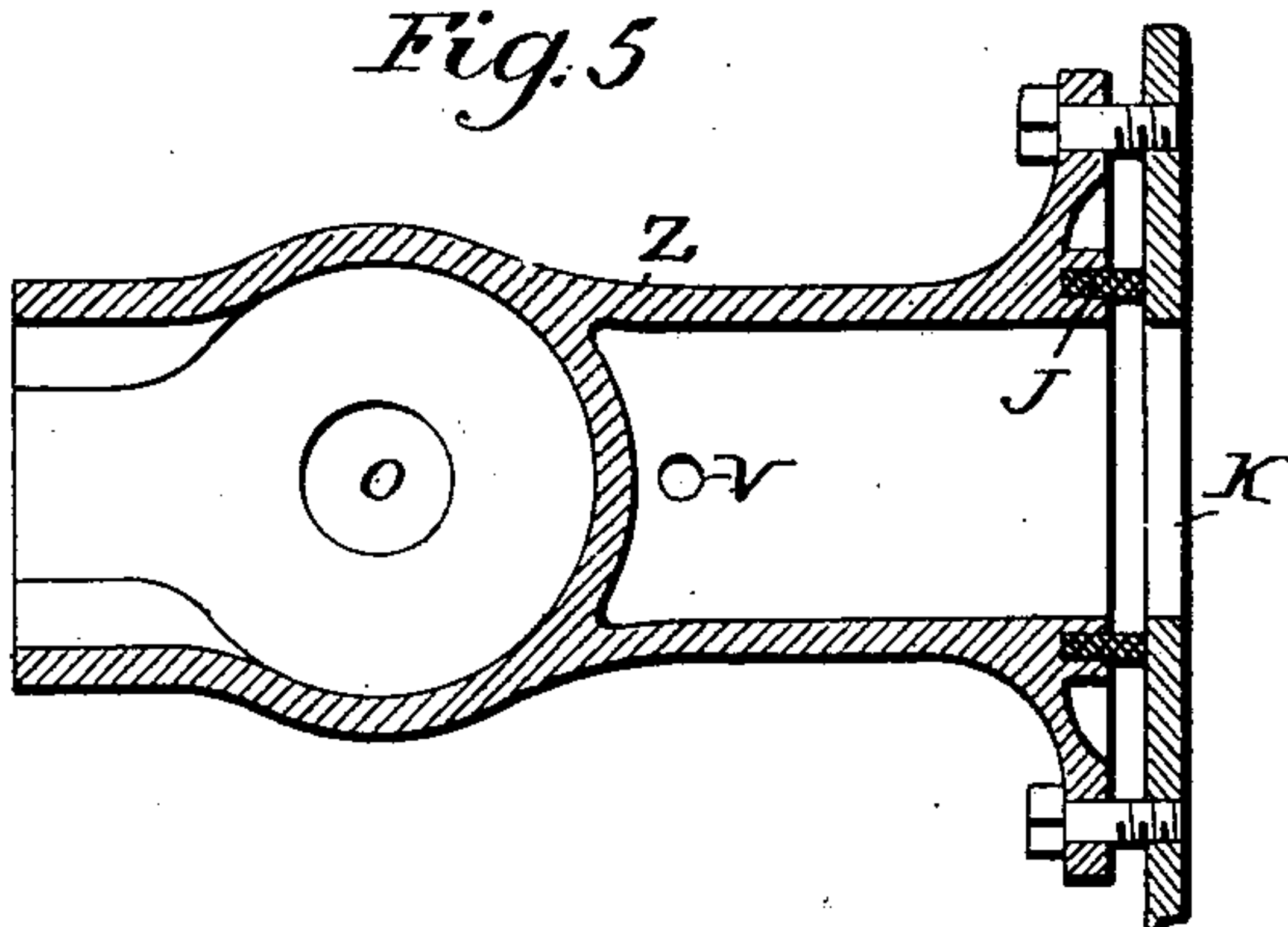


Fig. 9.

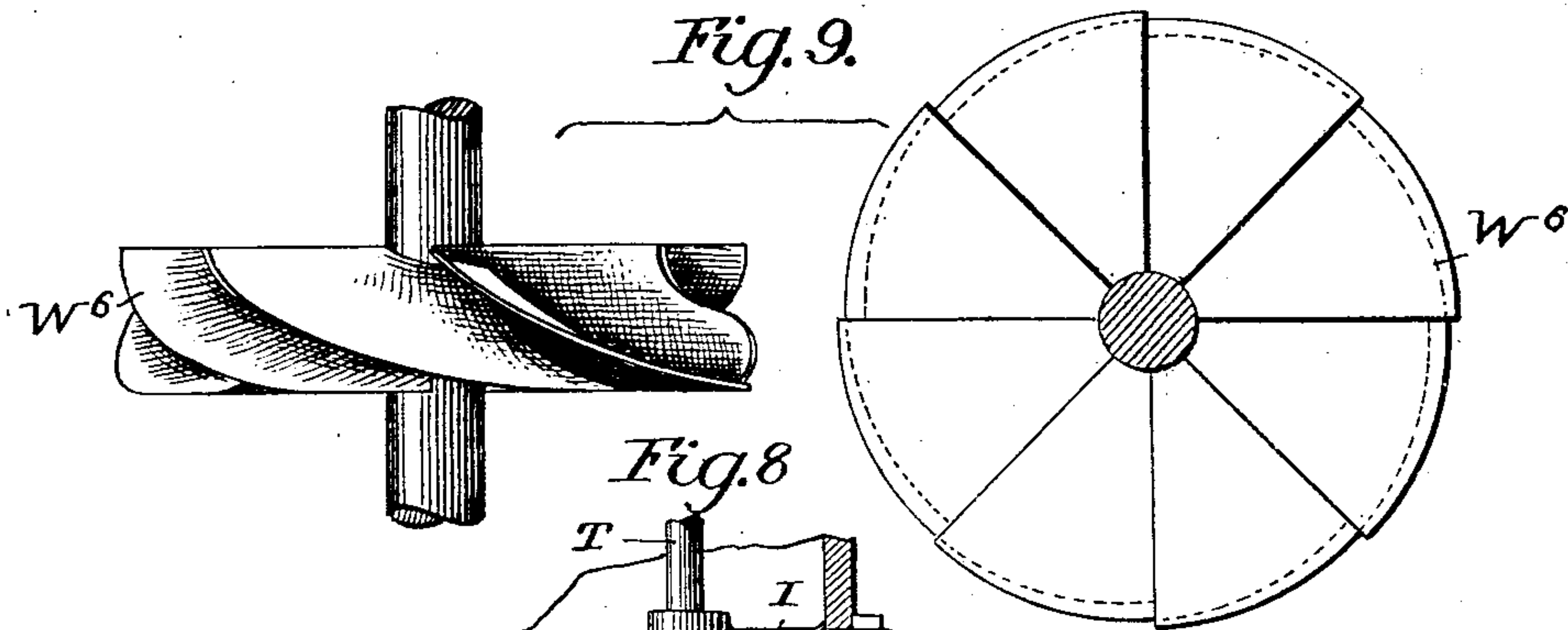
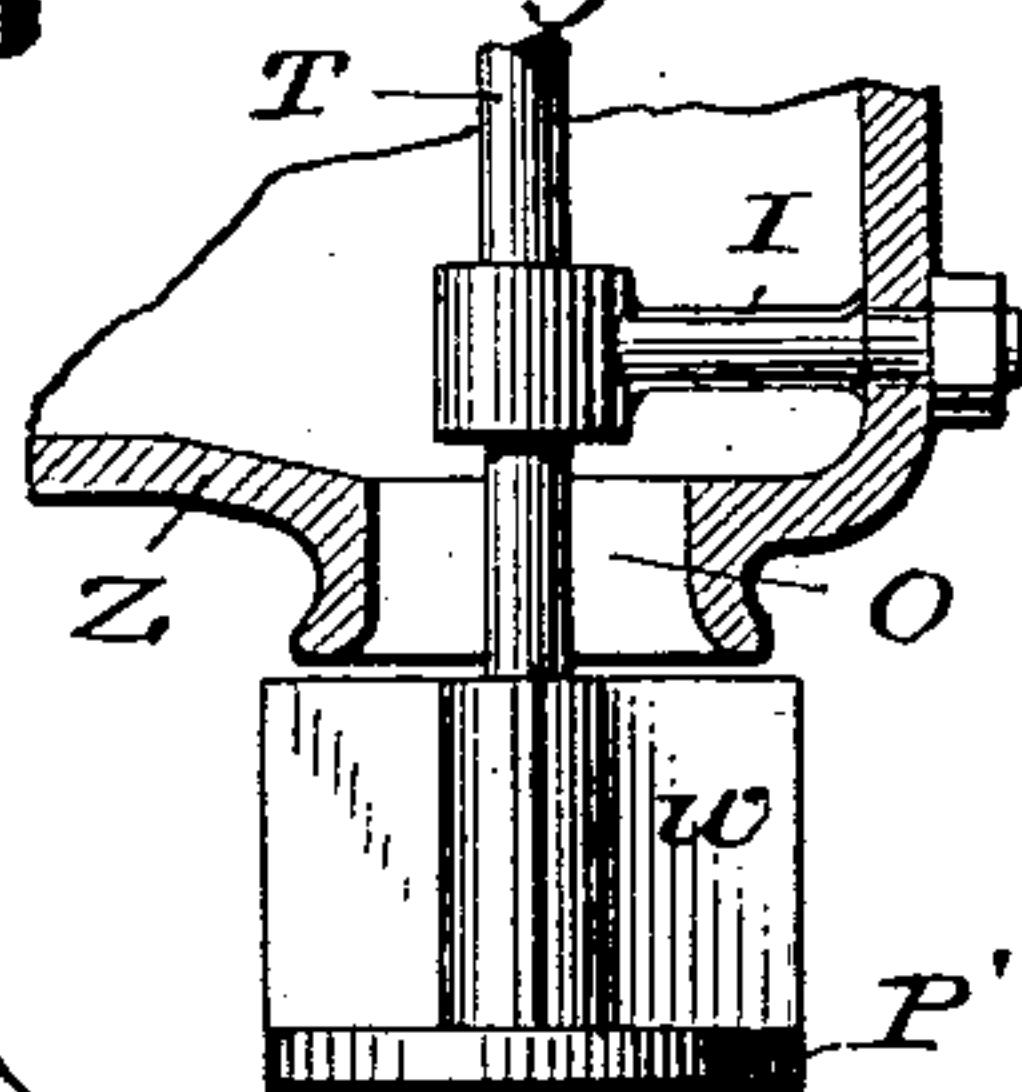


Fig. 8.



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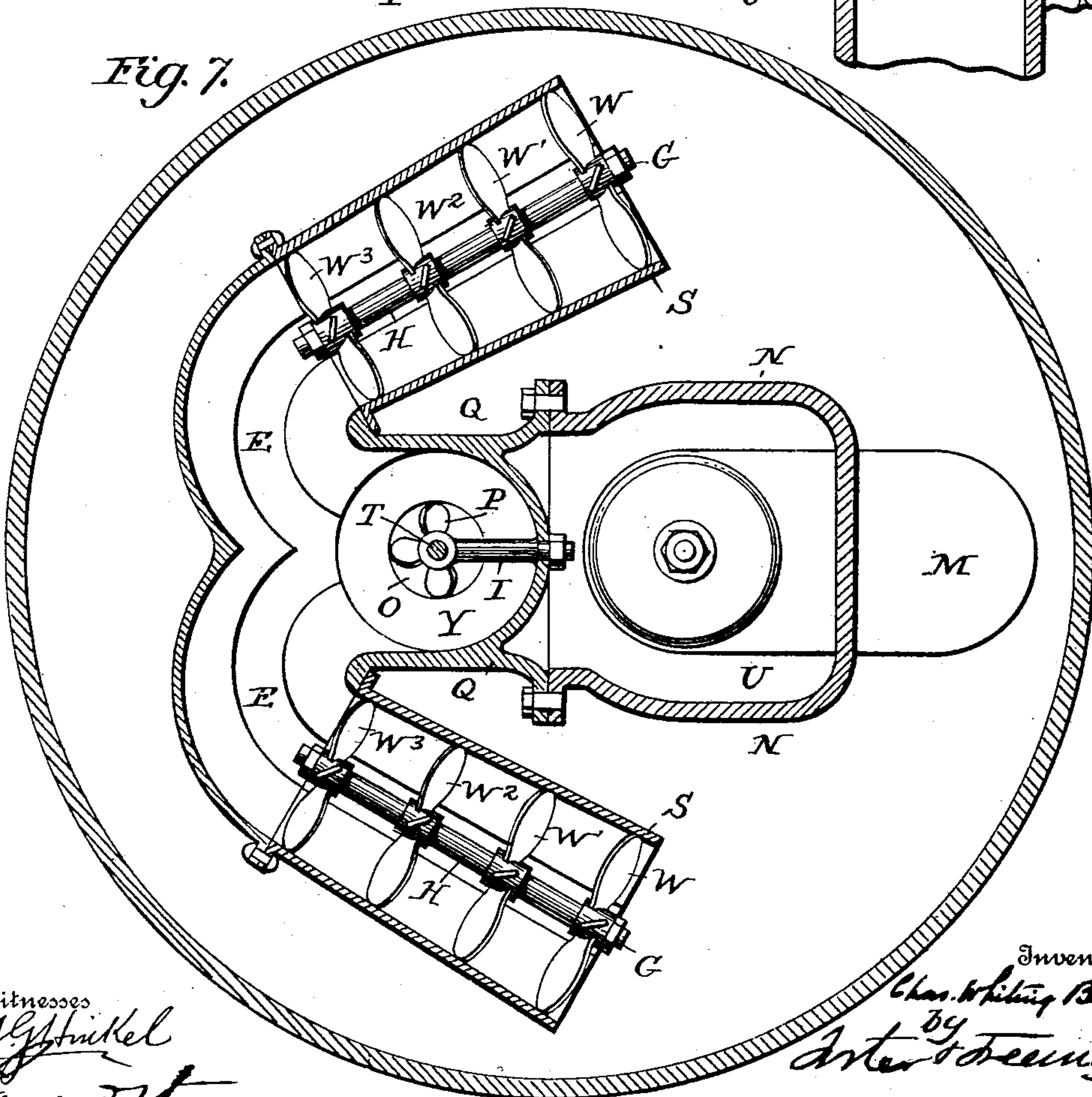
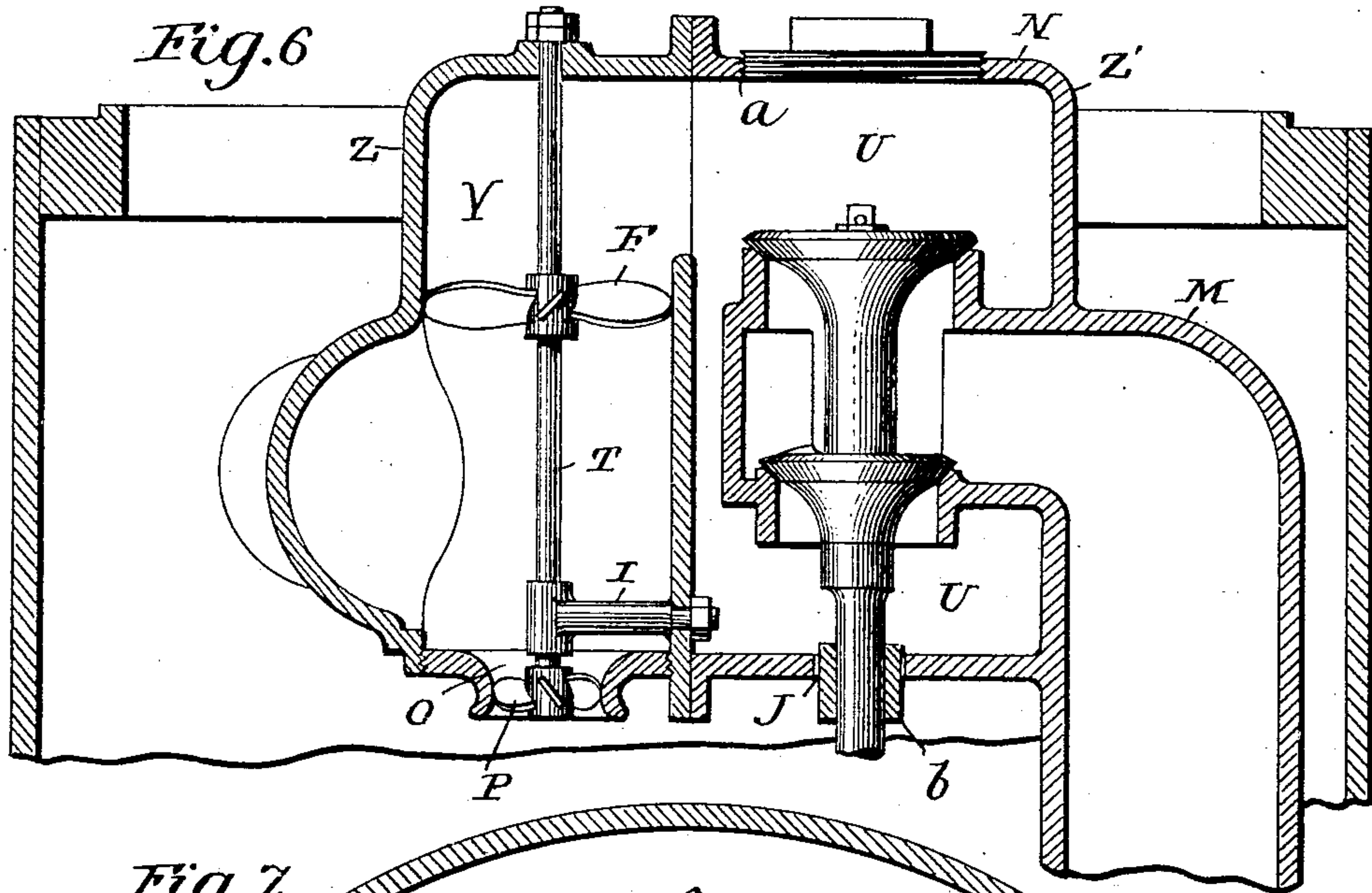
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

CHARLES WHITING BAKER, OF MONTCLAIR, NEW JERSEY.

STEAM-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 630,024, dated August 1, 1899.

Application filed December 29, 1897. Renewed December 19, 1898. Serial No. 699,755. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WHITING BAKER, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Steam-Separators, of which the following is a specification.

My invention relates to improvements in steam-separators, and especially in such separators as were shown and described in United States Patent No. 553,892, which are designed to be placed in the interior of steam-boilers to separate any entrained water from the steam before it passes out of the boiler.

The objects of my improvements are to simplify the apparatus, reduce the obstruction which it offers to the flow of the steam, render it less liable to clogging by grease or scum carried into it when the boiler is foaming, and facilitate the application of the device to boilers of various classes.

My improvements are illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of part of the shell of a horizontal boiler adjacent to the steam-pipe opening, showing my device also in longitudinal section attached to the steam-outlet. Fig. 2 is a cross-section of the same boiler through the center of the steam-outlet, with the propeller-wheel of my device and its supporting parts removed. Fig. 3 is a horizontal section on the line C D of Fig. 1, with the longitudinal chamber containing the separating device proper removed. Fig. 4 is a longitudinal section of a boiler having its steam-outlet pipe in the vertical end plate of the boiler and having my device attached to the outlet-pipe. Fig. 5 is a horizontal section on the line A B of Fig. 4. Fig. 6 is a vertical section through the steam-dome of a locomotive-boiler having my device attached to its throttle-pipe. Fig. 7 is a horizontal section of the same, and Figs. 8 and 9 sectional views illustrating different forms of discharge device.

Describing first the mechanism adopted in my device for separating the entrained water from the steam, this consists of one or more pipes or tubes S, Fig. 1, placed as nearly horizontal as possible and as nearly as possible to the top of the boiler or steam-dome. This pipe S so communicates with the steam-out-

let K that the steam leaving the boiler must pass through the said pipe. In making this passage I cause the steam by any suitable means to rotate with great velocity about the axis of this pipe, and the particles of water it contains are thrown by centrifugal force against the sides of the pipe. Along the lower side of the pipe is a channel E, into which the separated water drips through an opening α and either runs back to the mouth of the pipe S by gravity when the pipe is inclined or is impelled forward by the current of steam until it reaches the mechanism which returns it to the boiler. The rotation of the steam in the pipe is caused by a series of deflectors or blades. As shown, there is a series of stationary blades W W' W² W³ W⁴ of varying pitch. Thus the blade W at the mouth of the pipe S where the steam enters is at a small angle with the axis of the pipe, the next blade W' makes a larger angle, and so on until the last blade W⁴ makes an angle of nearly ninety degrees with the axis of the pipe.

I prefer to make the pipe S of tapering form, the large end being the mouth where the steam enters. In this way I give an easy entrance of the steam to the separator, and as the steam takes up its rotating velocity gradually as it passes the successive blades it is made to acquire so high a rotative velocity before it passes out of the separator as to absolutely dry it, yet the high rotative velocity is attained with the least friction and resistance to the moving current of steam. These blades may be secured to the pipe S, but, as shown, are supported and kept in position by a central rod G, on which they are strung, and they are spaced suitable distances apart by thimbles H upon this rod.

The means of returning the collected water to the steam-space of the boiler embodies the same principle that is set forth in my Patent No. 553,892—viz., the use of a motor—as, for instance, a moving propeller actuated by the flowing steam to drive a discharge device to return the water to the boiler—but in my present invention I have so simplified this device that it consists of a single moving part.

Referring to Fig. 1, it will be seen that entrained water which flows along the channel E on the lower side of the separator-pipe S would fall by gravity back into the steam-

space of the boiler through the opening O were it not for the rapid current of steam which tends to rush into this opening on account of the suction at the steam-outlet pipe; but to reverse this current through the passage O and cause it to move in the opposite direction I place a discharge-wheel, as a fan or blower P, in this opening and drive it by the motor, shown as a second fan or propeller F of larger diameter mounted on the same shaft and actuated by the full current of steam passing out of the outlet-pipe.

The current of steam as it leaves the separating-pipe S is rotating with great velocity and the blades of the propeller F are at such an angle that the rotating steam strikes squarely against them when the propeller is stationary. The effect of this is that the motor-propeller F is driven with very considerable power and will not be stopped by pieces of scale, grease, &c., which may at times enter the separator. It will be apparent that the pitch of the fan or motor-propeller F should be opposite to the pitch of the discharge-wheel.

To enable the mechanism shown to run for very long periods without appreciable wear, I prefer to make the shaft T on which these propellers are mounted of some exceedingly hard metal, such as manganese steel, chilled cast-iron, or steel of very high carbon. The bearings I I, in which the shaft runs, are made of large size to permit a great amount of wear, and an ample clearance is given between the ends of the propeller-blades and the walls surrounding them, so that even though the shaft-bearings I I should be much worn the propeller-blades would not strike.

To attach my apparatus to the inside of the boiler-shell, almost any suitable connection may be used. I prefer to arrange the parts in a casing, and great pains need not be taken to make a tight joint at the point of connection of the casing and its support, as the difference in steam-pressures on the two sides of this joint is too small to make leakage very considerable. I prefer, however, the form of connection shown in Figs. 1 and 2, in which there is a casing Z, with a groove for a packing-ring J around the face of the casing next the steam-outlet pipe, and this packing-ring can be trimmed off to fit the curve made by the interior of boiler-shells of various sizes. Projecting lugs L furnish an opportunity for attaching the separator-casing to the boiler-shell without interfering with the rivets which secure the outlet-pipe flanges to the boiler.

In the case of a boiler having its steam-outlet pipe in the vertical end or head I adopt the arrangement shown in Figs. 4 and 5. The separating-pipe S is exactly the same in this as in Fig. 1 and is therefore not fully shown. It will be seen that the steam after its passage through the separating-pipe S is led up into the casing Z and through the propeller

F on its way to the outlet, while the water is discharged out of the orifice O, as before. The small orifice at V is for the purpose of permitting any condensed water which may form in the steam-pipe when steam is not flowing in the pipe to flow back into the boiler by gravity and not accumulate in the pipe.

In Figs. 6 and 7 I have shown my device attached to the throttle-pipe of a locomotive-boiler. To do this, a throttle-pipe M, with a surrounding casing Z', is necessary, the casing having projecting flanges N N cast upon it, which form a part of the walls of a closed chamber U U, surrounding the throttle-openings. The chamber Y Y, containing my apparatus for returning the entrained water to the boiler, is in the casing Z of the separator, which casing Z has flanges Q Q, adapted to fit against the flanges N N of the throttle-pipe casing and complete the inclosure around the throttle-valve parts. The chamber Y Y, containing the mechanism for returning the water to the boiler, is located adjacent to this chamber U U, and two separator-pipes S S are connected to it in such a manner as to both lead to the chamber U and make the whole apparatus as compact as possible. When it is desired to enter the boiler through the dome, it is only necessary to unbolt the apparatus from the throttle-pipe and lift it out.

As there is no steam-pressure tending to force the casings Z Z' apart, two or three bolts are all that is necessary to hold the apparatus in place.

The form of the chamber U U, surrounding the throttle, is not material. In the form shown in the drawings the projections cast on the throttle-pipe extend over the top of the throttle-valve, making a screw-plug orifice a necessary to permit putting the throttle in place. In some cases, however, it may be preferred to decrease the projections N N from the throttle-pipe casing and extend the projecting flanges Q Q from the separator-casing, so that the top of the throttle-pipe will be wholly clear when the separator is removed. Again, the throttle-valve-rod orifice J is shown in Fig. 6 as large enough to permit the passage of the end of the rod, and a split sleeve b, pinned to the rod, is used to fill this orifice; but where desired the point of junction between the two casings Z Z' may be made on the center line of this rod, thus dispensing with the use of the sleeve.

For the sake of compactness the separator-pipes S S, Figs. 6 and 7, are turned back and placed adjacent to the steam-chamber U U, which surrounds the throttle; but it will be apparent that this arrangement may be varied according to the space available in boilers having domes of various forms and sizes.

While I have shown the discharge device in the form of a screw-propeller wheel in Figs. 1 to 7, it may be otherwise formed. For instance, in Fig. 8 it is a recessed wheel P', se-

cured to the spindle T of the motor, the recesses *w* receiving water from above and discharging it centrifugally.

While I have shown the deflectors or blades W W' in the various drawings as parts of screw-propellers, they may be made in any other form adapted to cause a rapid whirling motion of the steam as it passes through the pipe. For example, I prefer in some cases to use instead of the succession of propeller-blades shown in Figs. 1 and 7 a single propeller or turbine W⁶, placed at the mouth of the pipe S and having blades overlapping and of curved outline or increasing pitch, so that the rotative velocity of the steam is gradually increased as it passes through the openings between the blades, as shown in Fig. 9.

Without limiting myself to the precise construction and arrangement of parts shown and described I claim as my invention—

1. A steam-separator comprising means for separating the water from the steam, an outlet from such separator to the steam-space of a steam-boiler for the water collected from said separator, and a propeller in said outlet driven by a motor operated by the steam flowing through the separator, substantially as described.

2. A steam-separator comprising means for separating the water from the steam, an outlet for the separated water, a propeller arranged to be driven by the steam-current, and a second propeller in said outlet and mounted on the shaft of the first propeller, substantially as described.

3. In combination with a steam-separator a rotating propeller F adapted to be turned by the current of steam from the separator, and a second rotating propeller driven by the first, and arranged to discharge the water downward, substantially as described.

4. In combination with a steam-boiler, a steam-separator placed in the interior of said boiler, a discharge-passage for the water separated thereby, a revolving propeller adapted to cause a flow through said passage, and a motor placed in the passage from said separator to the steam-outlet and driving the said propeller.

5. A steam-separator and a casing therefor

adapted to be placed on the interior of the boiler, means for securing said casing to the shell of the boiler, a recess in the casing, and a packing-ring in and projecting from the recess and fitted to the contour of the boiler, substantially as described.

6. A steam-separator comprising a horizontal tube, a longitudinal chamber along the lower side, and a series of stationary inclined blades in said tube whose inclination to the axis of the tube increases with the distance from the mouth of the separator, substantially as described.

7. The combination of a boiler and a steam-separator, an upward passage-way therefrom for the steam, leading to the steam-outlet pipe of the boiler, a downward passage-way for the water, and rotary propellers adapted to operate in these passages, substantially as and for the purpose set forth.

8. The combination in a steam-separator, of a separating-casing having two branches, and an intermediate chamber, a motor arranged in said chamber and a water-discharge device connected with said motor, substantially as described.

9. In a locomotive-boiler having a throttle pipe and valve, means for drying the steam prior to its entering the throttle-valve openings, comprising one or more steam-separators, a motor operated by the flowing steam and forcing the water collected by the separators back into the boiler, and means for connecting said separator and apparatus to the throttle-pipe.

10. A steam-separator arranged in a boiler with a throttle-valve pipe having flanges projecting from it to form a portion of a closed chamber, a separator-casing with flanges adapted to connect with those of the throttle-valve pipe to form the remainder of said chamber, and means for connecting and disconnecting the two, substantially as described.

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

CHARLES WHITING BAKER.

Witnesses:

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CHAS. S. HILL.