

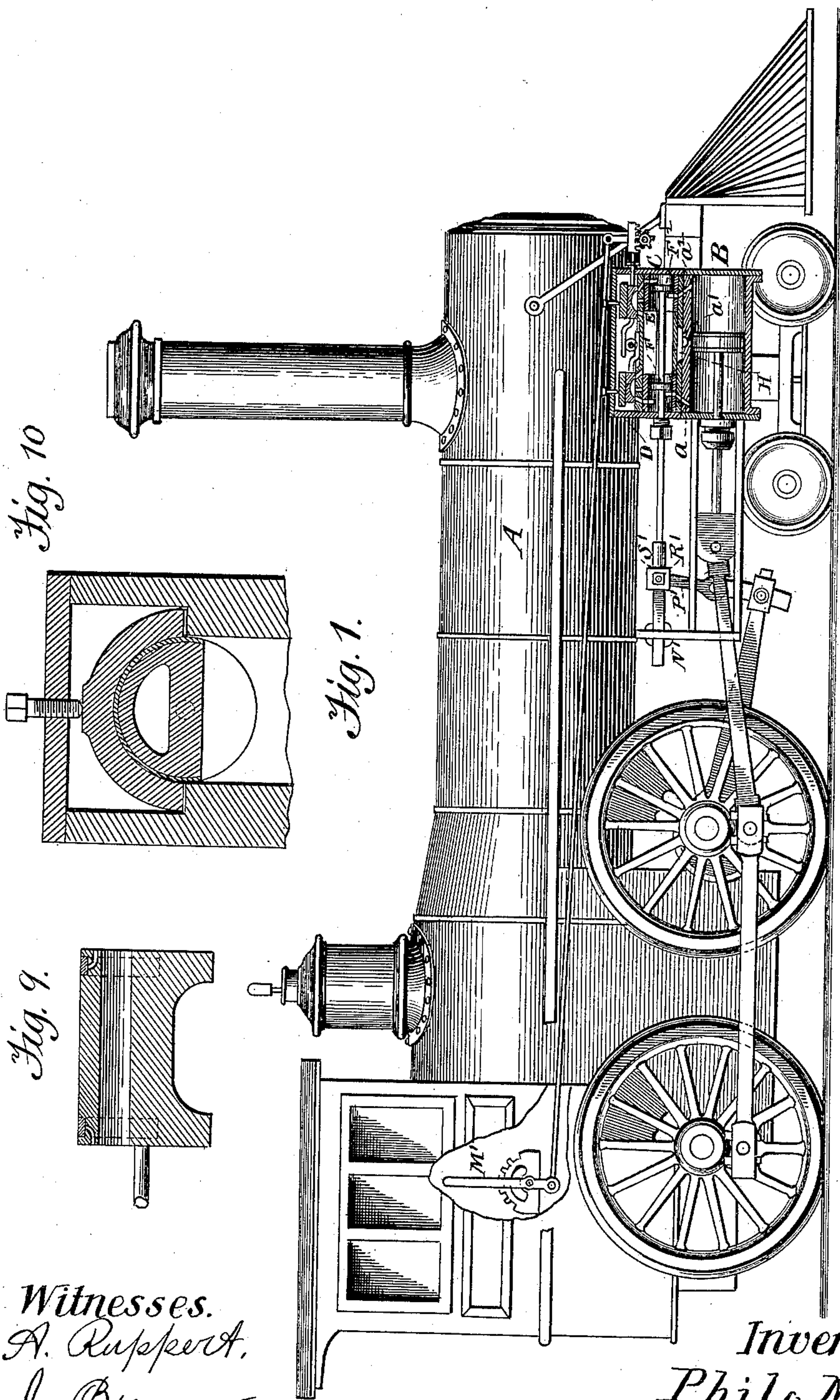
(No Model.)

4 Sheets—Sheet 1.

P. MALTBY.
REVERSING VALVE.

No. 378,604.

Patented Feb. 28, 1888.



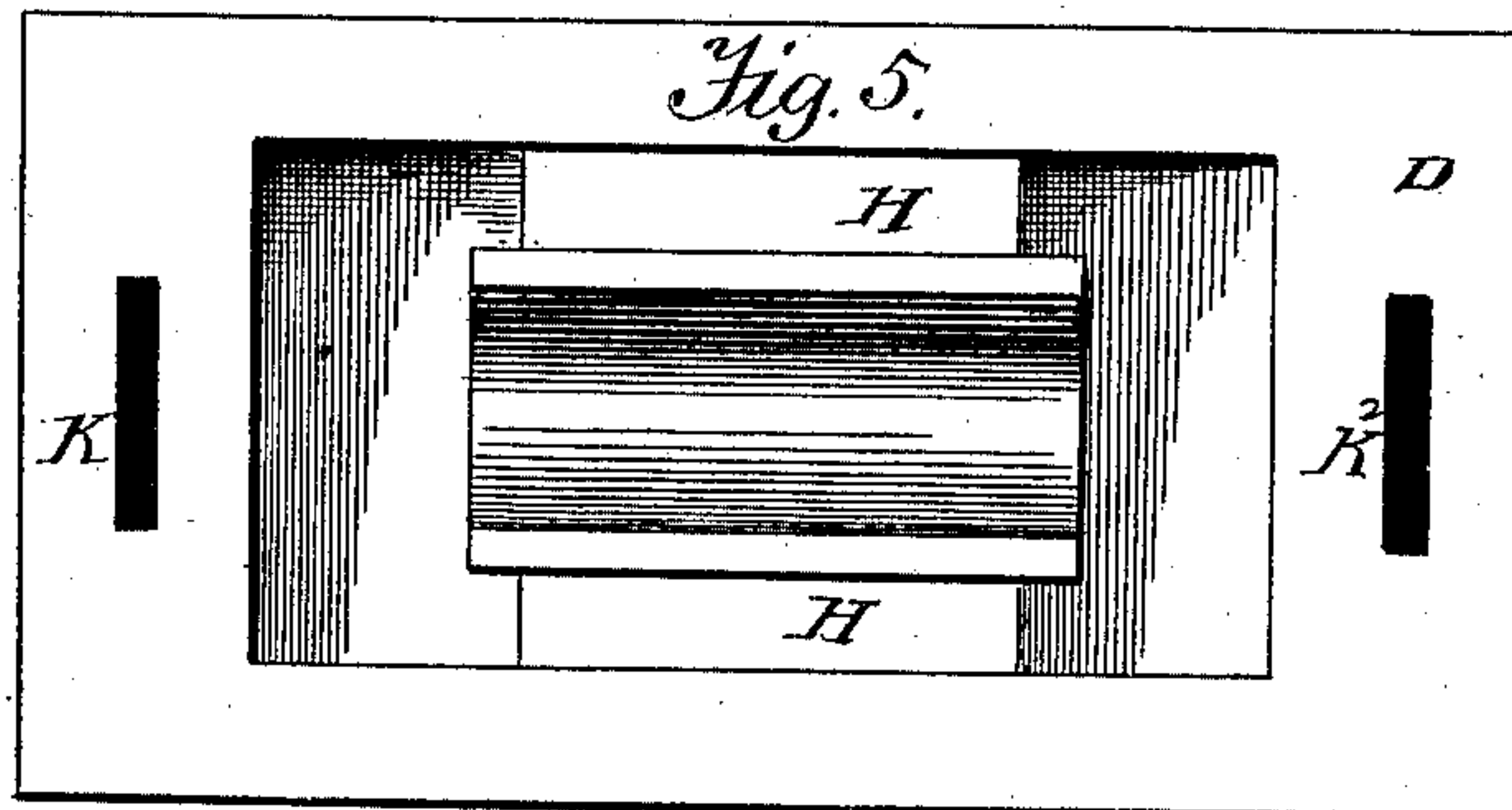
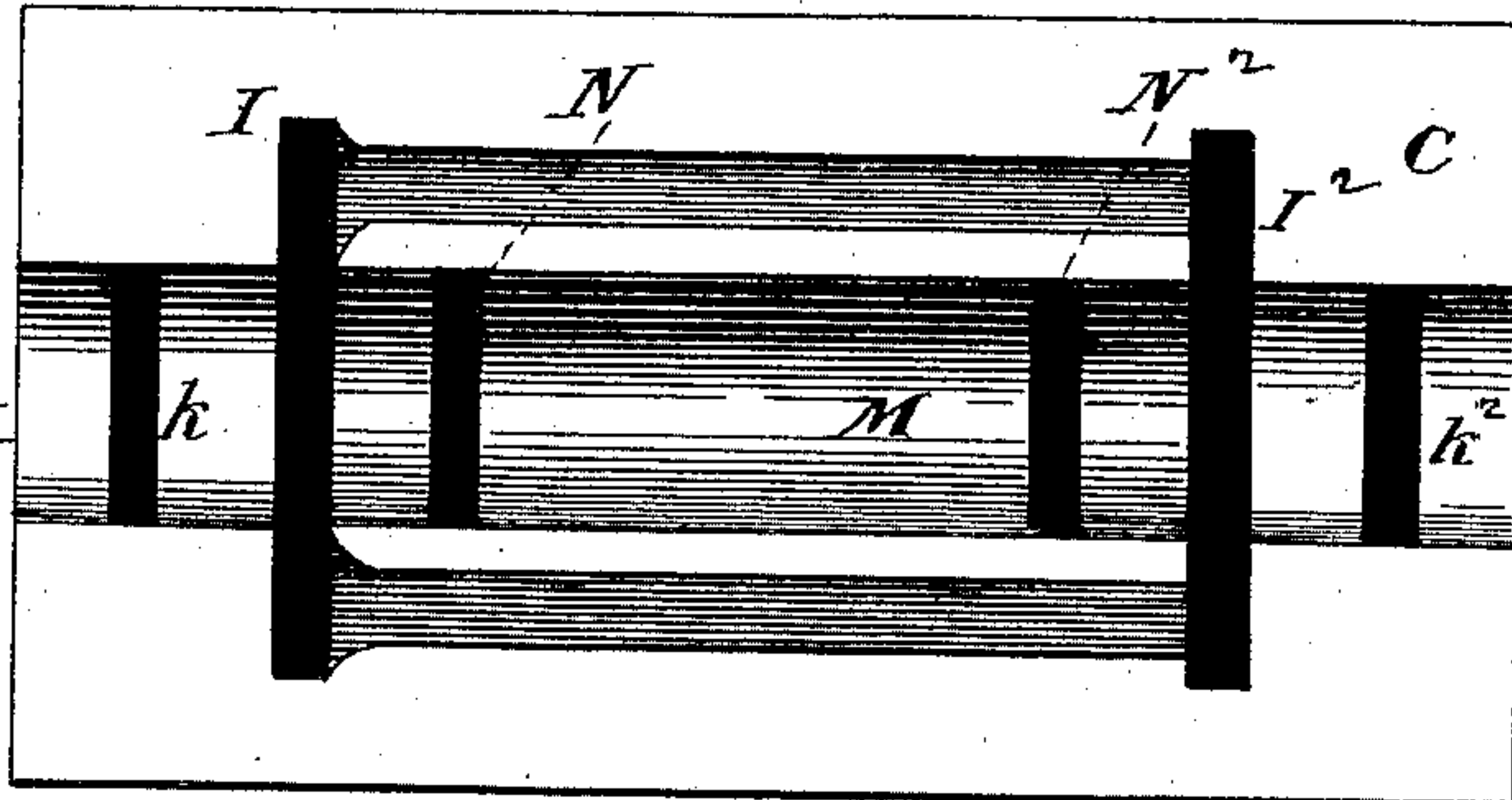
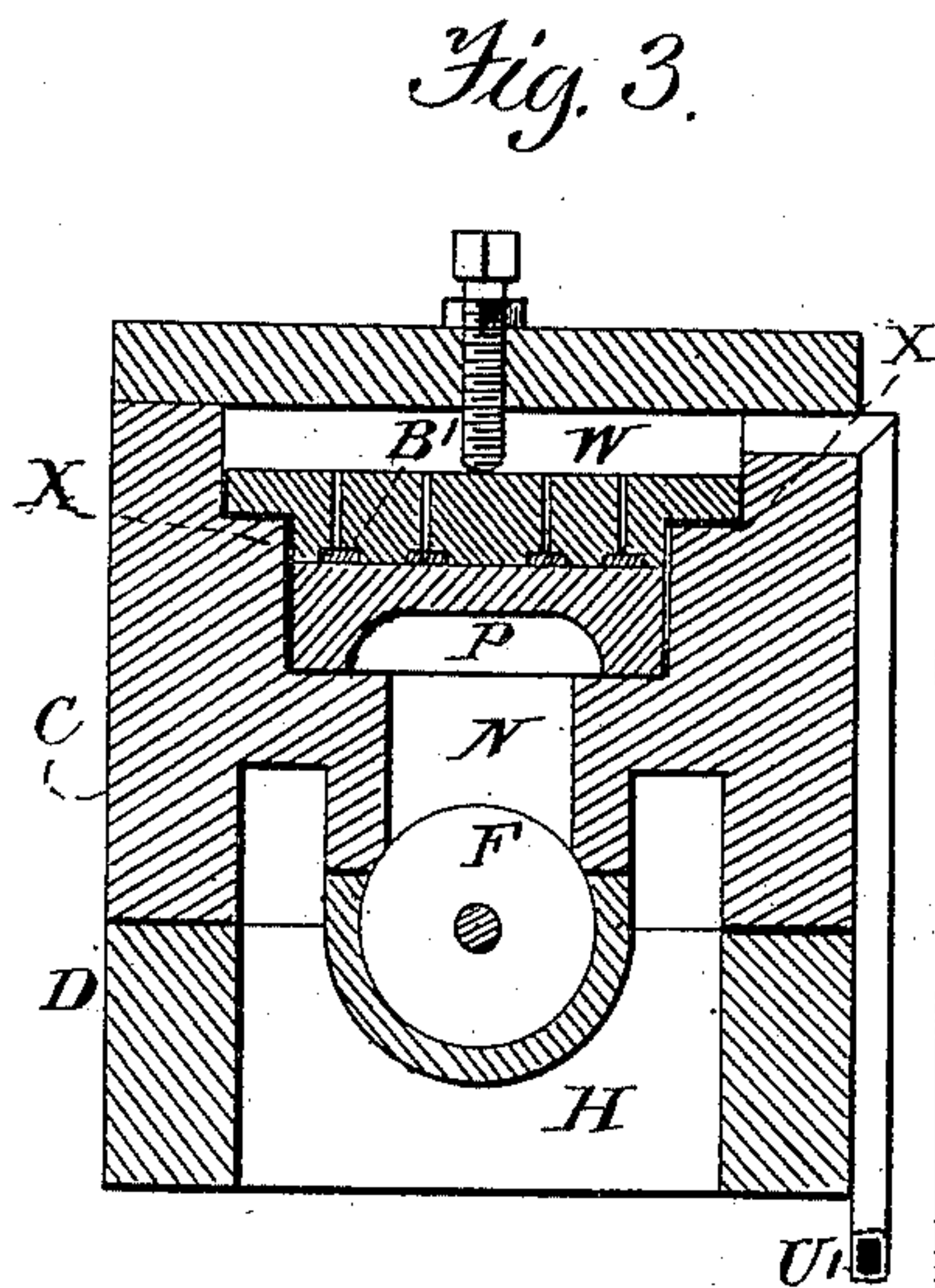
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4 Sheets—Sheet 2.

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Fig. 6.

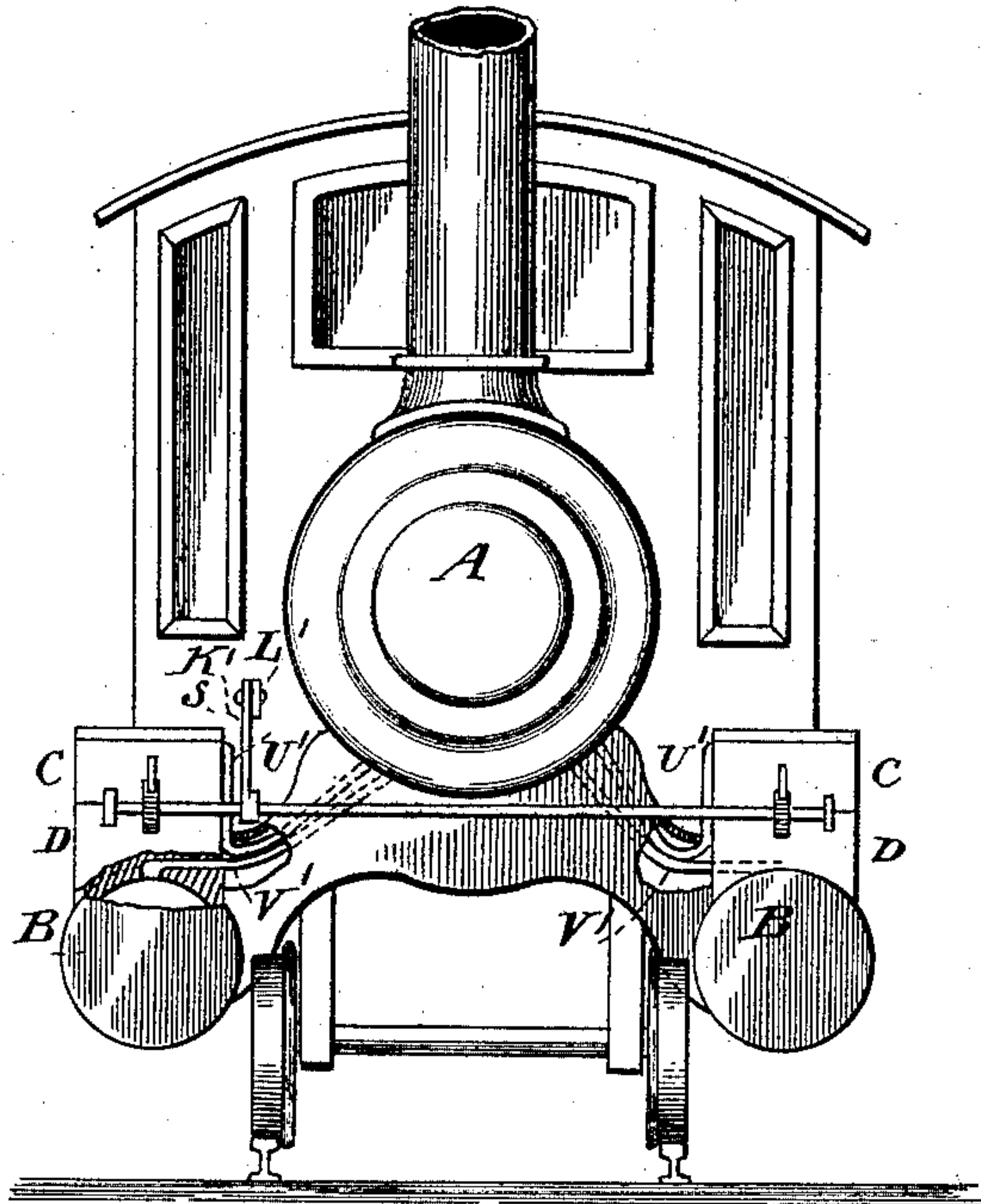


Fig. 7.

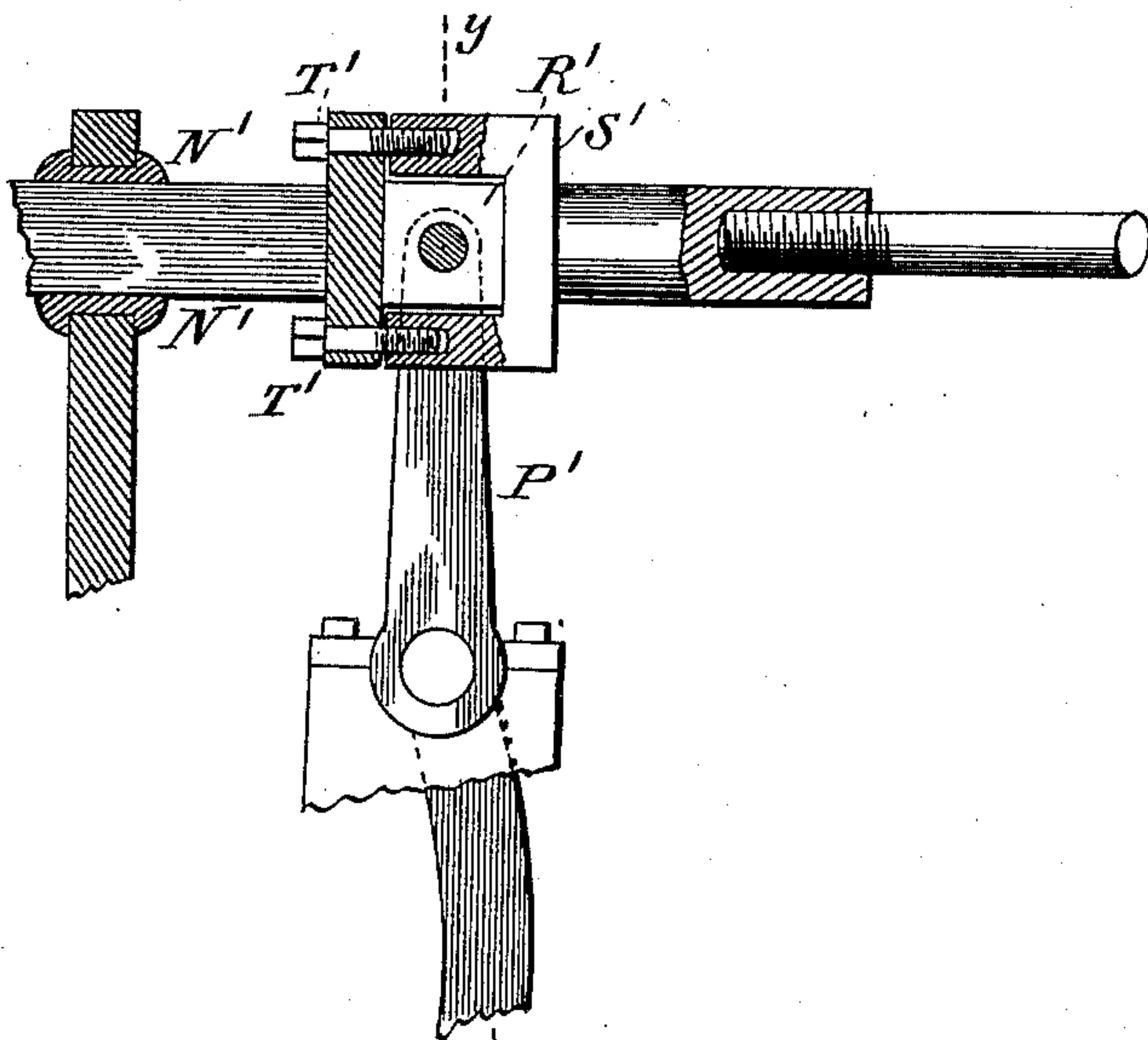
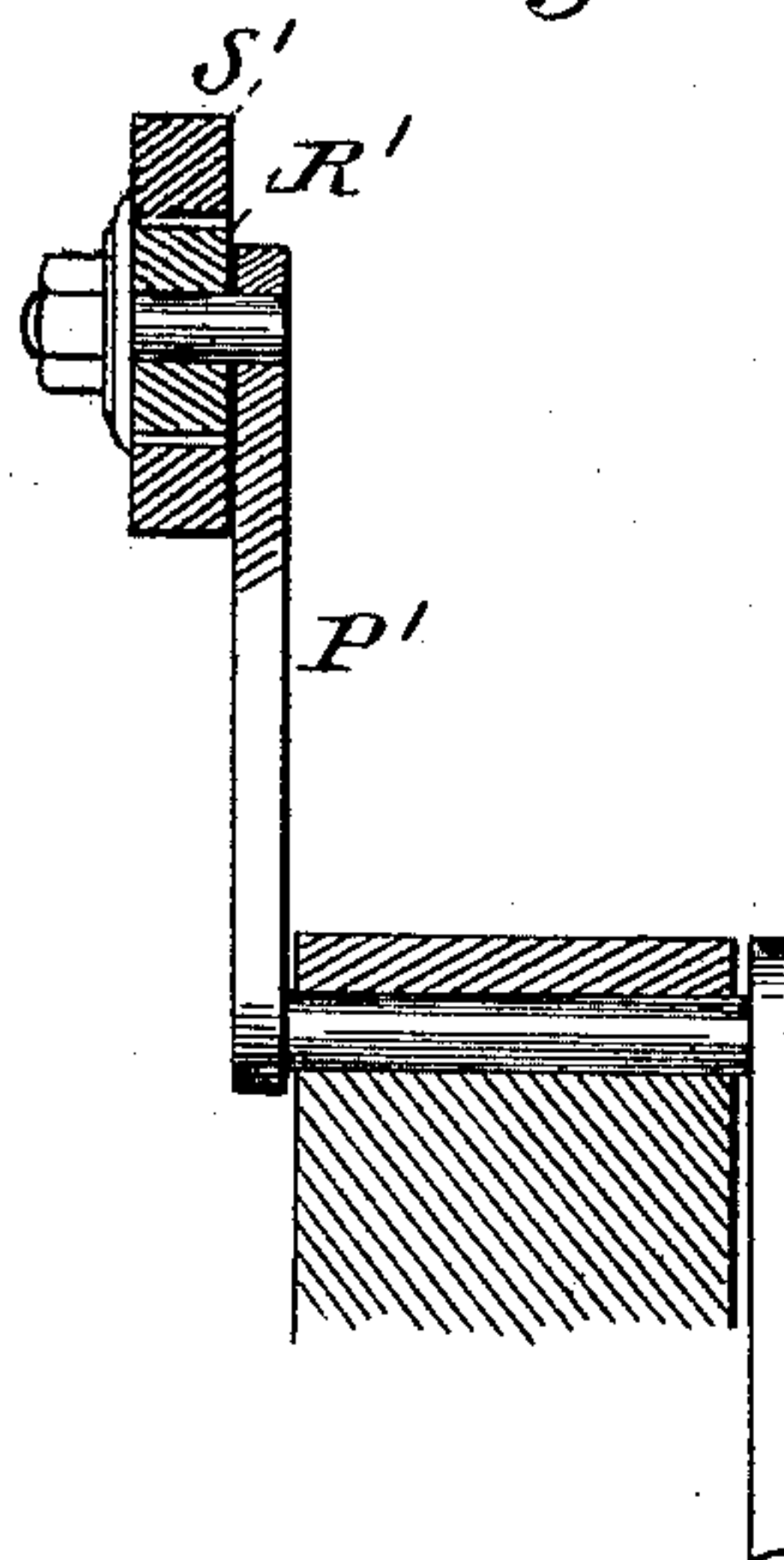


Fig. 8.



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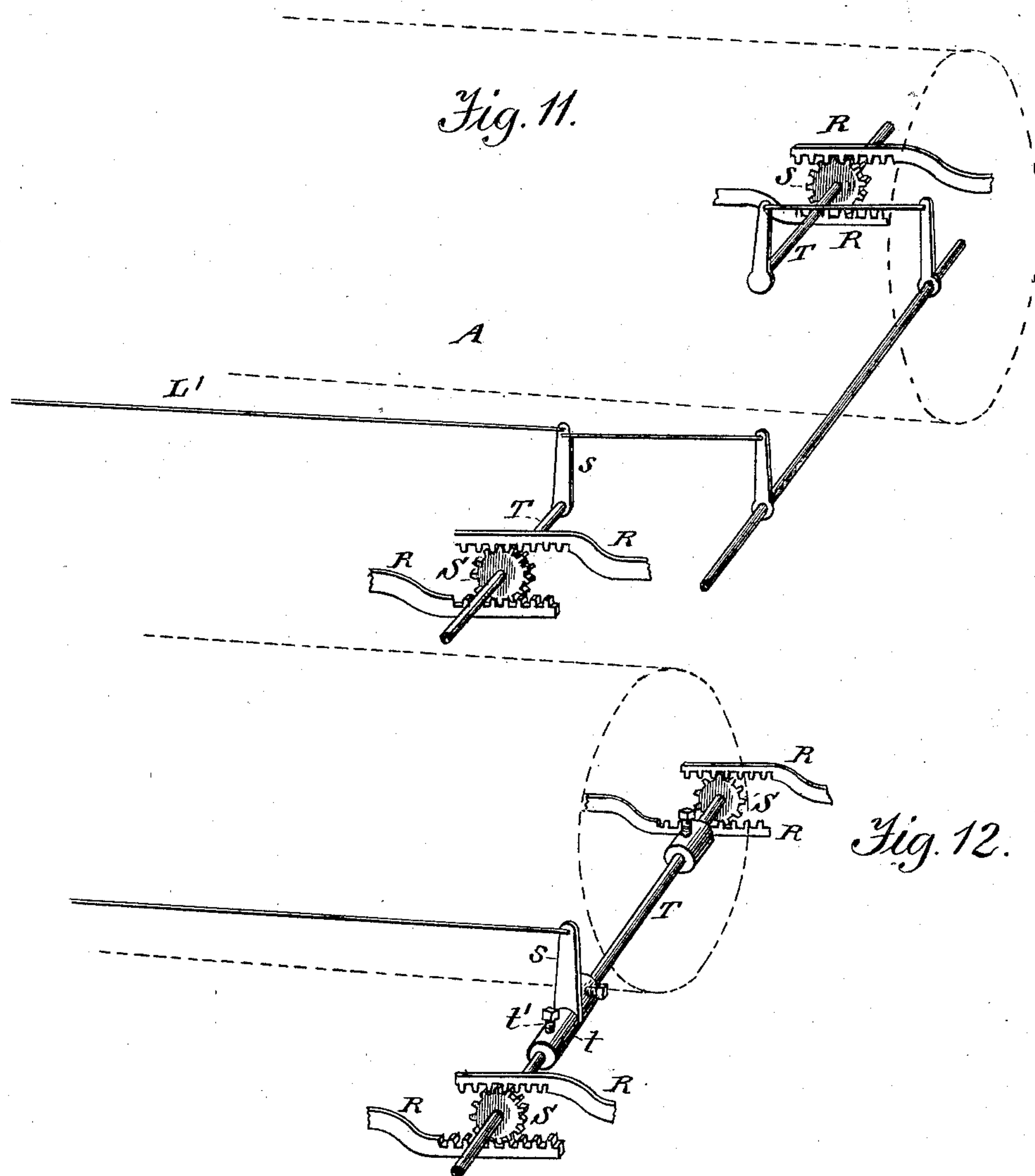
4 Sheets—Sheet 4.

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UNITED STATES PATENT OFFICE.

PHILO MALTBY, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO L. G. HINE, OF WASHINGTON, DISTRICT OF COLUMBIA.

REVERSING-VALVE.

SPECIFICATION forming part of Letters Patent No. 378,604, dated February 28, 1888.

Application filed October 27, 1887. Serial No. 253,482. (No model.)

To all whom it may concern:

Be it known that I, PHILO MALTBY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Reversing-Valves; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to certain improvements in reversing-valves for steam-engines; and its novelty consists in the construction and arrangement of the parts, as will be more fully hereinafter set forth, and specifically pointed out in the claims.

For convenience I have illustrated and will describe my invention in connection with a locomotive-engine, although it is applicable to all engines in which reversing mechanism is necessary, and especially in marine engines of various descriptions. In this class of reversing engines as ordinarily constructed the shifting-gear for reversing the valves is necessarily complicated, and one of the objects of my present invention is to simplify the construction of the reversing-gear, and also to increase the capacity of the ports, more particularly that of the exhaust-port, as more fully hereinafter set forth. These objects I attain by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation of a locomotive, with the steam and valve chests and cylinder in vertical longitudinal section. Fig. 2 represents a vertical longitudinal section of the steam and valve chests and cylinder, taken on a larger scale. Fig. 3 is a vertical cross-section of the same on line $x x$ of Fig. 2. Fig. 4 is a bottom plan view of the upper section of the valve-chest. Fig. 5 is a top plan view of the lower section of the same. Fig. 6 is a front elevation of a locomotive, showing a portion of the reversing mechanism and the live-steam and exhaust connections. Fig. 7 is a detail view, partly in section, of the mechanism

for operating the piston-valves. Fig. 8 is a vertical cross-section of the same, taken on line $y y$ of Fig. 7. Fig. 9 is a vertical cross-section of a portion of the valve-chest, showing a modified form of valve and casing. Fig. 10 is a vertical longitudinal section of the modified form of valve. Fig. 11 is a detail in perspective showing a modified construction of mechanism for shifting the reversing-valves simultaneously in opposite directions. Fig. 12 is a similar view showing another form of shifting mechanism.

My invention is designed to be applied to engines now in use; but it is evident that engines, with greater advantage, may be especially constructed for the purpose.

Referring to the drawings, the letter A designates the boiler of the engine, which may be of the ordinary or any approved construction; and B, the cylinders, which in the present instance are located at each side of said boiler, as is usual in locomotive-engines. The cylinders are of the ordinary construction, and are provided with the usual ports, $a a^2$, at the ends leading from the valve-chest, and the central exhaust-port, a' .

The valve-chest is located upon the outside of the cylinder in any convenient position, forming part thereof or bolted or otherwise secured thereto, and is formed in two sections, C and D, each section having cylindrical chambers extending from end to end thereof, which form cylindrical chambers for the bushing-cylinders E E² at each end, that receive the piston-valves F F² when the sections of the chest are secured together. The intermediate portions of the sections around the central semi-cylindrical recesses are formed with steam-spaces G G, the space in the lower section leading to a central exhaust-port, H, and that in the upper section connecting with exhaust-ports I I². From near each end of the semi-cylindrical recess of the lower section extend the ports K K², which connect with the ports $a a^2$, leading to the opposite ends of the cylinder, and serve alternately as induction and eduction ports, as usual. The recess surrounding the semi-cylindrical portion of the upper section is provided with ports $k k^2$, which lead to an upper steam-chamber, L, of the

valve-chest, and the intermediate portion of the semi-cylindrical chamber of the upper section is recessed, as indicated by the letter M, and at each end of the recess is formed ports $N N^2$, leading to the upper chamber, L, in which the reversing twin valves P P are located and travel. These valves may be similar to the ordinary slide-valve of an engine, or of any other suitable description, being represented in Figs. 1, 2, and 3 as of the ordinary slide-valve pattern. The said valves are arranged to be moved over the ports $k N k^2 N^2$, so as to open and close the said ports, the exhaust-ports $I I^2$ being always in connection with one or the other of said ports $k N k^2 N^2$, so as to provide for the exhaust of the steam in whatever position the valves may be, in order that the piston-valves may work freely in reversing.

As shown in Fig. 2 of the drawings, the ports $k N k^2 N^2$ are slightly open, so that the exhaust will pass freely out of the ports at both ends of the cylinder, thereby permitting the quick reversing of the engine. The ports being in the position shown in the drawings, Fig. 2, by operating the valves P so as to cause them to approach each other, the live steam passes through the ports $k k^2$ into the outer ends of the cylinders $E E^2$, and from thence to one end of the cylinder B, the exhaust from the opposite end of said cylinder escaping through the ports a^2 and K^2 to the exhaust-port H, and vice versa. When the valves P are moved apart, the live steam enters the space M between the cylinders $E E^2$, and from thence passes through the ports $K^2 a^2$ to the cylinder, exhausting through the ports $K a$ and port H, and vice versa. It will be seen that to reverse the engine it is only necessary to shift the valves P, as before mentioned, at any point of the stroke of the piston in the cylinder B, which will immediately change the direction of the live steam entering said cylinder and the exhaust therefrom, thus instantaneously changing the direction of its travel.

The twin valves P P are provided with bent rack-arms R R, which engage the opposite sides of an intermediate pinion, S, mounted upon a transverse shaft, T, suitably journaled in bearings in the sides of the valve-chest, so that the valves may be moved simultaneously toward and from each other to start, stop, and reverse the engine, as will be more fully hereinafter described. The lower rack-bar is arranged to travel in a groove, U, in the surface of the seat upon which the valves P travel, and the upper arm travels in a grooved plate, V, which is held down by a screw or any other suitable means passing through the top of the valve-chest, so as to guide the said upper arm and hold it to the pinion. Above each valve is located a plate, W, which covers entirely its valve in whatever position it may be, and which is supported in a rabbet, X, made in the valve-chest, and held against the same by means of a binding-screw and jam-nut. The rabbet X is packed in a manner and with a

material similar to that described in Letters Patent granted to me December 29, 1885, No. 333,419—that is, with very thin copper-foil or other suitable metal—so that the plate W may fit closely to the valve to prevent any great amount of steam passing under it, and when required may be removed to compensate for any wear of the valve. Each of the said plates W may be provided with grooves A' , in which may be located “packing-rings” B' , either square or round, to prevent steam, to any great extent, getting between the plate and valve. Such construction is shown in Fig. 3.

The letter D indicates a tube leading through the top of the valve-chest, over each valve, to the top of the plate W, which is provided with an oblique opening, E' . The said tube is provided with a funnel or cup on top and a suitable two-way stop-cock, and serves the double capacity of an oiler and steam-passage for the discharge of any confined steam from between the valves and plate. When the oil is cut off, the passage is left open for the escape of the steam, which may be conveyed by means of a pipe to any desired point.

The reversing-valves P P may be operated in any convenient manner. As shown in Figs. 1, 2, and 3 of the drawings, one of the valves is provided with a valve-rod, F' , which extends through a stuffing-box, G' , and is provided with a rack, H' , which engages a pinion, I' , mounted on a shaft, i , properly secured to the engine-frame, and provided with an arm, K' , which connects with a rod, L' , extending back to the cab and connected with a lever, M' , so as to be under the control of the engine-driver or engineer.

The rod of the piston-valves F F at its rear end slides in gibs N' , secured to the frame of the engine, so as to have a perfect rectilinear motion, and in order to transmit the motion from the eccentric-rod to the said valve-rod a connecting-lever, P' , is employed, the upper end of which is provided with a pivoted block, R' , which is arranged to slide in an adjustable box, S' , secured to the valve-rod, so as to play as the lever oscillates and permit the valve-rod to move truly in line without strain or displacement. The box is constructed in two parts, which are held together by set-screws T' , which serve to adjust the parts to compensate for wear. The operating-gear of the reversing-valves may, however, be varied, as shown in Figs. 11 and 12, without departing from my invention. For instance, in Fig. 11 the valves are operated by means of an arm, s , which connects the shaft of the intermediate pinion with the cab-rod L' . The rod F' , stuffing-box G' , and rack and pinion $H' I'$ are dispensed with. To avoid complications and exposure of the operating mechanism so far as possible, the shaft of the pinion may be extended through the boiler, as shown in Fig. 12, so as to connect the operating mechanism with the reversing-valves on the opposite side thereof, in order that they may be operated simultaneously. The rod L' in this instance

extends only as far as the connecting-arm *s*. To permit the said valves, however, to be operated independently, the pinion-shaft is divided at a point near the side of each valve-chest and fitted together by a sleeve, *t*, and set-screw *t'*, which may be set to make the parts work together or loosened to permit them to move independently of each other.

In the foregoing description but one cylinder and its valves have been described; but it is evident that the cylinders and valves are duplicated and arranged at opposite sides of the boiler.

So far I have described the reversing-valves as of the ordinary slide-valve variety; but it is evident that the style may be varied, as may be found convenient, and in Figs. 9 and 10 I have shown a modification of said valve, in which it is semi-cylindrical and is held to its seat by a semi-cylindrical cover, the packing-strip being approximately a half-circle and dropped into its seat between the cover and top of the valve.

The letter *U'* indicates the induction-pipe, which leads from the boiler in the ordinary manner and connects at one side of the valve-chest, and *V'* indicates the exhaust-pipe leading from the exhaust-port *I*.

In marine and other engines where the cylinders are located away from the boiler two or more cylinders may be arranged side by side and the operating pinion-shaft divided, as above mentioned, and the parts connected by sleeves and set-screws, so that all the cylinders may be operated together or separately, as may be desired.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a single steam-cylinder, of the reversing twin valves adapted to be moved simultaneously toward or from each other, so as to change the induction-ports to admit steam to either end of the cylinder at will in order to reverse the engine, substantially as specified.

2. The combination, with the valves operated by the eccentric of an engine to alternately change the ports to operate the piston, of the reversing twin valves and the mechanism whereby the induction-ports are changed to admit steam to either end of the cylinder at will for the purpose of reversing, substantially as specified.

3. The combination, with the reversing twin valves, of the rack-bars and intermediate pinion and mechanism for operating the valves, so that they may move simultaneously to change the ports for the purpose of reversing, substantially as specified.

4. The combination, with the valves operated by the eccentrics of an engine to alternately change the ports to operate the pistons,

of two sets of reversing twin valves, one set located upon the outside of each steam-cylinder, and mechanism whereby each set of reversing-valves may be operated simultaneously to change the induction-ports to admit steam to either end of the cylinder, substantially as specified.

5. The combination, with the steam-cylinders of an engine, of twin valves, one set located on the outside of each cylinder, the rack-bars secured to each set of twin valves, and the pinions intergearing with each set of rack-bars, respectively, and mounted on a common rock-shaft to shift the valves simultaneously, substantially as specified.

6. The combination, with the cylinders of a locomotive, of the pinion-shaft extending through the same, the pinions and rack-bars, the twin reversing-valves, the connecting-arm, and the rod extending to the cab, substantially as and for the purpose specified.

7. The combination, with the valve-chest, constructed in two sections, having cylindrical chambers extending from end to end thereof, and suitable ports, as described, of the reversing twin valves and their operating mechanism, and the piston-valves, whereby the direction of the induction and eduction of steam is changed for reversing, substantially as specified.

8. The combination, with the valve-rod and a support within which it slides, of the sword-arm or curved lever, the connecting-lever or rocker-arm, the sliding block pivoted thereto, and the box secured to the valve-rod, wherein said block is adapted to slide, substantially as specified, whereby the valve-rod is given a rectilinear movement.

9. The combination, with the steam-cylinders of a locomotive, of the twin valves, one set located on the outside of each cylinder, the rack-bars secured to each set of twin valves, the pinions intergearing with each set of rack-bars, respectively, and mounted on a common shaft to shift the valves simultaneously, and means whereby each set of twin valves may be operated independently of each other, substantially as specified.

10. The combination, with the reversing-valve of an engine, of a tube leading from an opening to the valve, and provided with a two-way cock and an oil-cup, whereby oil may be fed to the valve and any steam that may be confined between the valve and its cover permitted to escape alternately, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

PHILO MALTBY.

Witnesses:

J. R. NOTTINGHAM,
WILLIAM FITCH.