

No. 799,498.

PATENTED SEPT. 12, 1905.

B. SMARTT.
REVERSING VALVE.

APPLICATION FILED APR. 15, 1906.

3 SHEETS—SHEET 1.

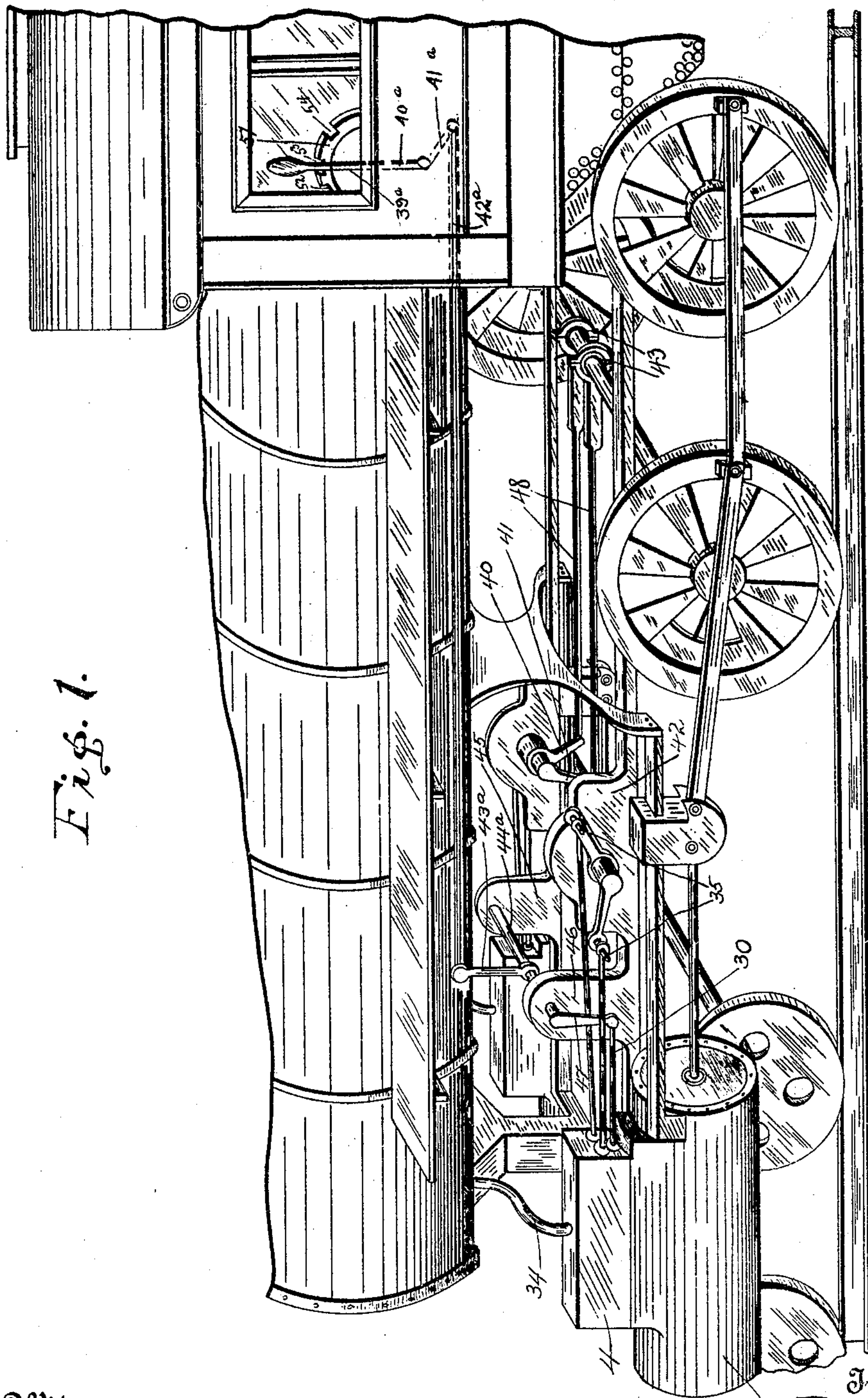


Fig. 1.

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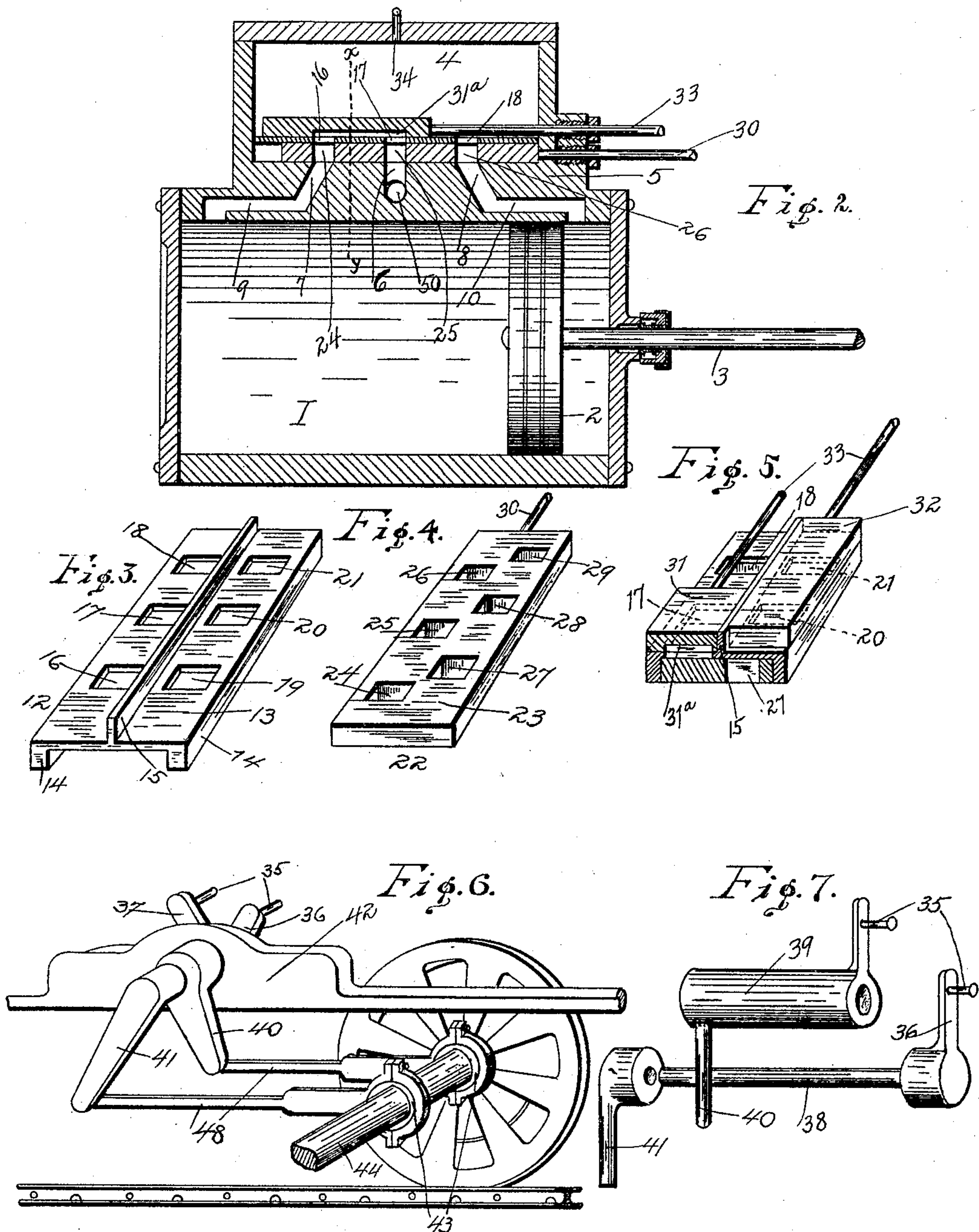
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3 SHEETS—SHEET 2.



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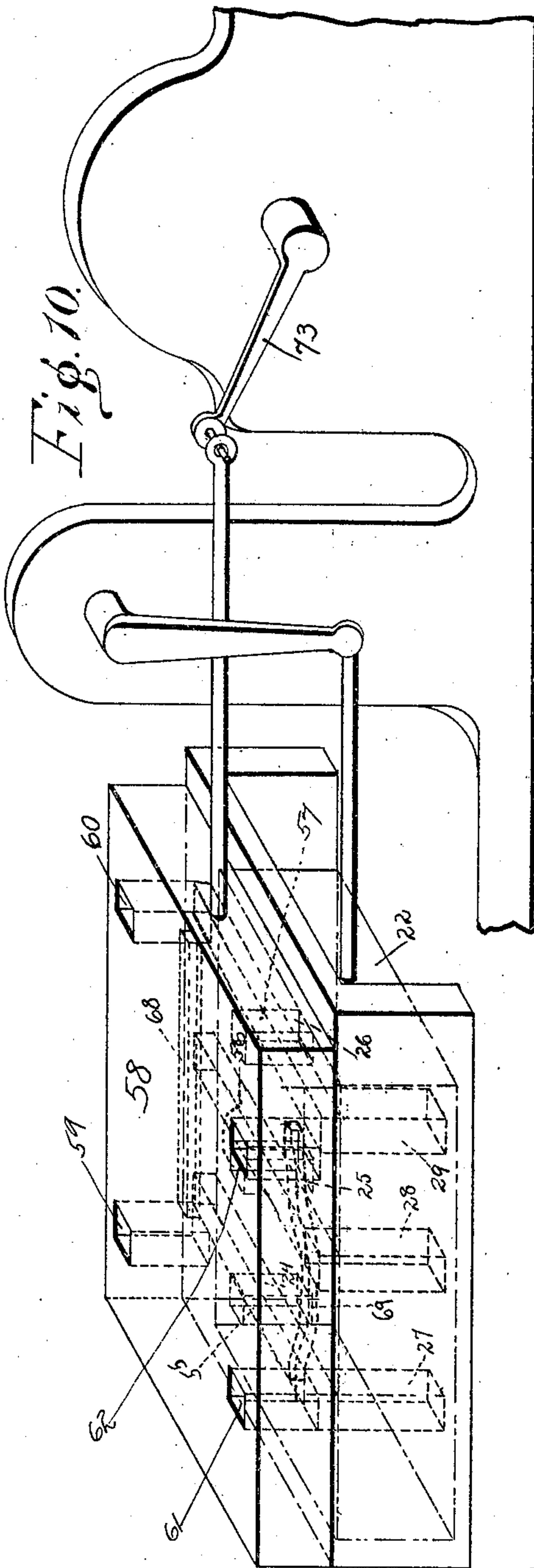
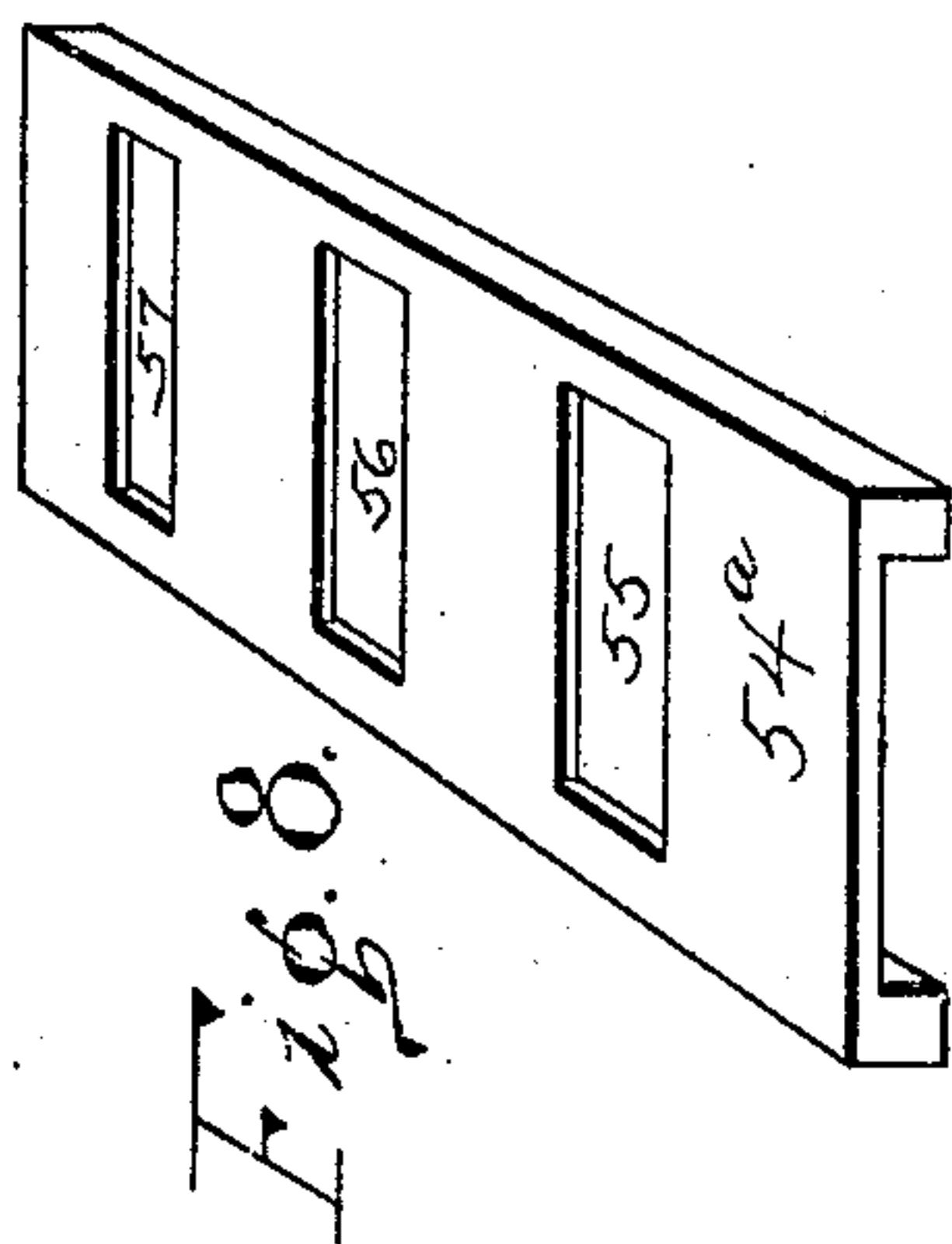
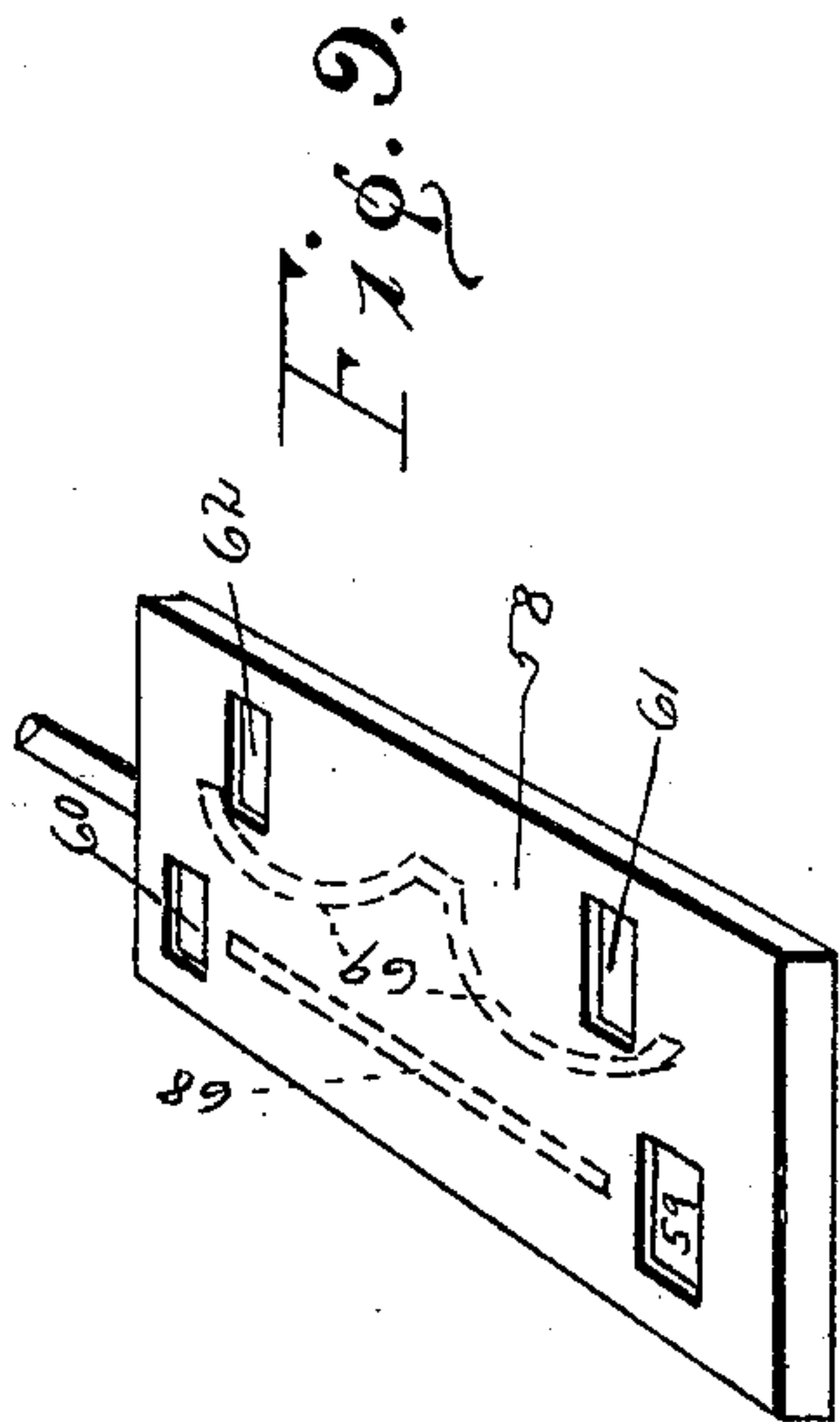
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

BRINAY SMARTT, OF NASHVILLE, TENNESSEE, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE SMARTT INVENTING AND MANUFACTURING COMPANY, OF NASHVILLE, TENNESSEE, A CORPORATION OF TENNESSEE.

REVERSING-VALVE.

No. 799,498.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed April 15, 1905. Serial No. 255,757.

To all whom it may concern:

Be it known that I, BRINAY SMARTT, a citizen of the United States, residing at Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Reversing-Valves; and I do hereby 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.

The object of my invention is generally the provision of a reversing-valve device, designed particularly for locomotive-engines, which shall be simple in construction and exceedingly reliable and positive in its action.

I do not confine my invention to application with locomotive-engines, as it may be employed in many other kinds of machinery wherever its use may be efficacious—such, for instance, as in stationary engines, steamboat-engines, steamship - engines, war - ship engines, automobile-engines, &c.

More specifically, the object is by the employment of my peculiarly-constructed reversing-valve with a short lever and intermediate connections to obviate the employment of the usual link-motion. Thus in a locomotive the operation of my reversing-valve device will be exceedingly easy as compared with the customary link arrangement, as the reversing-valve is with greatest facility and ease operated by a small lever (which may be about the size of the ordinary throttle-lever) conveniently located in the locomotive-cab.

By my invention a cumbersome six-foot lever, say, is supplanted by a small easily-operated lever, so that at the same time an engineer may operate the reversing-valve lever with one hand and the throttle-lever with the other hand.

As a matter of further and specific improvement I so construct the reversing-valve with relation to the other parts of the mechanism of my device that it may entirely cut off the steam from the cylinder when desired, thus taking the place and performing the function of the throttle when necessary.

Another object of my invention is by the peculiar construction in pairs of rocker-arms for operating the rods connected to the steam-valves (whereby the said rocker-arms work one within or through the other and

shifting the steam-valves in opposite directions, or right and left) to minimize space and to provide for ready and easy detachment or disconnection thereof, whereby one rocker-arm in a pair may be dispensed with in use, if desired.

With these objects in view and others appearing as the specification proceeds my invention consists in the novel construction, combination, and arrangement of parts of a device characterized by my invention, as will be hereinafter fully described in the specification, summed up in the claims, and illustrated in the drawings.

In the accompanying drawings, Figure 1 is a perspective view of a locomotive (the top and other portions thereof being broken away) embodying my invention and showing more particularly the arrangement of the rocker-arms and connecting mechanism for operating the rods connected to the steam-valves. Fig. 2 is a central vertical longitudinal section of the steam-chest and underlying cylinder, displaying the relation of the steam-valves and reverse-valve with relation thereto, the upright flange on top of steam-valve seat being omitted for the sake of clearness. Fig. 3 is a detached detail perspective view of the steam-valve seat. Fig. 4 is a detached detail perspective view of the reversing-valve. Fig. 5 is a view of a portion of the steam-valve seat and of the steam-valves thereon, the section being taken at line *xy*, Fig. 2, to show channel on under side of steam-valve. Fig. 6 is a detached perspective view, looking at the rear, of a pair of rocker-arms. Fig. 7 is a collective detail view of a pair of rocker-arms. Fig. 8 is a detail view of a form of steam-valve seat adapted more particularly for coöperation therewith of a single steam-valve. Fig. 9 is a detail view of a different form of steam-valve from that shown in Figs. 2 and 5. Fig. 10 is a detail view of the single valve shown in Fig. 9, of the steam-valve seat shown in Fig. 8, and of the reversing-valve shown in Fig. 4, showing more particularly the coöperation with the single steam-valve of a single rocker-arm.

In my invention and by my constructions either a pair of steam-valves and a pair of rocker-arms to operate the same or a single steam-valve and a single rocker-arm to operate the same may be used.

I will first describe the application of my invention in connection with a pair of steam-valves and a pair of rocker-arms cooperating therewith, and for this purpose, referring to the drawings, 1 designates a cylinder with a piston-head 2 and connected piston-rod 3 working therein. Above the cylinder 1 and connected therewith in any suitable manner is a steam-chest 4. In the wall or partition 5, which separates the steam-chest and underlying cylinder, I form a central exhaust-port 6 and on opposite sides thereof ports 7 and 8, which communicate with passages 9 and 10, leading to opposite ends of cylinder 1, all as clearly shown in Fig. 2.

Located in the chest 4 and supported in contact with wall 5 is my peculiarly-constructed removable steam-valve seat, (designated generally by 12, Fig. 3,) comprising, preferably, a substantially oblong-shaped plate 13, having flanges or downturned longitudinal edges 14 14, resting directly on wall 5, a central upturned flange 15, (shown in Fig. 3, but omitted in Fig. 2 for the sake of clearness of illustration of other parts,) and pairs of transverse openings 16, 17, 18, 19, 20, and 21, (constituting two series, one on each side of flange 15,) or each pair of openings, as 16 and 19—one opening of such pair on one side of upturned flange and the other opening of the pair on the opposite side of the flange—may be cut to form one elongated slot or opening, as shown in Fig. 8. It will be seen that my valve-seat is entirely separate and distinct from and unconnected to any part of the device, so that it may be removed at will, as when it is desired to substitute therefor the form of seat shown in Fig. 8, so that a single steam-valve of the form shown in Fig. 9 may be used. If my valve-seat were formed integral with or permanently connected to some other part of the device, as is usual, this could not be accomplished. The downturned flanges subserve the dual function of supporting the plate or seat proper, 13, and of guiding the reversing-valve, which it incloses, as presently described, and such peculiar and novel form of steam-valve seat I deem an important, essential, and valuable feature of my invention. Also located in chest 4 and supported in contact with wall 5 and working under and guided by flanges 14 14 of steam-valve seat 12 is my peculiarly-constructed reversing-valve, (designated generally by 22, Fig. 4,) and comprising, preferably, an oblong-shaped plate 23, having alternately-disposed or staggered transverse openings 24, 25, 26, 27, 28, and 29, these openings constituting two series, the transverse openings of one series being out of parallelism with the openings of the other series, all as clearly shown in Fig. 4. It will thus be noted that when the openings of one series on one side of reversing-valve are alined with similar openings on the same side of steam-valve seat 12, the openings of the other

series on the opposite side of valve-seat are blanked, and vice versa. It will be understood that instead of having the two series of openings in steam-valve seat 12 in transverse alignment and the two series of openings in reversing-valve 22 staggered I may have the series of openings in the valve-seat 12 staggered and the series of openings in reversing-valve 22 in transverse alinement, as would be entirely obvious.

The openings for passage of steam are so arranged, as shown, that when the reversing-valve 22 is at a point in the middle of its range of movement from one end of steam-chest to the other all ports are closed or blanked, thus effectively cutting off the steam from cylinder, wherefore my reversing-valve may be used instead and to perform the function of the throttle when necessary or desired. This is a most eminently valuable feature of my invention. By my invention if the throttle-valve refuses to work in an emergency of this nature my reversing-valve comes into timely use to stop the engine.

Supported on the valve-seat 12 are two steam-valves 31 32, having steam-exhaust channels or passages 31^a on their under surfaces, rods 33 connecting with the valves, said steam-valves working right and left, changing steam from fore to aft, and being governed by eccentrics on drive-wheels.

Communicating with steam-chest 4 is inlet steam-pipe 34.

The construction and operation of the rocker-arm, forming an important feature of my invention, will now be described.

Connecting by pins 35 with steam-valve rods 33 are a pair of rocker-arms 36 37, integral with shanks 38 39, extending at right angles to the rocker-arms and passing through box 42, suitably supported on the running-gear of the engine, the shank 38 being reduced and the shank 39 hollow, whereby shank 38 telescopes into shank 39, one shank thus working in or through the other. Shank 39 terminates in integral right-angularly-formed crank 40, and the shank 38 is suitably secured to right-angularly-formed crank 41, cranks 40 and 41 being pivotally connected to eccentric-rods 48, operated by eccentrics 43 on drive-shaft 44. The arrangement just described effects a shifting of the steam-valves 31 32 in opposite directions, or right and left. In operation rocker-arms 36 37 approach and pass each other and continue moving until each occupies the original starting position from which the other has just moved. The rocker-arms again approach and pass each other, continuing as before, and so on, thus effecting an alternate shifting of the steam-valves or a shifting thereof in opposite directions, right and left.

The advantage of my construction of rocker-arms as just described is that, first, it economizes space, a pair of my rocker-arms

occupying the space usually occupied by one rocker-arm, and, second, it provides for ready and easy detachment or disconnection thereof when it is desired to use only one rocker-arm, and thus discard the other, as for the purpose presently appearing.

The reversing-valve 22 is controlled by connected rod 30 and by reverse-lever 39^a (the latter conveniently located in the cab of the engine—as, for instance, directly under the throttle-lever, not shown—and being preferably of the same size as the throttle-lever) through intermediate mechanism, which may be as follows: Reverse-lever 39^a, through link 41^a, imparts movement to rocker-shaft 42^a, pivoted to crank 43^a, rigidly secured to rocker-shaft 44^a, suitably journaled in supporting-bearings 45 46, the rocker-shaft 44^a connecting with crank 47, pivoted to rod 30, controlling reversing-valve 22. Reversing-lever 39^a may work in an arc-plate 51, which may be provided with three notches, the arc-plate describing the path of movement of the reversing-lever 39^a, so that when the latter is moved to rest in the middle notch of the arc-plate the reversing-valve 22 will thereby have been moved to a point about the middle of its extent of movement from one end of steam-chest to the other, all steam-ports being thus blanked, effectively cutting off passage of steam to steam-cylinder. In this manner and by this construction reversing-valve 22 may be used instead of the throttle when the latter breaks or refuses to work in any emergency.

In operation the movement of the steam is as follows, supposing that the openings 24, 25, and 26 in right-hand side of reversing-valve 22 are in register with corresponding openings 16, 17, and 18 in steam-valve seat 12, (see Fig. 2:) Steam enters steam-chest 4 through pipe 34, passing through opening 18 in steam-valve seat 12, (in right-hand side thereof,) thence through corresponding opening 26 in reversing-valve 22, thence into port 8 in division-wall 5, thence into passage 10, and out into the cylinder 1 at the right-hand end thereof, forcing piston-head back or inward to the left-hand end of the cylinder. This movement of piston-head forces dead steam through passage 9 and communicating port 7 in division-wall 5, thence through opening 24 in reversing-valve 22, into channel 31^a on under side of steam-valve 31, to and through port 6, thence into exhaust-chamber 50, connecting with smoke-stack. The position of the steam-valve 31 when the steam is taking the course just described is toward left-hand end of steam-chest 4. When the piston-head is forced outward, eccentrics change steam-valves, so that the valve 31 is moved or pulled outward and valve 32 forced inward, thus changing course of steam from fore to aft. To reverse engine, the engineer pulls reversing-lever 39^a from one end of arc-

plate to the other end thereof, whereby the reversing-valve 22 is moved so that openings 16, 17, and 18 will be blanked and the openings 27, 28, and 29 in reversing-valve brought into register with openings 19, 20, and 21 of steam-valve seat 12, thus reversing the direction of movement of the engine, as is obvious. If the engineer desires to stop the engine without the use of the throttle, as when the throttle breaks or any like emergency, he simply pulls reversing-lever 39^a into the central notch of arc-plate, as described, when all steam ports and openings will be blanked.

Referring to Figs. 8, 9, and 10 of the drawings, I have shown a slightly-modified form of steam-valve and in the device of which figures only one steam-valve is used instead of two and only one rocker-arm instead of two, as before. The steam-valve seat used in connection with this latter construction may be the same as that designated by 12, Fig. 3, except that the central upturned flange 15 is omitted, or it may be formed as shown in Fig. 8 and designated generally by 54^a, the only difference between this form and that shown in Fig. 3 being that the central upturned flange 15 of Fig. 3 is omitted, and the openings are preferably not in two series, as shown in Fig. 3, but are preferably elongated, as shown at 55, 56, and 57, (the two series of openings shown in Fig. 3 being thus merged into one series.) The reversing-valve used in connection with this single steam-valve form is exactly the same as shown in Fig. 4 (designated by 22) and as fully described in connection with that figure, and when describing the parts shown in Figs. 8, 9, and 10 in connection with the reversing-valve attention is directed back to the illustration of the reversing-valve in Fig. 4. It will be noted that when openings 24, 25, and 26 of reversing-valve 22 are in register with openings 55, 56, and 57 of steam-valve seat 54^a openings 27, 28, and 29 of reversing-valve 22 are out of register with such openings 55, 56, and 57 of steam-valve seat, and vice versa. The form of steam-valve shown in Fig. 9 (designated generally by 58) is made and arranged to occupy the space used by the two steam-valves shown in Fig. 5. Said steam-valve 58 has four staggered openings therethrough, (designated by 59, 60, 61, and 62,) so arranged that (assuming openings 24, 25, and 26 of reversing-valve 22 to be in register with openings 55, 56, and 57 of steam-valve seat 54 and openings 27, 28, and 29 of reversing-valve 22 therefore out of register with such openings 55, 56, and 57 of steam-valve seat) when opening 60 is in register with opening 57 of steam-valve seat all other openings in steam-valve 58 will be blanked, and, vice versa, when opening 59 is in register with opening 55 of steam-valve seat all other openings in the steam-valve will be blanked. The exhausting steam escapes by means of channel 68 or channel 69, peculiar-

iarily positioned and formed in the lower surface of steam-valve 58. Suppose steam to be entering through opening 60 of steam-valve. In this position all other openings of steam-
 5 valve are blanked, as stated. But one end of exhaust-channel 68 is then in communication with opening 55 of steam-valve seat 54, and consequently with alined opening 24 of reversing-valve 22, and escaping dead steam is
 10 then coming up through opening 24 of reversing-valve 22 and through alined opening 55 of steam-valve seat, into and through exhaust-channel 68 (one end of which is then in communication with such alined openings 24 and
 15 55) to alined openings 56 and 25 in steam-valve seat and reversing-valve, respectively, whence it escapes through the exhaust-port in division-wall to exhaust-chamber, as previously explained in connection with Figs. 1
 20 to 7. At the next movement of steam-valve 58 steam enters through opening 59 thereof and exhausting dead steam is coming up through alined openings 26 and 57 in reversing-valve 22 and steam-valve seat 54, respectively, thence into exhaust-channel 68 of
 25 steam-valve 58, one end of which in this position of steam-valve is then in communication with the alined openings 57 and 26 in steam-valve seat and reversing-valve, respectively, to alined openings 56 and 25 in steam-
 30 valve seat and reversing-valve, respectively, whence it escapes through exhaust-port in division-wall to exhaust-chamber, as previously explained in connection with Figs. 1 to 7. Suppose the reversing-valve 22 be moved,
 35 placing openings 27, 28, and 29 therein in register with openings 55, 56, and 57 of steam-valve seat (thereby blanking openings 24, 25, and 26 of reversing-valve) and suppose opening 62 of steam-valve to be in register with
 40 alined openings 57 and 29 for entrance of steam, (all other openings in steam-valve 58 being thereby blanked.) Steam enters through these registering openings 62, 57, and 29 and exhausting dead steam is coming
 45 up through alined openings 27 and 55 in reversing-valve and steam-valve seat, respectively, into exhaust-channel 69 (one end of which is then in communication with such alined openings 55 and 27) to alined or registering
 50 openings 56 and 28 in steam-valve seat and reversing-valve, respectively, whence it escapes into port in division-wall to exhaust-chamber, as described in connection with Figs. 1 to 7. At the next movement of steam-valve opening 61 is in register
 55 with alined openings 55 and 27 of steam-valve seat and reversing-valve, respectively, and exhausting dead steam is coming up through alined or registering openings 29 and 57 in reversing-valve and steam-valve seat, respectively, thence into and through channel
 60 69 on lower surface of steam-valve (one end of which exhaust-channel is in this position of the steam-valve in communication with
 65 of the steam-valve in communication with

such alined openings 57 and 29) into opening 56 of steam-valve seat, whence it escapes to exhaust port and chamber, as described in connection with Figs. 1 to 7. Only one
 70 rocker-arm is necessarily employed with this form of single valve construction, and this rocker-arm 73 is connected up to steam-valve in the manner described in connection with Figs. 1 to 7.

Various modifications may be made in minor details of construction without affecting the spirit of the invention.

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

1. The combination with a cylinder and a steam-chest, of a removable, unattached steam-valve seat within the steam-chest and formed as a plate having downturned longitudinal supporting-flanges resting on top of the
 85 steam-chest and provided with two port-bearing regions, a normally stationary reversing-valve beneath the valve-seat and inclosed and guided in its movement by the flanges of said plate, the reversing-valve being constructed
 90 to expose simultaneously half only of each of said port-bearing regions and arranged, upon movement, to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat and operating to alternately un-
 95 cover the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one half of each region while the other is uncovered and vice versa.

2. The combination with a cylinder and a steam-chest, of a removable, unattached steam-valve seat within the steam-chest and formed as a plate having downturned longitudinal supporting-flanges resting on top of the
 100 steam-chest and provided with two port-bearing regions, a normally stationary reversing-valve beneath the valve-seat and inclosed and guided in its movement by the flanges of said plate, the reversing-valve being constructed
 105 to expose simultaneously half only of each of said port-bearing regions and arranged, upon movement, to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat and operating to alternately uncover
 110 the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one half of each region while the diagonally opposite half of the other region is uncovered and vice versa.

3. The combination with a cylinder and a steam-chest, of a removable, unattached steam-valve seat within the steam-chest and formed as a plate having downturned longitudinal supporting-flanges resting on top of the steam-
 120 chest and provided with two port-bearing regions, a normally stationary perforated reversing-valve beneath the valve-seat and inclosed and guided in its movement by the flanges of said plate, the reversing-valve being
 125 constructed to expose simultaneously half
 130

only of each of said port-bearing regions and arranged, upon movement, to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat and operating to alternately uncover the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one half of each region while the other is uncovered and vice versa.

4. The combination with a cylinder, and a steam-chest, of a removable, unattached steam-valve seat within the steam-chest and formed as a plate having downturned longitudinal supporting-flanges resting on top of the steam-chest and provided with two port-bearing regions, a normally stationary reversing-valve beneath the valve-seat and inclosed and guided in its movement by the flanges of said plate and provided with staggered openings, said reversing-valve being constructed to expose simultaneously half only of each of said port-bearing regions and arranged upon movement to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat and operating to alternately uncover the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one half of each region while the other is uncovered and vice versa.

5. The combination with a cylinder and a steam-chest, of a removable, unattached steam-valve seat within the steam-chest and formed as a plate having downturned longitudinal supporting-flanges resting on top of the steam-chest and provided with two port-bearing regions, a normally stationary reversing-valve beneath the valve-seat and inclosed and guided

in its movement by the flanges of said plate, the reversing-valve being constructed to expose simultaneously half only of each of said port-bearing regions and arranged, upon movement, to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat, channeled for passage of exhausting steam on its under surface, and operating to alternately uncover the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one half of each region while the other is uncovered and vice versa.

6. The combination with a cylinder and steam-chest, of a removable, unattached steam-valve seat within the steam-chest and provided with supporting-flanges and with two port-bearing regions, a normally stationary reversing-valve beneath said valve-seat and inclosed and guided in its movement by the flanges of said seat, said reversing-valve being constructed to expose simultaneously half only of each of said port-bearing regions and arranged, upon movement, to reverse such exposure; and a valve mechanism reciprocating on the steam-valve seat and operating to alternately uncover the exposed halves of the two port-bearing regions, said mechanism being constructed to cover one-half of each region while the other is uncovered and vice versa.

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

BRINAY SMARTT.

Witnesses:

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J. P. RHINES.