(No Model.)

3 Sheets—Sheet 1.

F. F. ROSE.

HYDRAULIC VALVE MOTION FOR LOCOMOTIVES.

No. 330,927. Patented Nov. 24, 1885.

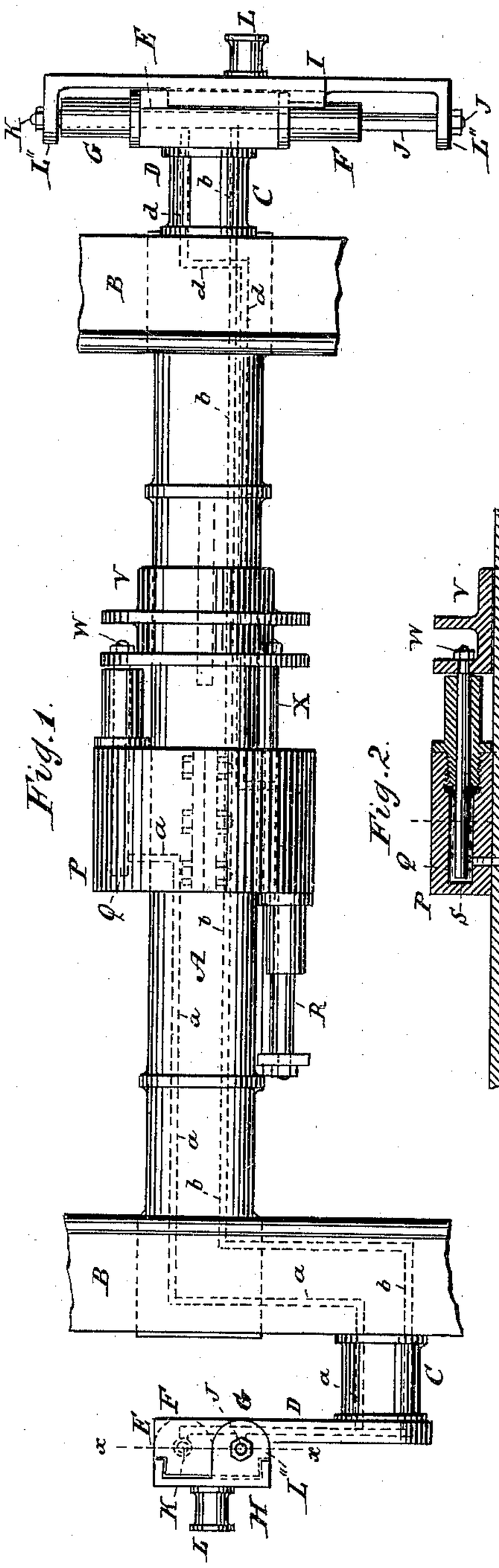

Fig. 1.

Fig. 2.

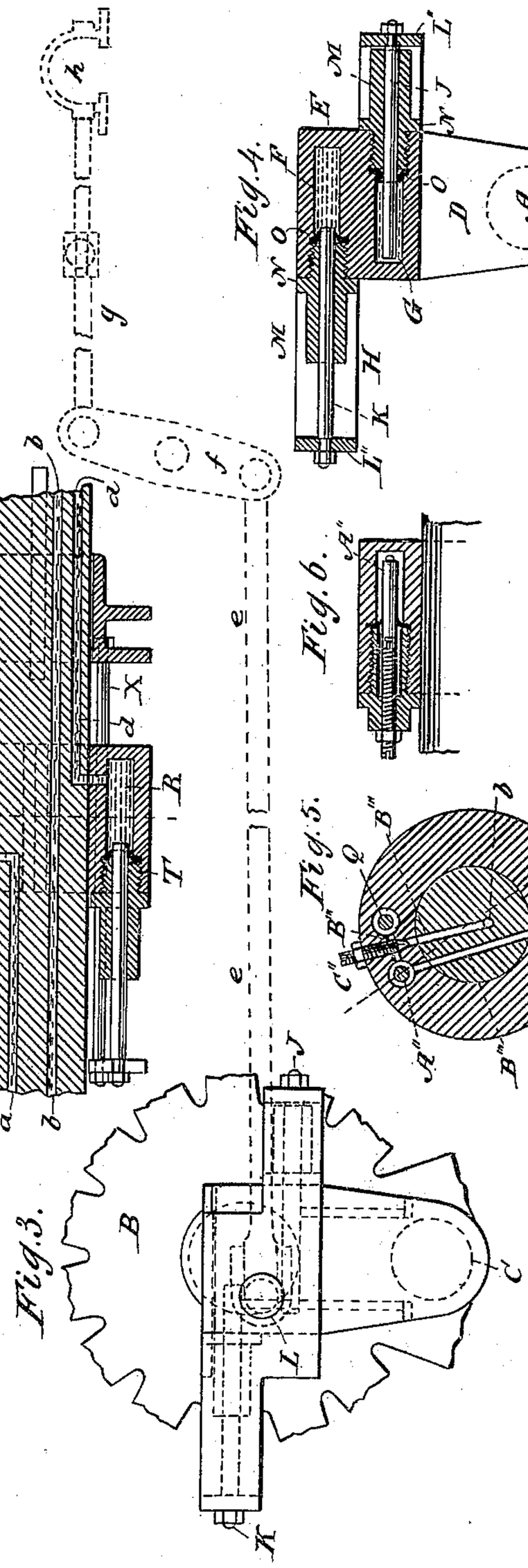

Fig. 3.

Fig. 4.

Fig. 6.

Fig. 5.

WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 9.

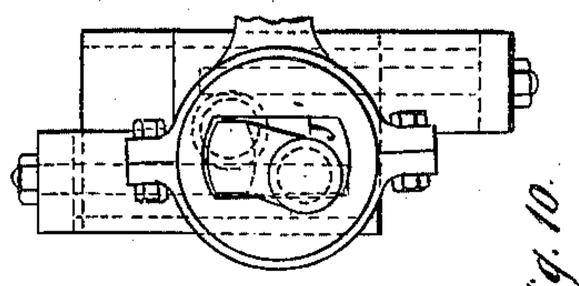

Fig. 10.

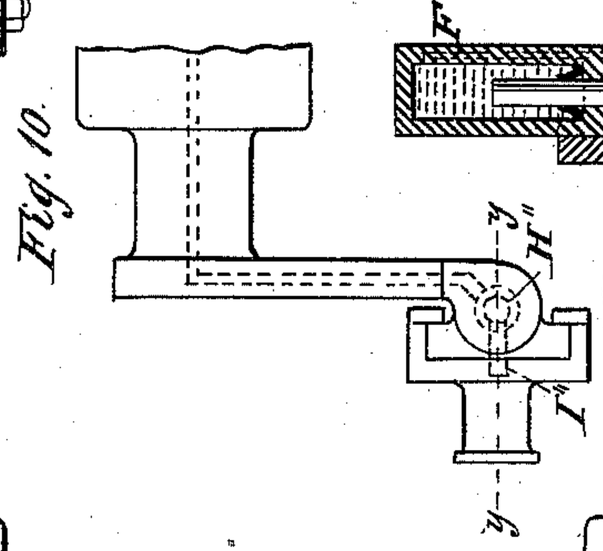

Fig. 7.

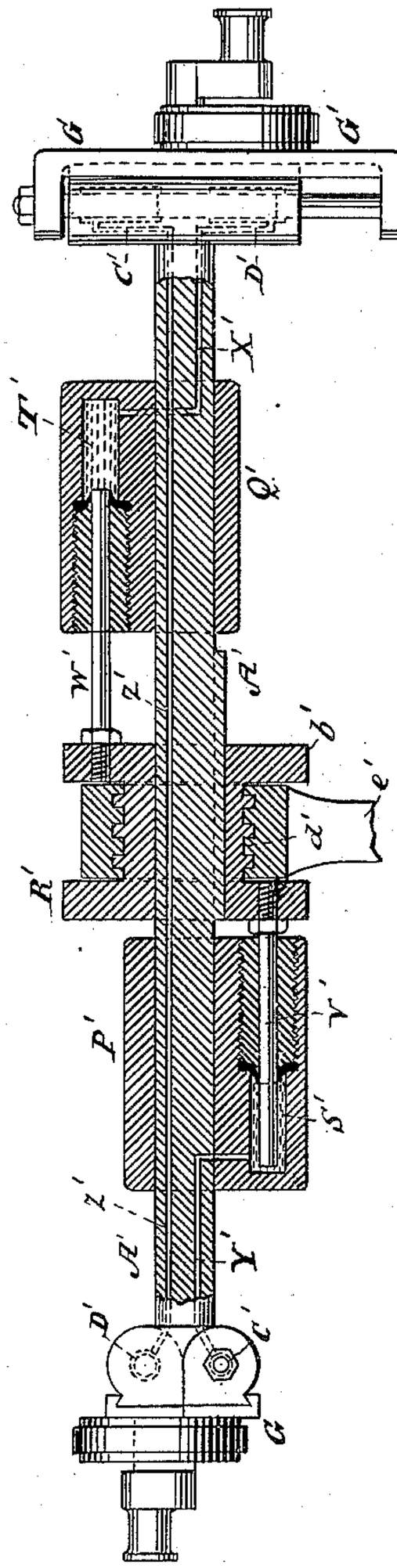

Fig. 8.

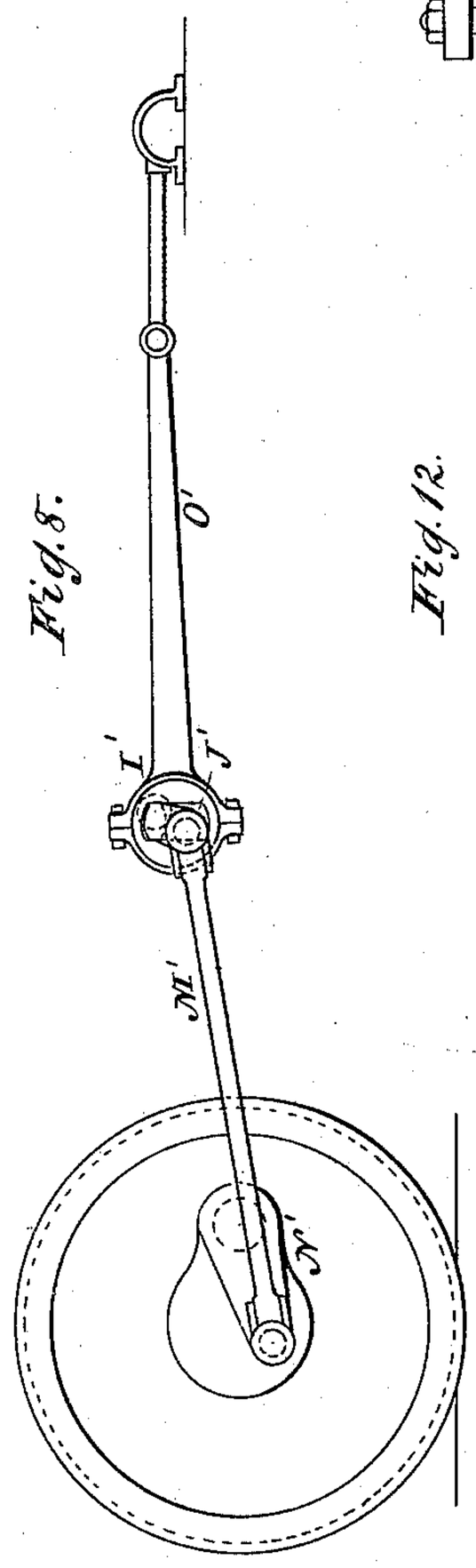

Fig. 12.

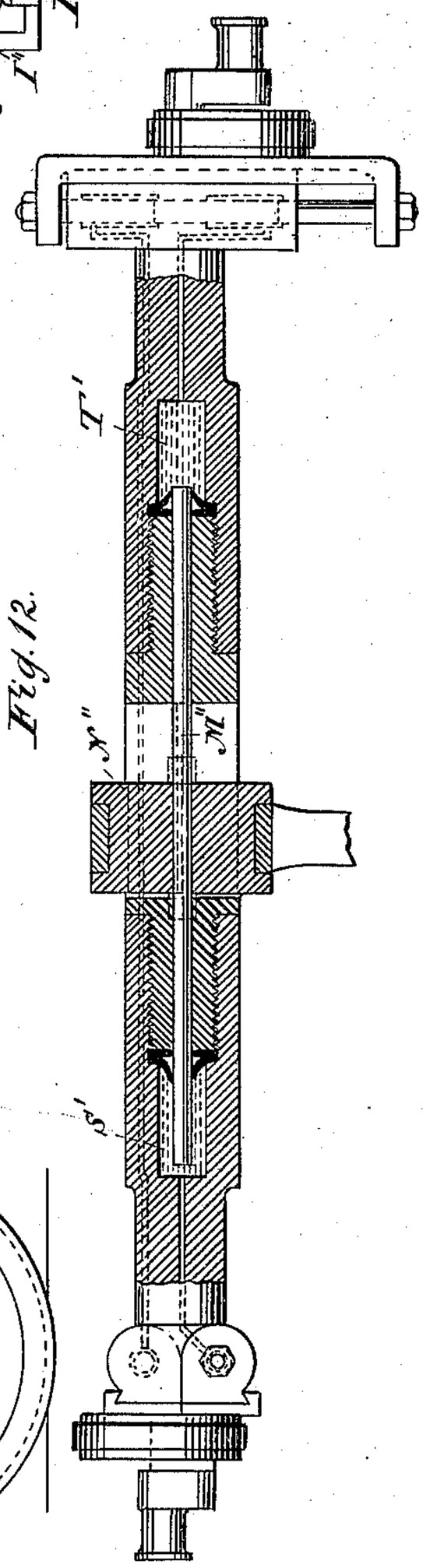

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Fig. 14.

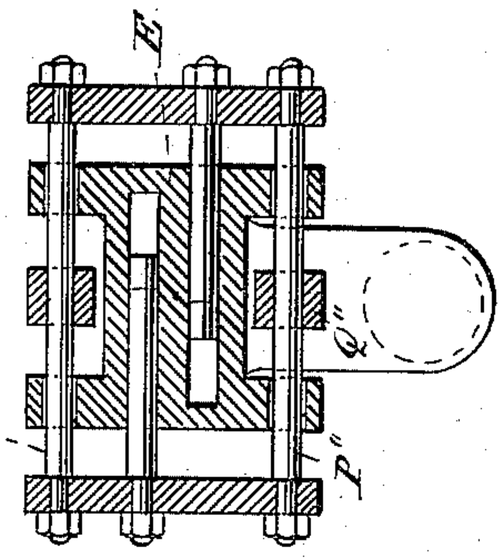


Fig. 15.

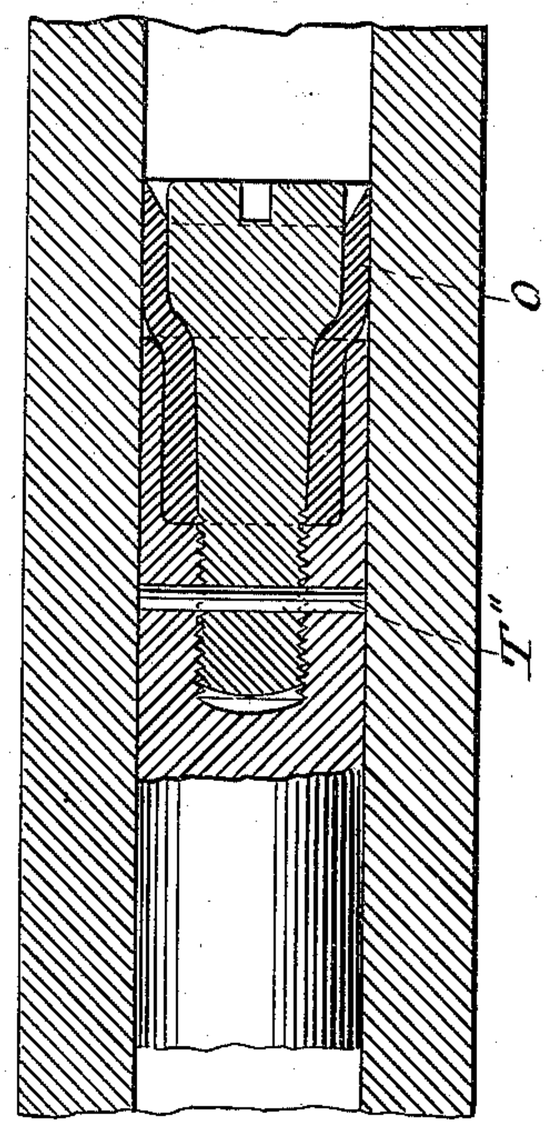
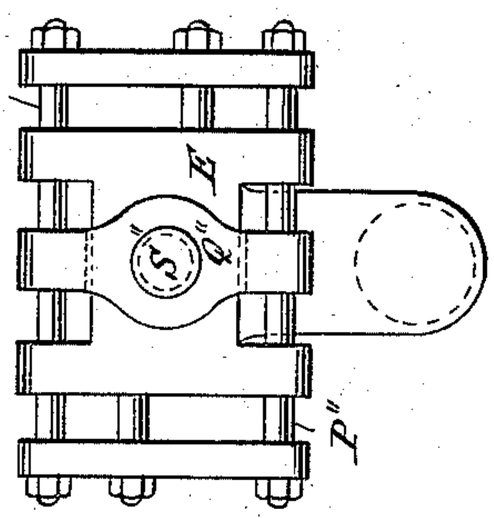


Fig. 13.



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UNITED STATES PATENT OFFICE.

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HYDRAULIC VALVE-MOTION FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 330,927, dated November 24, 1885.

Application filed April 20, 1885. Serial No. 162,762. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK F. ROSE, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Hydraulic Valve-Motions for Locomotives, &c., of which the following is a specification.

The invention relates to improvements in locomotive-engines; and it consists in novel hydraulic mechanism for controlling the movement of the valves, as hereinafter fully described.

The object of the invention is to produce an efficient mechanism for moving the valves without the use of the present link-motion now universally employed for this purpose, and which mechanism will be reliable, inexpensive as compared with the link-motion, and perfect in its movements.

Referring to the accompanying drawings, Figure 1 is a side elevation of the driving-shaft of a locomotive embodying my invention. Fig. 2 is a central vertical longitudinal section of the central portion of said shaft. Fig. 3 is a side elevation of one of the driving-wheels of the locomotive, illustrating the end of the driving-shaft having the invention applied to the crank-pin, and the valve-rod, rocker-shaft, and valve, the latter devices being shown by dotted lines. Fig. 4 is a sectional view taken on the line *x x* of Fig. 1. Fig. 5 is a vertical section on the line 1 2 of Fig. 2. Fig. 6 is a detached section on the line 3 4 of Fig. 5. Fig. 7 is a longitudinal sectional view of a modified form of the invention applied to a supplemental shaft forward of the driving-shaft of the locomotive. Fig. 8 is a side elevation of one driving-wheel of the locomotive, and illustrating an end view of the supplemental shaft shown in section in Fig. 7 in connection with the valve-rods of the engine. Fig. 9 is an end view of the supplemental shaft shown in Fig. 7. Fig. 10 is an enlarged side elevation of one end of a modified form of the invention. Fig. 11 is a transverse section on the line *y y* of Fig. 10. Fig. 12 is a central longitudinal section of a modified form of the invention. Fig. 13 is a modified form of the slide for the ends of the shaft. Fig. 14 is a central vertical section of same; and Fig. 15 is an enlarged sectional view of one of the plungers, carrying the leather packing on its end.

I will first describe the invention as it appears in Figs. 1 to 4, inclusive, and then explain the modifications thereof illustrated in the remaining figures of the drawings.

In Figs. 1 to 4, inclusive, A denotes the main driving-shaft of the locomotive, B the driving-wheels, and C the crank or wrist pins on the face of the wheels, and at a suitable distance from the center thereof to permit a proper throw of the usual piston-rods, which are in connection with the customary pitman-rods having their rear end secured on the said pins. The pins C are at right angles to each other, and upon their outer ends are firmly applied the arms D, extending toward the driving-shaft, and having upon their free extremities the blocks or enlargements E, in which are bored from opposite sides the chambers F and G, (see Fig. 4,) and upon the outer face of which are arranged in suitable grooves the slides H I, carrying the plungers J K and (upon their outer face) the pins L, upon which the valve-rods are secured, as indicated in Fig. 3. The chambers F G in the blocks E are side by side, and open in opposite directions, and the plungers J K are arranged one on each end of the slides H I, in suitable relation to enter and have a direct movement in the chambers F G, as hereinafter explained. Upon each end of the slides H I is an inwardly-projecting lug, L″, to which one of the plungers J K is secured by a nut, as shown in Fig. 4, or otherwise, as may be found convenient. The outer end of the chambers F G is slightly enlarged, and into this portion is screwed the plug M, having an annular shoulder or stop, N, which abuts against the end of the block E, as indicated in Fig. 4. The screw-plugs M are centrally bored to permit the passage through them of the plungers J K and retain at their lower ends the packing O against the shoulder formed by the enlargement of the outer ends of the chambers F G. The packing O encircles the plungers, which are smaller in diameter than their chambers, and effectually prevents the escape of liquid.

Upon or about the center of the driving-shaft A is provided a collar, P, in which are formed chambers (lettered Q R, respectively) having screw-plugs and plungers S T, corresponding to the similarly-named devices applied to the blocks E, above mentioned. The chambers Q R are parallel with the shaft A and open in opposite directions for convenience in operating their plungers, and to the right of the collar P is arranged on the shaft the sliding collar or sleeve V, having an annular groove, W, and to which collar is directly secured the plunger S, the plunger T being directly connected with the same through a supplemental rod, X. Upon the collar V being moved toward the collar P the plunger S will be moved into and the plunger T from their respective chambers Q R, and upon a reverse movement of the collar P the plungers will assume an opposite position.

The collar V will be operated by the engineer in his cab through a system of levers of any suitable construction connecting with the collar, the connection being preferably a clutch fitting into the groove W, as indicated in Fig. 12. The chamber F at the left-hand end of the shaft A is connected by a channel, *a*, with the chamber Q in the collar P. The chamber G at the left-hand end of the shaft A is in communication with the chamber F at the right-hand end of the shaft by means of a channel, *b*, passing through the shaft, and the chamber R in the collar P and the chamber G at the right-hand end of the shaft are joined by the channel *d*. The slides H I, the plungers, and other parts described being in position, the channels and chambers specified will be charged with a liquid—such as oil or water, for example—under heavy pressure—say about five thousand pounds to the square inch, more or less, according to circumstances—when the mechanism will be ready for use. The valve and piston rods being in connection with the wrist-pins C L, the adjustment of the valves will be accomplished by simply moving the slides H I on the blocks E until the valve-rods have the proper throw, instead of by the expensive method heretofore practiced of constructing eccentrics of given proportions and affixing them in permanent position on their pins. The movement of the slides H I is simultaneous, as hereinafter described, and their position determines that of the pins L, and also consequently the movement of the engine-valves. The engine may be reversed by simply moving the slides H I, causing thereby the pins L to approach or recede from the cylinders. For instance, referring to Fig. 3, if the slide H were moved toward the cylinder, the position of the pin L would be forward of that it is shown to occupy, the connecting-rod *c* and lower end of the rocker-shaft lever *f* would be pushed forward, while the upper end of the latter and the valve-rod *g* and valve *h* would be retracted. The employment of the slides H I and pins L dispenses entirely with the usual eccentrics and link-motion mechanism now universally used on locomotive-engines.

The method of giving the slides H I their proper movement simultaneously is of prime importance, and to accomplish this result in a simple manner, yet with certainty and accuracy, I employ hydraulic means, the particular operation of which will appear below.

In the position of the parts illustrated in Figs. 1, 2, and 4 it will be observed that the plungers K on each end of the shaft and the plunger S in the collar P are depressed into their respective chambers, and under this condition the position of the slides H I and pins L is such that the engine will impel the carriage forward. When it is desired to reverse the engine, the engineer will simply move the sliding collar V toward the right, thereby withdrawing the plunger S from its chamber Q and forcing the plunger T into its chamber R, at which time the pressure of liquid in the chamber F at the left-hand end of the shaft A and in the channel *a* will be relieved into chamber Q, and that in the chamber R is forced into the channel *d* and chamber D at the right-hand end of the shaft. The increase of pressure in the chamber G at the right-hand end of the shaft A and the simultaneous decrease in pressure in the chamber F at the left-hand end of the shaft operate to force the plunger K from said chamber G, thereby moving the slide I and driving the plunger J at the right-hand end of the shaft A into its chamber F, the liquid previously in which being impelled into the channel *b* and the chamber at the left-hand side of the shaft, whereby the plunger K in said chamber will be forced therefrom, changing the position of the slide H and pin L. The movement of the slides at each end of the shaft are simultaneous, and it will be observed that they are caused by altering the pressure from one to the other of the chambers at opposite ends of the shaft. The slides H I and pins L may be returned to their former position, being that shown in Fig. 1, by the engineer's simply moving the sliding collar V toward the collar P, whereby a reverse flow of the liquid in the channels *a b d* will occur and the slides H I assume their former positions.

I have used the expressions "increase" and "decrease" as applying to the pressure in the chambers at opposite ends of the shaft; but these must be understood in a qualified sense, since the actual pressure of the liquid is the same at all times in all parts of the apparatus, and the word "decrease" meaning that additional space is afforded by the withdrawal of the plunger at one end of the shaft, while the "increase" is simply the inward movement of the plunger at the opposite end of the shaft sufficiently far to move the liquid into the said space at the said end of the shaft first mentioned. The liquid in the channels and chambers of the shaft being always under the same pressure, the plungers and slide V may be

moved with the slightest exertion, and when moved will rigidly maintain their position.

The channels *a b d* may be charged with the liquid at any suitable point desired; but I prefer to connect them and the chambers Q R with a supplemental chamber, A″, by channels or passages B‴, as shown in Fig. 5, and to charge them with the liquid through this chamber. The passages B‴ will cross each other at a given point, at which there will be provided a screw-valve, C″, which will be screwed to place after the channels have been charged, and thus cut off the supply and prevent leakage. After the channels have been charged and the screw-valve C″ seated, the chamber A″ may be charged and used as a reservoir or pump, whereby should any leakage occur at any point of the mechanism, so as to lower the pressure in the channels the same might be compensated for by elevating the screw C″ from its seat and forcing the plunger D″ into the chamber A″, driving a portion of the liquid therein into the said channels through the passages B‴, after which the screw-valve should be again seated. The extra chamber A″, with its plunger, thus acts as a pump permanently carried by the driving-shaft, and while it might never be required it may be provided as a precautionary measure.

In lieu of providing the main driving-shaft with the liquid channels and chambers, the same may be applied to a separate shaft, A′, located forward of the driving-shaft, substantially as indicated in Figs. 7 and 8. Upon the ends of the supplemental shaft are the blocks B, arranged at right angles to each other and containing at opposite ends the chambers C′ D′, in which move the plungers E′ F′, carried by the slides G′. The plungers E′ F′ are suitably packed, as in the arrangement shown in Fig. 1, and are retained in a set position by nuts H′. Upon the outer face of each of the slides G′ is cast the eccentric I′, having a central elongated slot, J′, (shown in Fig. 9,) through which the shaft A′ projects, and beyond which the ends of said shaft are provided with cranks K′, having pins L′. From the crank-pins L′ connecting-rods M′ pass to the cranks N′ on the main driving-shaft, as indicated in Fig. 8, while the eccentrics I′ sustain the rear ends of the valve-rods O′. That portion of the shaft A′ within the elongated slots J′ is from the center of the main part of the shaft, and is reduced on opposite sides, as shown in Fig. 9. The movement of the slides G′ is the same as that of the slides H I, (shown in Fig. 1,) and to effect this movement I provide on the shaft A′ collars P′ Q′, and between them a slide, R′, the former containing liquid-chambers S′ T′, and the latter carrying plungers V′ W′, arranged to have a movement in the chambers when the slide is actuated. The chamber T′ communicates through a passage, X′, with the chamber D′ at one end of the shaft. The chamber S′ is connected by a passage or channel, Y′, with the chamber C′ at the opposite end of the shaft, and the chamber D′ at the left-hand end of the shaft opens into a channel, Z′, which leads into the chamber C′ at the right-hand end of the shaft. Upon the slide R′ being moved either to the right or left, the plungers V′ W′ will actuate the liquid in the channels and chambers to move the slides G′ in lines at right angles to each other, in a manner exactly similar to the operation of the plungers S T in the arrangement shown in Fig. 1. Between the annular shoulders *a′* the slide R′ is provided with annular elevations *b′*, corresponding with and entering the annular internal depressions, *d′*, in the lever *e′*, for the purpose of dividing or distributing the lateral pressure of the lever *e′* when moved over an increased area. The movement of the slides G′ on the reduced ends of the shaft A′ alters the throw of the valve-rods, and this operation is wholly within the control of the engineer.

The modification shown in Figs. 10 and 11 consists, essentially, in combining the two plungers at each end of the shaft, so as to use a single rod, H″, for them, and in arranging the chambers F G to receive the ends of the rod. A pin, I″, connected with the rod H″, enters an aperture in the slide J″, carrying the wrist-pin, and communicates the motion of the plunger-rod to the slide.

The modification shown in Fig. 12 differs from the construction illustrated in Fig. 7 only in the fact that the chambers S′ T′ are located within the shaft A′, and that a single rod, M″, answers as a plunger for both of said chambers, being connected with a slide, N″, located in an elongated slot cut transversely through the shaft.

It is not to be understood, of course, that I limit myself to the employment of slides H I of the construction shown in Fig. 1, since these may be modified without departing from the spirit of the invention. For example, I illustrate one modification of the slide in Figs. 13 and 14, wherein the usual block, E, is bored at opposite sides to receive rods P″, connected by the cross-heads Q″, which carry the plungers, and are sufficiently removed from the blocks to permit a proper movement of the plungers in their respective chambers. Upon the central parts of the rods P″ is rigidly affixed the cross-bar R″, upon which is the wrist-pin S″, and which moves with the rods and cross-heads when the liquid in the chambers acts against the plungers.

The packing O is shown in Fig. 4 as being held in place by the plugs M; but it may be secured in any suitable manner, as in the ordinary hydraulic jack, or on the end of the plungers, in the manner shown in Fig. 15, wherein it will be seen that the lower end of the plunger is hollow, and that the leather packing is secured therein by a screw, which is prevented from turning by a pin, T″.

While I have described my invention as being applied to a locomotive-engine for pur-

poses of explanation, I reserve the right to employ it in connection with any engine which has heretofore used the link-motion.

The liquid to be employed in the liquid chambers and channels will be water, oil, alcohol, or of any nature suitable for the purpose.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an engine, the mechanism for controlling the movement of the valves, consisting of a shaft, a slide on the shaft carrying plungers, liquid-chambers to receive said plungers, a slide at each end of the shaft, one extending at right angles to the other and each carrying plungers, and a pin or support for the valve-rod, liquid-chambers at the end of the shaft to receive said last-mentioned plungers, and chambers connecting said liquid-chambers so that a movement of the slide on the shaft will cause the liquid to move the end slides and the rear end of the valve-rod, substantially as and for the purposes expressed.

2. In an engine, the mechanism for controlling the movement of the valve, consisting of a shaft carrying on its ends the driving-wheels and about its center a slide, plungers connected with the slide, liquid-chambers to receive said plungers, crank-pins on the wheels to receive the rear end of the pitman-rods, blocks connected with said crank-pins and containing at opposite ends liquid-chambers, slides extending at right angles to each other on said blocks and carrying plungers at opposite ends adapted to move within said last-mentioned liquid-chambers, pins on said slides to receive the rear end of the valve-rods, and channels connecting said liquid-chambers so that a movement of the slide on the shaft will move the end slides and valve-rods, substantially as and for the purpose set forth.

3. In an engine, the shaft having liquid-chambers Q R and supporting a slide carrying plungers adapted to move within said chambers, supports in line with said shaft for slides H I and containing liquid-chambers F G, plungers carried by the slides H I for movement within said chambers F G, pins or supports on the slides H I for the valve-rods, a channel, *a*, connecting the chamber Q with chamber F at one end of the shaft, a channel, *b*, connecting chamber G at said end of the shaft with the chamber F at the other end thereof, and a channel, *d*, connecting the chamber R with chamber G at the end of the shaft, substantially as set forth.

4. In an engine, the shaft having upon its center a collar, P, and slide V, the collar containing liquid-chambers Q R, and the slide carrying plungers S T, adapted to move in said chambers, in combination with the driving-wheels, crank-pins for the pitman-rods, supports in line with said shaft for slides H I, which extend at right angles to each other, chambers F G in said supports, plungers J K, pins on the slides, and channels *a b d*, substantially as set forth.

5. In an engine, the shaft having the collar P and slide V, combined with the plungers S T, chambers Q R, channels *a b d*, auxiliary plunger and chamber A″, channels B‴, valve C″, and slides H I, with their plungers and chambers, substantially as set forth.

6. In an engine, the shaft combined with slides extending at right angles to each other, one being at each end of the shaft and carrying a pin for connection with the valve-rod, and hydraulic means, substantially as described, for simultaneously moving said slides, and thus altering the position of the valve-rod pins.

7. In an engine, the shaft combined with slides extending at right angles to each other, one being at each end of the shaft and carrying a pin for connection with the valve-rod, a system of hydraulic chambers and plungers for simultaneously moving said slides, and a lever connected with one set of said plungers, substantially as set forth.

8. In an engine, the shaft combined with slides extending at right angles to each other on parallel planes, one being at each end of the shaft and carrying a pin for connection with the valve-rod, a system of hydraulic chambers and plungers for simultaneously moving said slides from a given point, and an auxiliary plunger and chamber charged with the liquid and separated from the other liquid-passages by an adjustable valve, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 18th day of April, A. D. 1885.

FREDERICK F. ROSE.

Witnesses:

CHAS. C. GILL,

M. B. STAFFORD.