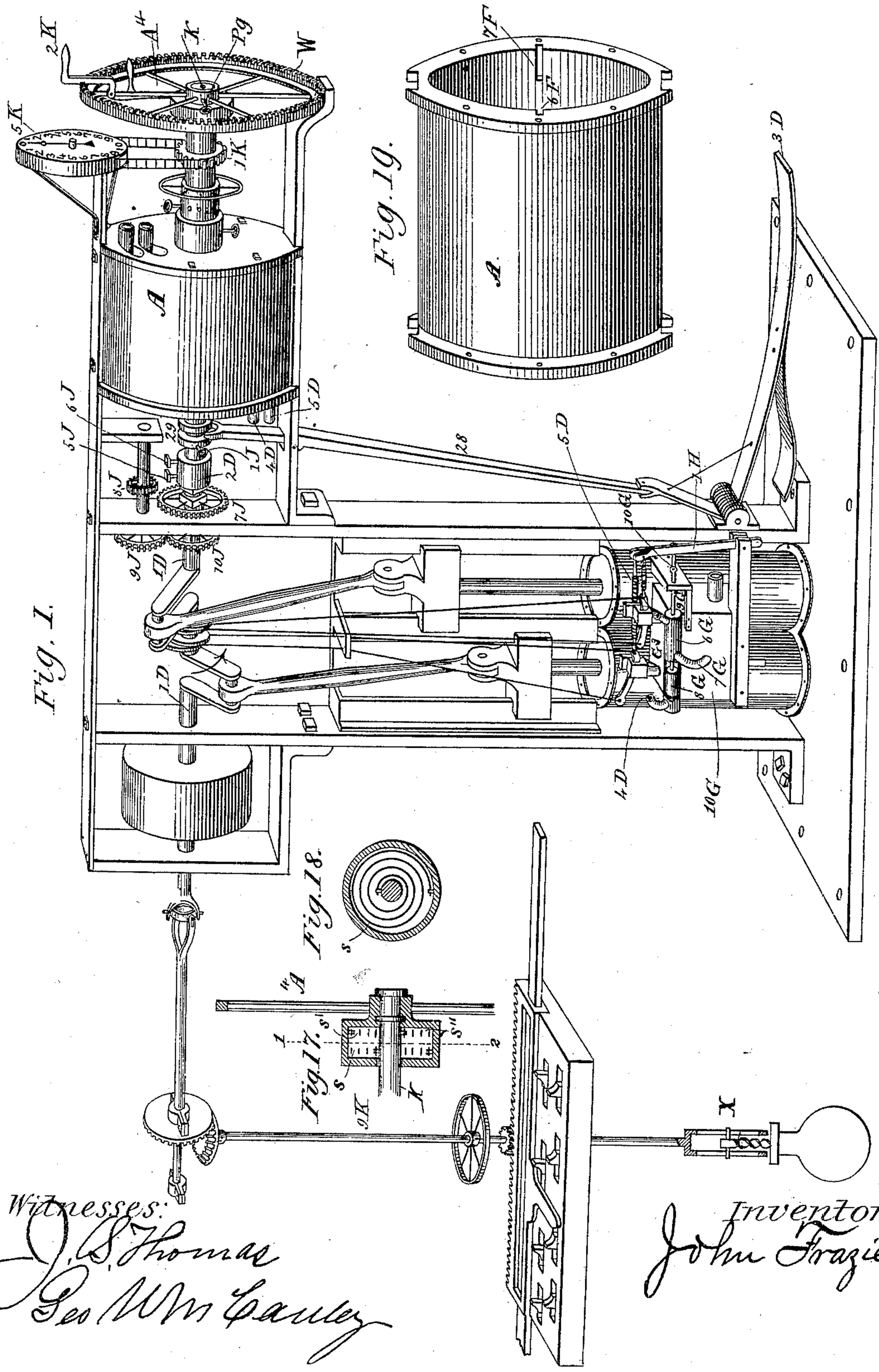
(No Model.) 3 Sheets—Sheet 1

J. FRAZIER.

STEAM ENGINE REVERSING MECHANISM.

No. 271,327. Patented Jan. 30, 1883.



Witnesses:
J. S. Thomas
Geo. W. Gaulay

Inventor.
John Frazier

(No Model.)

3 Sheets—Sheet 2

J. FRAZIER.

STEAM ENGINE REVERSING MECHANISM.

No. 271,327. Patented Jan. 30, 1883.

Fig. 16.

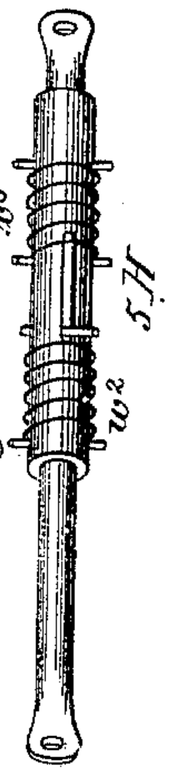


Fig. 2.

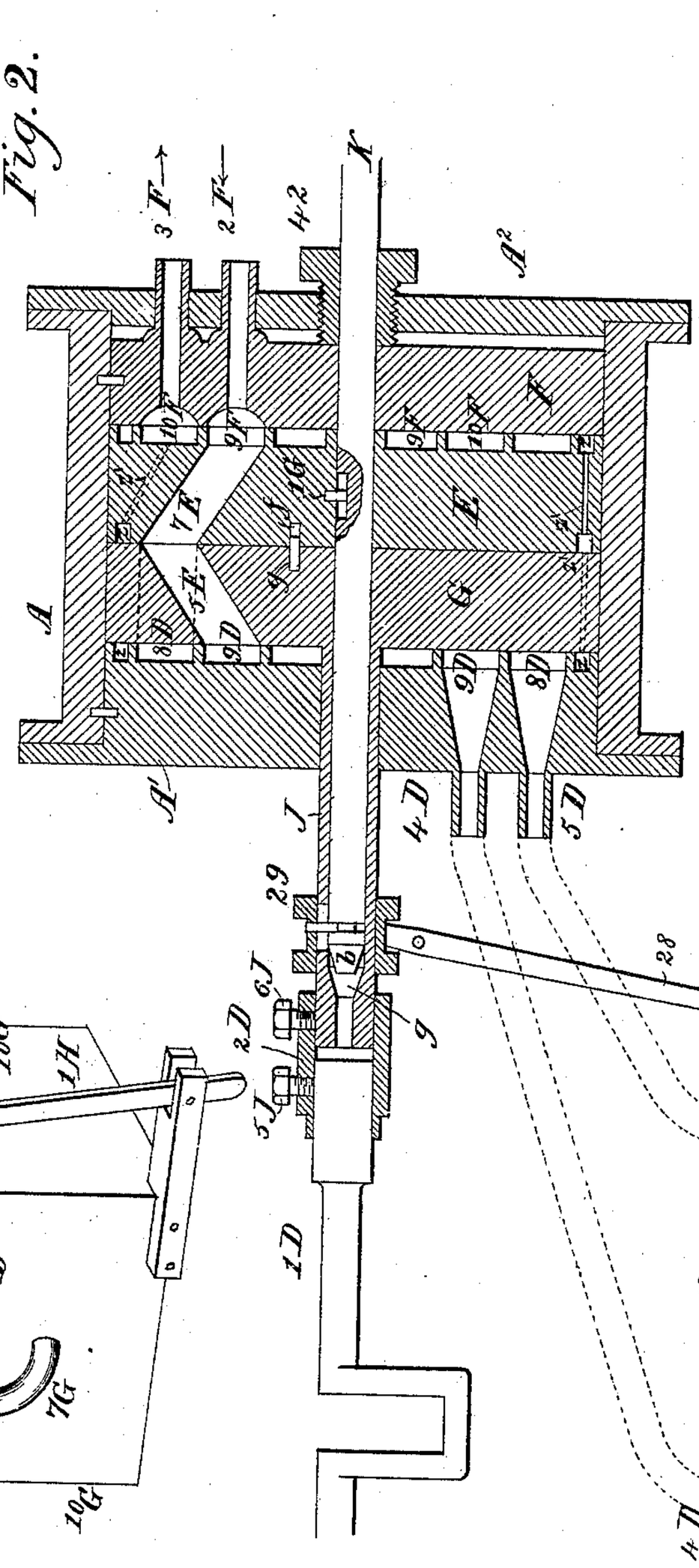
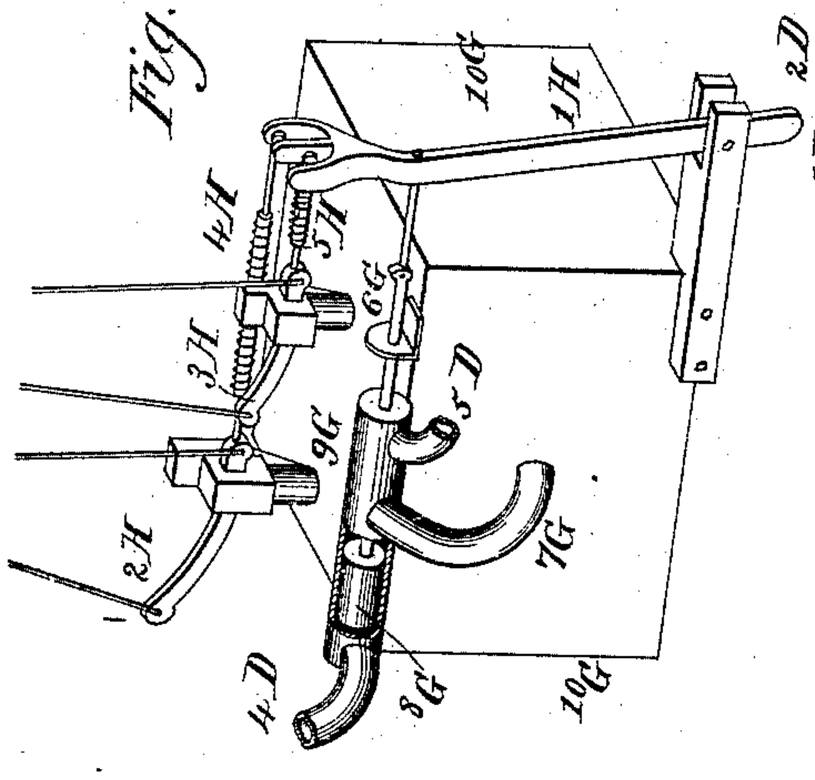


Fig. 15.



Witnesses:
Charles E. Foster
W. E. Tansmann.

Inventor:
John Frazier

(No Model.) 3 Sheets—Sheet 3

J. FRAZIER.

STEAM ENGINE REVERSING MECHANISM.

No. 271,327. Patented Jan. 30, 1883.

Fig. 3.

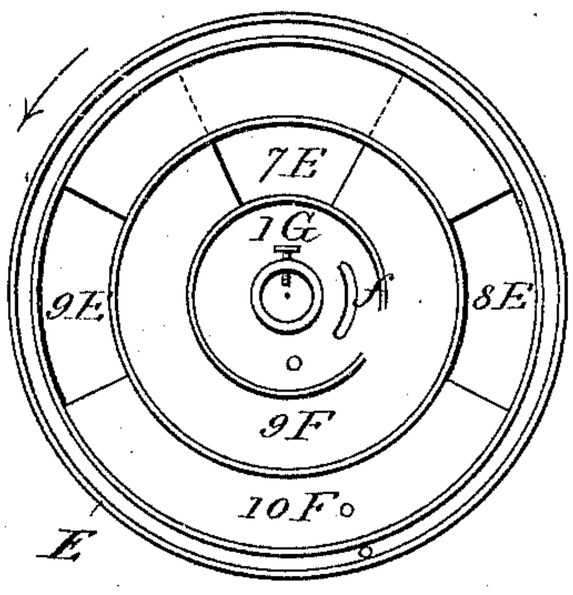


Fig. 4.

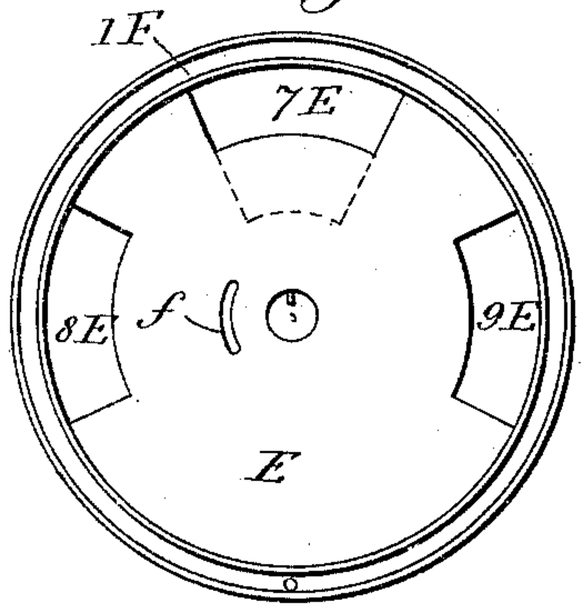


Fig. 5.

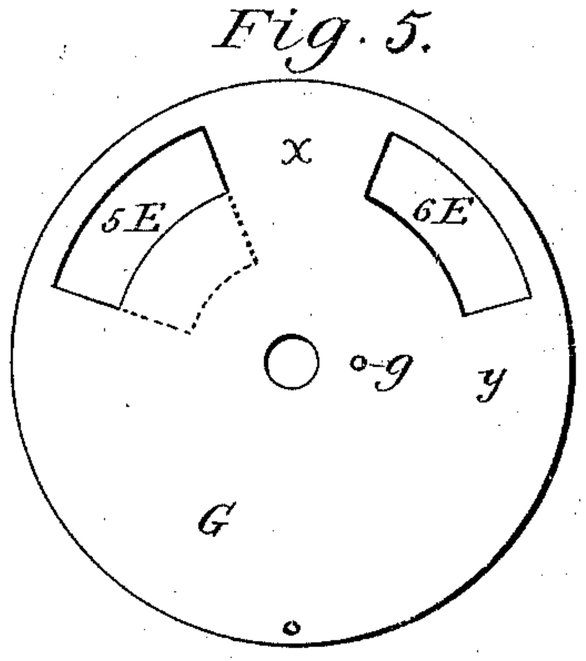


Fig. 6.

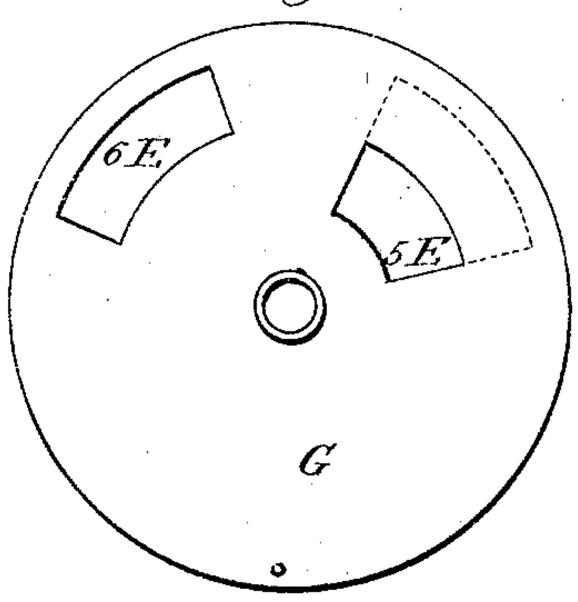


Fig. 7.

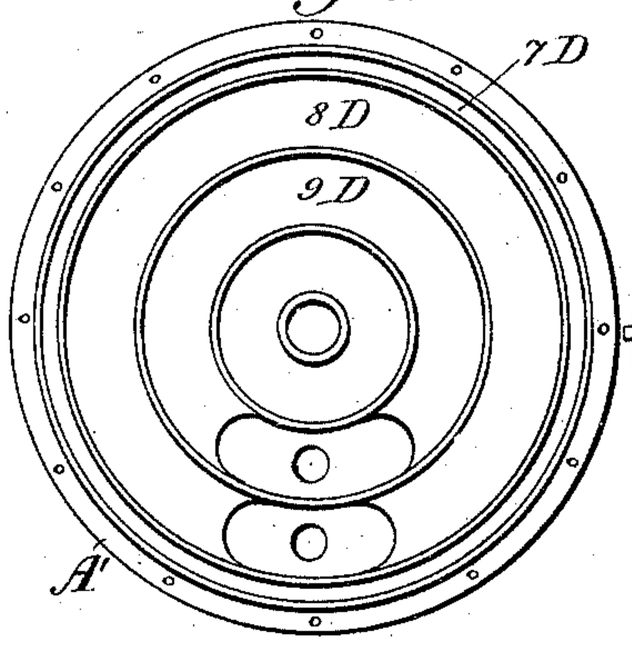


Fig. 8.

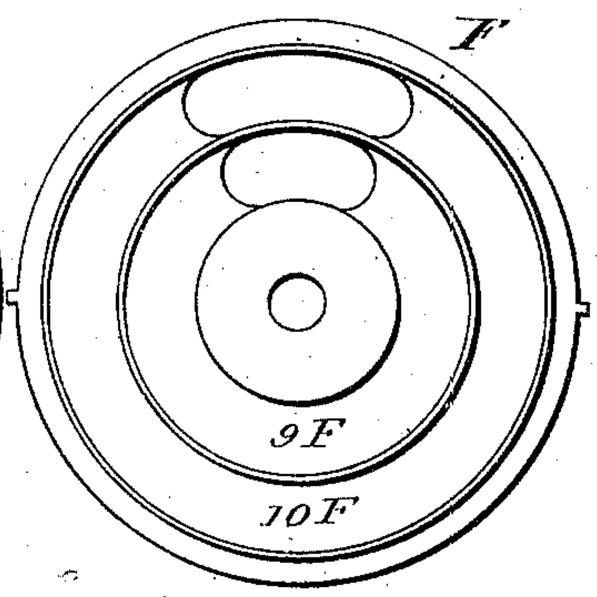


Fig. 9.

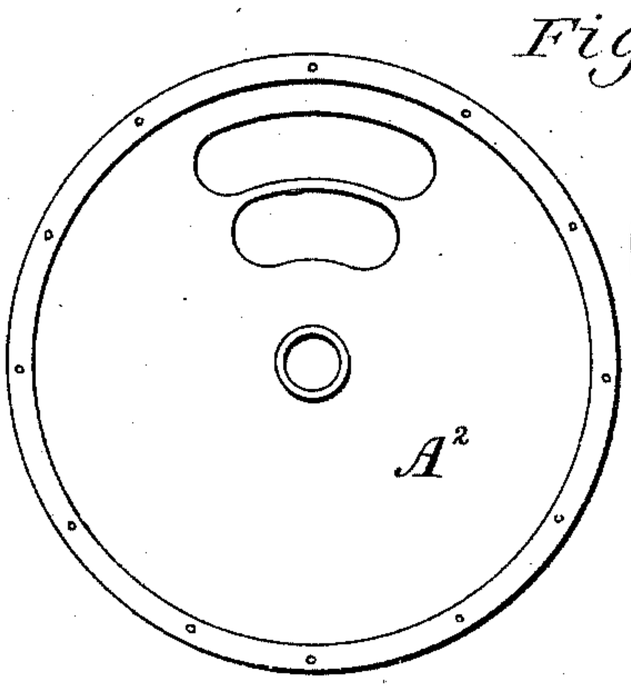


Fig. 10.

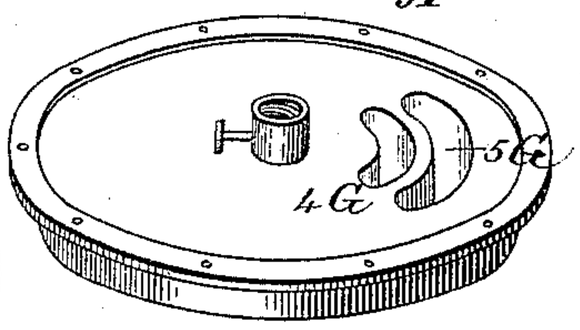


Fig. 11.

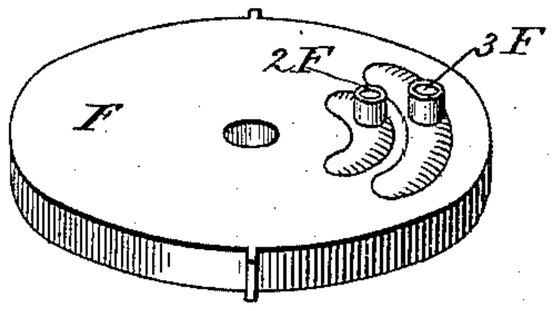


Fig. 12

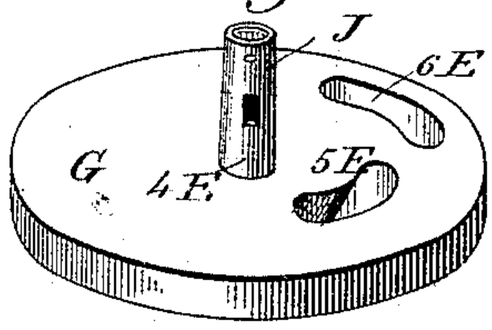
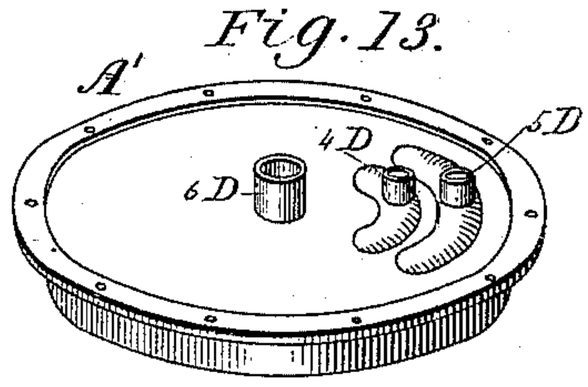


Fig. 13.



Witnesses:
J. S. Thomas
Geo. W. Mr Cauley

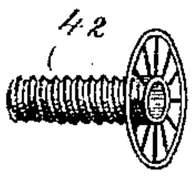


Fig. 14.

Inventor:
John Frazier

UNITED STATES PATENT OFFICE.

JOHN FRAZIER, OF SEARCY, ARKANSAS.

STEAM-ENGINE-REVERSING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 271,327, dated January 30, 1883.

Application filed July 19, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRAZIER, a resident of Searcy, White county, Arkansas, have invented Improvements in Steam-Engine-Reversing Mechanism, of which the following is a specification.

My invention is a valve device, constructed as fully described hereinafter, to control an engine arranged to operate the throttle of a larger engine, whereby upon the adjustment of said device said secondary engine may be moved to any predetermined extent in any direction to secure a definite and positive adjustment of the throttle.

In the drawings, Figure 1 is a perspective view of a throttle-operating engine provided with my improved valve device. Fig. 2 is a longitudinal section of said device. Figs. 3 to 14 are views showing parts of said device detached. Fig. 15 is a perspective view of part of the reversing mechanism of the engine. Fig. 16 is a detached view of one of the connecting-rods of the reversing-lever. Fig. 17 is a section of the hand-wheel and devices for operating the valve-device shaft, and Fig. 18 is a section on the line 1 2, Fig. 17. Fig. 19 is a detached view of the body of the cylinder.

In carrying out my invention I combine with the throttle-valve X of any suitable main propelling-engine a supplemental engine constructed to move said valve, and a valve device whereby the operator may start, stop, or reverse said supplemental engine at pleasure.

The supplemental engine may be of any suitable character, as a rotary, reciprocating, or oscillating engine. I have shown a double-cylinder reciprocating engine, by which motion is imparted to the double-crank shaft D, the engines being provided with ordinary slide-valves and with link-motions for reversing and cutting off, the links 2^H 3^H being connected to a lever, 1^H, which is connected to the piston-rod 6^G of a piston, 8^G, in an auxiliary cylinder, G^3, that communicates through a central pipe, 7^G, with the steam-chest 10^G. As one lever could not accompany the varying movements of both the links connected to it, I use extensible yielding connecting-rods 4^H 5^H, Figs. 15 and 16, each consisting of a rod sliding in a tube, with cross or bearing pins and springs w^2 w^3 so arranged as to yield when the rod is drawn out or in, thus maintaining the tension on the rod, but permitting it to extend or contract when necessary. The operation of the links is the same as in all engines.

The supplemental engine described is geared to a shaft, 9^K, or otherwise connected to suitable devices, whereby on the movement of the engine in one direction the throttle-valve X will be raised and on the movement in the other direction it will be depressed.

By throwing steam into a pipe, 4^D, communicating with one end of the cylinder G^3, the piston and lever 1^H are thrown in one direction, and an opposite movement is imparted when steam is admitted to the other end of the cylinder through a pipe, 5^D, the steam, after setting the piston in either direction, flowing into the steam-chest, and, according to the position in which the links have been set, turning the engine in one direction or the other. Thus the position of the links is controlled by directing the steam to one or other of the pipes 4^D 5^D. An ordinary two or three way cock could not be used for directing the steam to the desired pipe, because the pilot could not thereby control the number of revolutions of the engine, nor arrest it at any exact or predetermined point, owing to the expansion of steam after it is cut off, momentum, and other causes. For these reasons I employ the special device which I will now describe.

A is a cylinder having two fixed heads, A' A^2, two inner revolving disks, G E, and a sliding disk, F, which may be set up by a tubular screw, 42, against the rotary disk E, so as to make close joints between the disks and the rear end of the cylinder. From the disk F, and through slots in the head A^2, project pipes 2^F 3^F, the latter of which permits the escape of any steam that may be exhausted or leak from the joints and the former communicates with the pipe that supplies steam to the engine. Channels z z' convey away leakage steam and water. These two pipes may communicate with annular orifices 9^F 10^F in the disk E, or in the corresponding face of the disk F, or in both. From annular orifices or channels 8^D 9^D in the inner face of the head A' lead the pipes 4^D 5^D, extending to the cylinder G^3. Through

the disk E extend three segmental slots, 7^E 8^E 9^E, the slot 7^E inclining from near the periphery at the inner side to a point opposite the groove 9^F on the other side, as shown in Figs. 2, 3, 4. In the disk G are two segmental openings, 5^E 6^E, the latter extending directly and the former obliquely from a point near the periphery, Figs. 2 and 5, to a point on the opposite side corresponding with the position of the groove 9^D. In one of the disks G or E is a curved slot, *f*, and from the other extends a pin, *g*, the slot being of such length that the disk E can be turned in one direction to bring the outer end of the port 7^E to coincide with the outer end of the port 5^E, and in the other direction until the outer end of the port 7^E coincides fully with the port 6^E.

The turning of the disk E may be effected by hand by turning the shaft K, which is slotted to receive a pin or feather, 1^G, extending from the disk, Figs. 2 and 3. When the disk E is turned to the left—that is in the direction of the arrow, Fig. 3—until the port 7^E coincides with the port 5^E of the disk G, Fig. 2 the steam will pass from the pipe 2^F and annular channel 9^F, through the ports 7^E 5^E, to the annular channel 9^D, and thence through the pipe 4^D to the left-hand end of the cylinder G^3, throwing the piston and lever 1^H to the right and setting the links in such position that the engine will revolve in the direction of its arrow, Fig. 1. As described hereinafter, the shaft of the engine is connected to the disk G, which therefore turns with the engine-shaft, the result being that the port 5^E is carried away from the port 7^E until the blank space *x* of the disk G, Fig. 5, closes the port 7^E, cutting off the passage of steam to the engine. If the disk E is now again moved to the left, the ports 5^E 7^E will again coincide, and the steam will again be directed to the engine, and the operation will continue until the port 7^E is again closed. If the disk E is moved to the right, the port 7^E will be brought to coincide with the port 6^E in the disk G, (see Fig 5 and dotted lines, Fig. 1,) and the steam will flow through the port 6^E and the channel 8^D to the pipe 5^D, and to the right-hand end of the cylinder G^3, and will reverse the position of the piston 8^G and of the links and start the engine in the contrary direction. The movement of the engine-shaft will be continued until the disk G is turned to the right sufficiently to bring the blank face *x* opposite the port 7^E, when the flow of steam will be cut off. Should the momentum of the engine or expansion of the steam tend to continue the revolution of the shaft 1^D in either direction after the flow of steam is stopped, the continued revolution of the disk G will carry the face *x* away from opposite the port 7^E, in one direction or the other, until the following opening 5^E or 6^E (according to the direction of revolution) coincides to a slight degree with the port 7^E, when the steam will pass to the other pipe, 4^D or 5^D, than that just closed, and will throw the links to the opposite side and reverse the engine, practically bringing it to a full stop. When the steam is thrown to one end of the cylinder G^3, that at the opposite side of the piston will flow through the other pipe (which now becomes the exhaust) into the valve-case A, when it passes into one of the channels 9^D 8^D to one of the ports 5^E 6^E, which is not occupied, thence to one of the ports 8^E 9^E in the disk E, Fig. 4, and thence to the channel 10^F, and out of the pipe 3^F.

It will be seen that by the construction described the pilot can by varying the direction of the valve-motion determine the direction in which the throttle-operating engine shall start. By varying the extent of the throw of the valve he can determine exactly how far the throttle shall be moved, and that when the engine has moved sufficiently to bring the throttle to the desired position it is brought to a full stop.

It will further be seen that the pilot continuing to turn the shaft K, so as to keep the port 7^E of the disk E ahead of but in communication with the port 5^E or 6^E in the other disk, the latter is prevented from overtaking and closing the port 7^E, and the movement of the engine is continued as long as the pilot turns the disk, the rapidity of movement of the engine being proportioned to the rapidity of the movement of the hand.

I have stated that the disk G is connected to the shaft of the engine. This is effected by a coupling-sleeve, 2^D, having two screws, 5^J 6^J, by which connection is made with the shaft 1^D and with a sleeve, J, extending from the disk G through the head A′ of the cylinder. By loosening either screw the connection may be broken.

It is sometimes desirable to continue the rotation of the disk E and the operation of the engine for a longer time than it would be practicable for the pilot to continuously rotate the shaft K. I therefore provide means whereby to couple the shaft with the engine. Different devices may be employed for this purpose. I have shown a clutch consisting of a conical serrated seat, *y*, in the end of the sleeve J, and a corresponding conical serrated head, *b*, on the end of the shaft K, and a sleeve, 29, sliding on the shaft J, and having a pin extending through a slot in the sleeve J into an annular groove in the shaft K. By moving the sleeve 29 by means of a lever, 28, the end of the shaft K may be brought into the socket in the sleeve J, the frictional contact causing the shaft K and its disk E to turn with the disk G; and it will be seen that the relative position of the two disks at the time the shaft K is thrown inward will be preserved, so that if the port 7^E has been uncovered to a slight degree the engine will move slowly, and move quickly in proportion as the port was opened at the time the connection was made.

To start the engine in either direction, the pilot first rotates the disk E by hand until the

port 7^E is sufficiently uncovered, and then throws the shaft K into gear. To facilitate the latter operation, an L-shaped pivoted spring-treadle, 3^D, may be connected to the lever 28, as shown in Fig. 1, so that by placing the foot upon the treadle the lever will be swung to bring the end of the shaft K into its socket.

To secure a multiplying action, the multiplying-gear shown in Fig. 1 may be used, the screw 5^J being loosened, the pinion 7^J being moved onto a square hub on the coupling-sleeve 2^D, and into gear with a pinion, 8^J, driven by gears 9^J 10^J from the shaft 1^D. Any other adjustable multiplying or reducing gear may be used.

To facilitate the hand-turning of the shaft K, a wheel, A^4, is secured to the shaft by a movable pin, P^g, and is provided with a handle for turning it, and with a spring-catch, 2^K, which, when engaged with the teeth of an annular rack, W, secured to the frame of the machine, holds the wheel and shaft in position. The wheel A^4 may be connected to the shaft through the medium of two springs, *s s'*, Figs. 17 and 18, coiled in different directions, and each connected at one end to the shaft and at the other to a case or hollow hub, *s''*, of the wheel, which can turn freely on the shaft. When the wheel is turned rapidly in any direction to any point and then fixed, one spring is coiled and the other unwound, and in resuming their normal or neutral position the springs impart rotation to the shaft, and consequently continue the motion of the engine until the power of the springs is exhausted. The pilot may thus secure a continuance of the rotation of the shaft for any predetermined number of revolutions with the cessation of all movement the instant the said number of revolutions have been effected. A register, 5^K, and gear connections with the shaft K enable the pilot in winding up the springs to set the parts definitely in any position required to produce the desired effect.

It will be apparent that instead of rotary disks with ports other valve devices having two parts or sections, one adjusted by hand to open the ports and the other moved by the engine after it has operated to a definite extent to close said ports, and thereby arrest its own motion, may be used—such for instance, as set forth in a separate division of this application for Letters Patent.

I claim—

1. The combination, with the throttle-valve of a main engine, of a separate supplemental engine for operating said valve, and a two-part valve device controlling the flow of steam to said engine, and provided with passages and ports, one part adjustable by hand and the other connected to be operated by the engine, substantially as set forth, whereby after the adjustment of said valve device by hand to open the steam-passage the movement of the engine is made the means of closing said passage, as specified.

2. The combination, in a valve device, of two sections with ports and passages arranged substantially as set forth, one section provided with appliances for setting it by hand and the other connected to the engine, the whole constructed to operate to secure a movement of the engine after the adjustment of the hand-section until the section moved by the engine closes the ports of the hand-section, substantially as set forth.

3. The combination, with an engine, of a two-part valve, one part provided with hand setting mechanism, and with ports and passages whereby the steam may be directed to either port of the engine-cylinder, and the other connected to the engine, and provided with ports and passages whereby to permit the passage of steam to the engine until said section has moved a distance determined by the adjustment of the hand-section, as set forth.

4. The combination of a steam-engine valve and links for adjusting the valve, and a supplemental valve having one section adjustable by hand and another movable by the engine, and provided with ports and passages arranged to secure the passage of steam to different ports of a reversing device, as specified, to reverse the engine and to permit a movement of the engine operated section until it reaches a position determined by the adjustment of the hand-section, as specified.

5. The combination of the valve-casing, its inlet and exhaust ports, and channels extending to the reversing device of the supplemental engine, and disks C E, having passages and ports, as described, capable of a limited movement independently of each other, devices for adjusting one disk by hand, and connections whereby the other is moved upon the movement of the engine, substantially as set forth.

6. The combination of the valve-casing, disks E G, shaft K, connected to the disk E, and appliances for turning the same by hand, sleeve J, attached to the disk G, and connections for turning said disk on the movement of the engine, and appliances whereby the shaft and sleeve may be coupled to turn together, as set forth.

7. The combination of the valve device, constructed as set forth, the engine shaft 1^D and adjustable multiplying-gear interposed between the said shaft and the sleeve J of the valve device, constructed as described.

8. The combination of the valve-casing containing the disks G E and disk F and adjusting-screw 42, as set forth.

9. The combination of the valve device, as specified, a supplemental engine having reversing mechanism, and an auxiliary cylinder, G^3, communicating with the ports of said device and with the valve-chest of the engine, and provided with a piston connected to the reversing-lever, as specified.

10. The combination, with the shaft K of the valve device, of an adjustable hand-wheel,

A[4], connected with the shaft by spiral springs *s s'*, wound in different directions, for the purpose described.

11. The combination of the valve device of a supplemental engine, controlling a throttle-shaft, K, and register 5[K], having a pointer connected to be operated by said shaft and graduated to indicate the position of the throttle, as set forth.

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

JOHN FRAZIER.

Witnesses:
CHARLES E. FOSTER,
WILLIAM PAXTON.