(No Model.)

2 Sheets—Sheet 1.

E. F. WILLIAMS.

FLUID PRESSURE MOTOR.

No. 544,804. Patented Aug. 20, 1895.

FIG. 1.

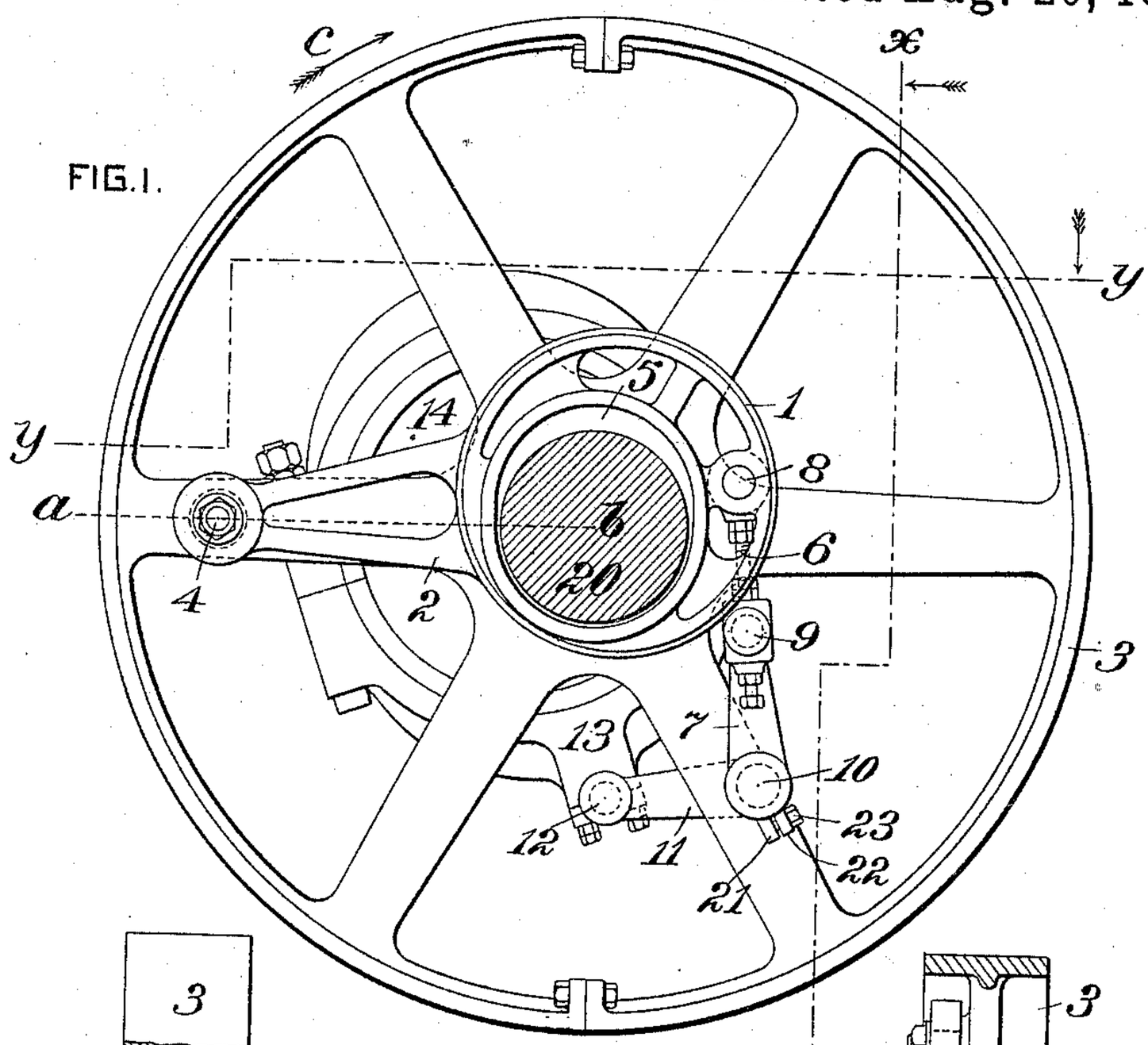


FIG. 2.

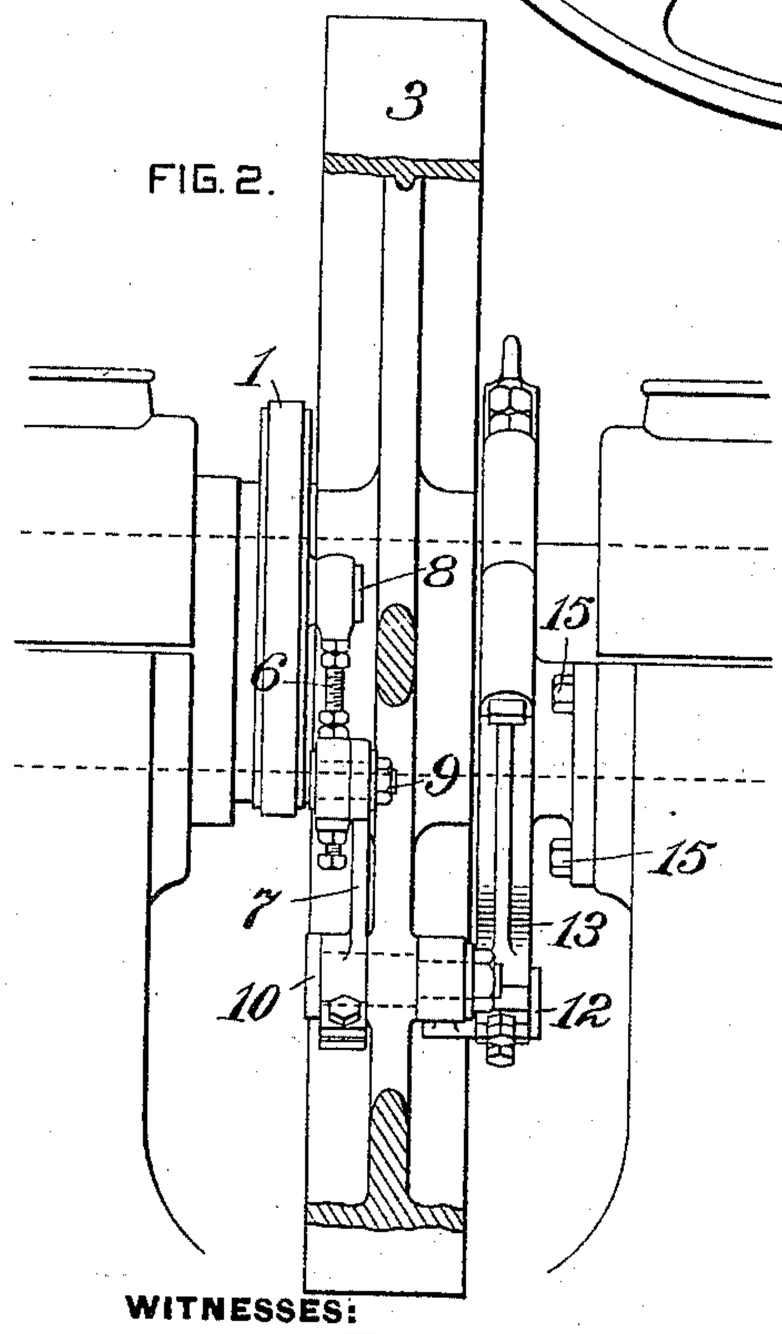
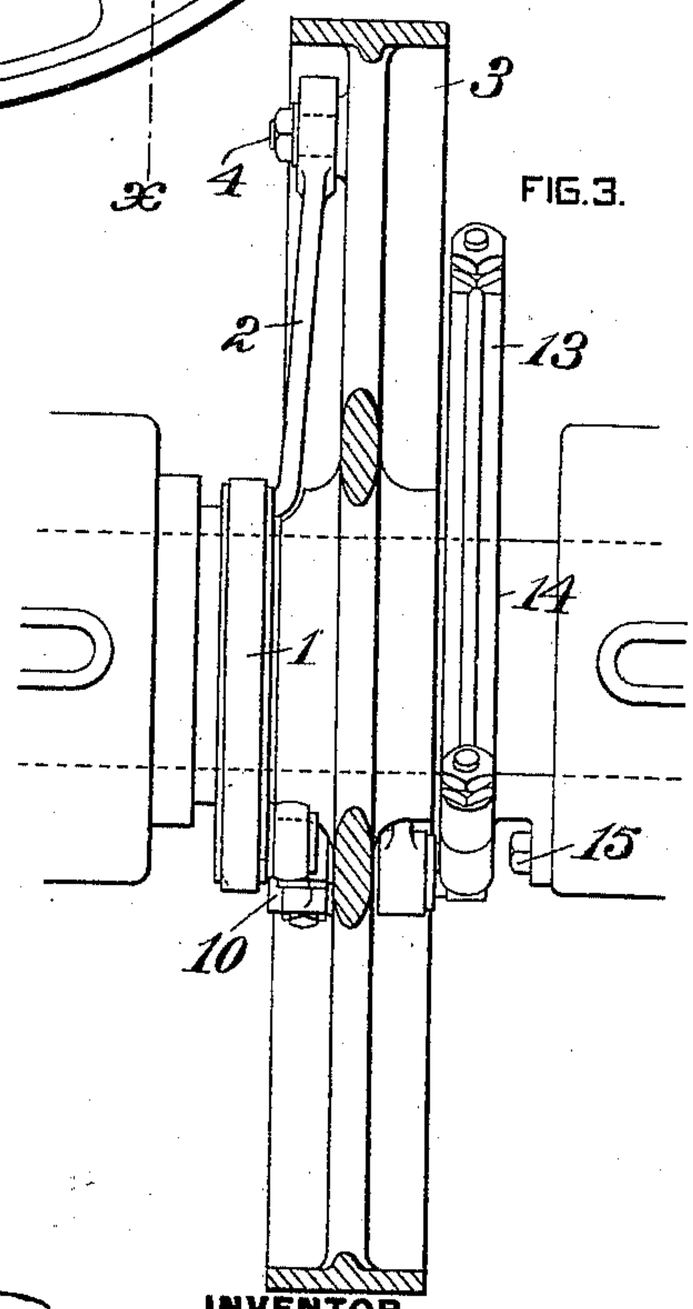


FIG. 3.



WITNESSES:

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INVENTOR,

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by J. Howard Bell,

Att'y.

(No Model.) 2 Sheets—Sheet 2.

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FLUID PRESSURE MOTOR.

No. 544,804. Patented Aug. 20, 1895.

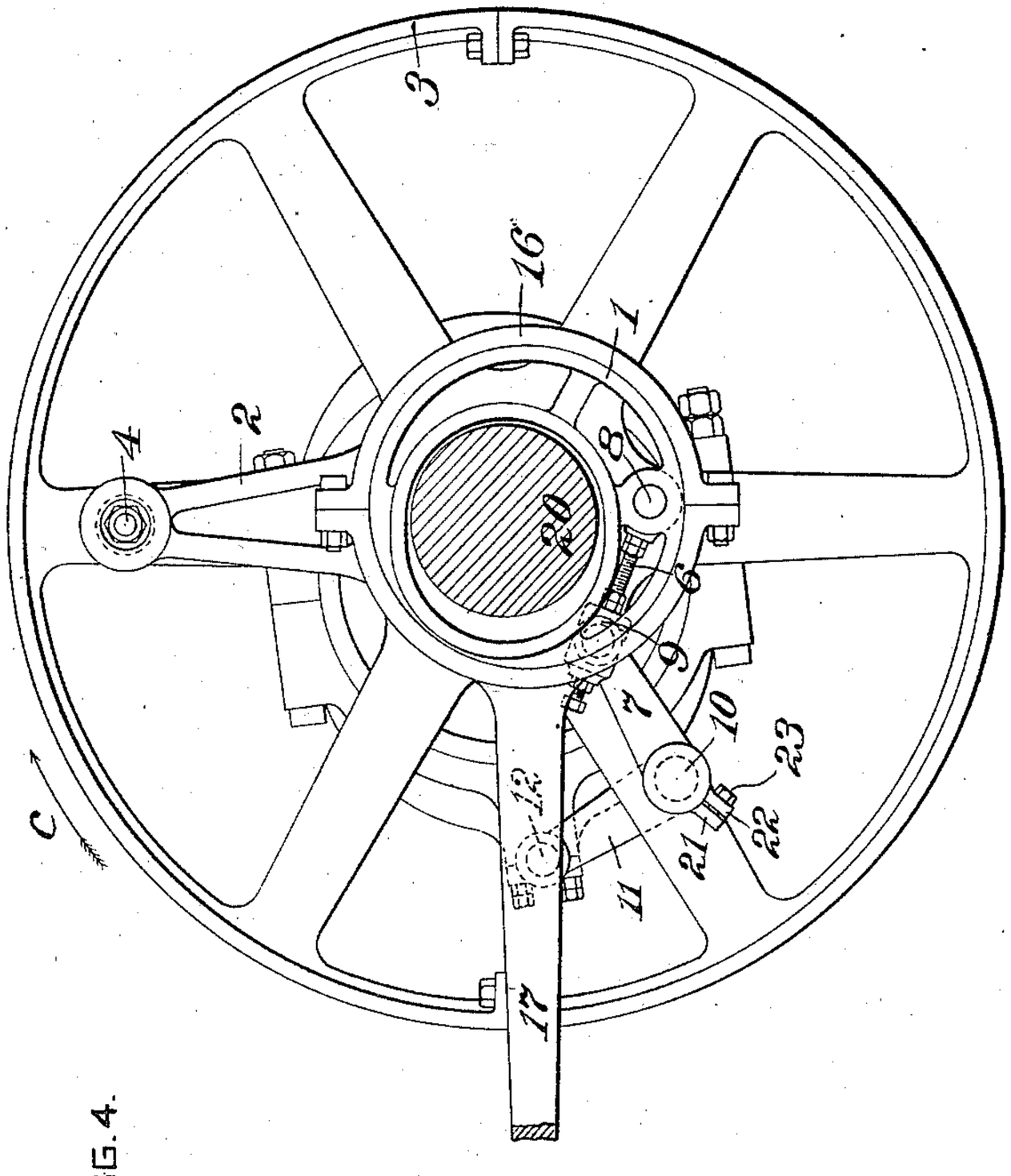
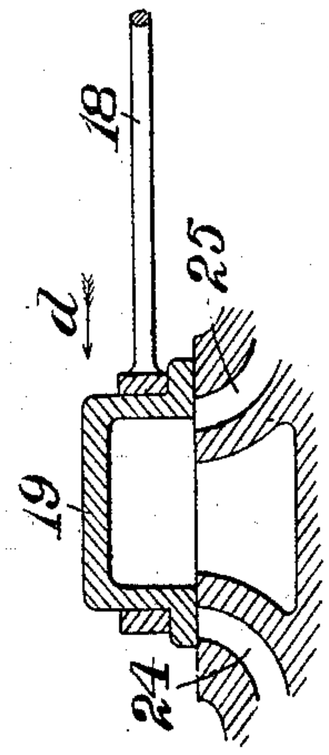


FIG. 4.



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UNITED STATES PATENT OFFICE.

EDWIN F. WILLIAMS, OF NEW YORK, N. Y.

FLUID-PRESSURE MOTOR.

SPECIFICATION forming part of Letters Patent No. 544,804, dated August 20, 1895.

Application filed April 22, 1895. Serial No. 546,687. (No model.)

To all whom it may concern:

Be it known that I, EDWIN F. WILLIAMS, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented or discovered a certain new and useful Improvement in Fluid-Pressure Motors, of which improvement the following is a specification.

The object of my invention is to provide an improvement in fluid-pressure motors; and to this end it consists in a new and improved method of and means for effecting the distribution of fluid in motors actuated by fluid under pressure.

While my improvement is specially adapted for employment in connection with the operation of valve devices, it may be otherwise employed, as a whole or in part, as a mechanical movement, especially where it is desired to produce a compound or aggregate motion of one or more pieces of mechanism, and my invention is not, therefore, limited to the specific construction, arrangement, or combination shown in the drawings.

In the accompanying drawings, which illustrate an application of my invention, Figure 1 is a side elevation showing a form of my improvement as applied to the shaft of a steam-engine and in combination with a fly-wheel or rotary carrier mounted on the shaft; Fig. 2, a front elevation of the construction shown in Fig. 1, the rim of the fly-wheel being broken away on the line $x\,x$ of Fig. 1, so as to show the connections between the parts; Fig. 3, a plan view, the rim of the fly-wheel being broken away on the line $y\,y$ of Fig. 1; Fig. 4, a side elevation showing my improvement in combination with and adapted to operate a slide-valve, the parts being shown in the positions which they will occupy when the engine-crank is ninety degrees in advance of the position corresponding to the arrangement of parts shown in Fig. 1.

With many forms of valve devices employed for effecting the distribution of fluid in steam and other fluid-pressure motors, the adjustment of the valve-gear to obtain an early cut-off of the admission of the steam or other fluid involves a correspondingly early closure of the exhaust, or a correspondingly early diminution of the exhaust-opening, which is objectionable. This is particularly true where a single valve is employed to control both the admission and exhaust of fluid to and from the cylinder of the engine, and it is to obviate this difficulty that my improvement is specially intended.

Various devices have been employed for the purpose of obtaining results somewhat similar to those effected by my improvement—such as the employment of separate steam and exhaust valves, or the employment of a main valve in combination with a cut-off valve, or some other complicated and expensive arrangement of valves and valve-gear—but my improvement differs from all of these, both in the method of distributing the fluid and in the method of operating the valve mechanism, and also in the means by which such distribution of the fluid and operation of the valve mechanism are effected.

My improvement is applicable to the simplest forms of engine and valve mechanism, and is specially adapted to be employed in connection with a single slide-valve. When employed in connection with a single slide-valve, its operation is such that the motion communicated to the valve may effect an early cut-off of the fluid and a comparatively late closure of the exhaust—that is, the operation is such that after the cut-off occurs the movement of the valve is such that the closure of the exhaust instead of corresponding to the real cut-off is deferred and occurs at a time corresponding to some later cut-off. The advantages of such a method of operation need not be described, as they will be apparent to any one skilled in the art, and it frequently happens in steam-engine practice that an early cut-off of the steam is desired without a high degree of compression, such as usually accompanies an early cut-off and a correspondingly early closure of the exhaust.

Generally stated, my invention comprises a movable or shifting eccentric or crank, or its equivalent, which is mounted on a shaft or on a rotary carrier in proper relation to the shaft, and is adapted to be operatively connected to a valve mechanism, a stationary eccentric, crank, or equivalent, with connections from the stationary eccentric to the shifting eccentric, whereby the eccentricity or angularity, or both the eccentricity and angularity, of the shifting eccentric may be

varied, and the combination of the stationary and shifting eccentrics and their connections with a valve device for controlling the distribution of motive fluid.

In Fig. 1 of the drawings the parts are in the positions which they will occupy when the engine-piston is at one end of its stroke and the engine crank-pin on a dead-point. The center line of the engine-crank will then coincide with the line *a b* of Fig. 1.

The movable eccentric 1 is provided with an arm 2, which is rigidly secured to the eccentric and pivoted at its outer end to the fly-wheel or rotary carrier 3 by means of a stud or pin 4. A slot or opening 5 in the eccentric permits it to be swung on the pivot 4, so that the position of the center of the eccentric relative to the crank and to the center of the shaft may be varied. The eccentric 1 is connected by means of a link 6 with one end of a rocker-arm 7, the link 6 being pivotally connected at one end to a stud or pin 8, which projects from one side of the eccentric, and at its other end to a pin 9, which projects from the rocker-arm 7. A pin or short rock-shaft 10 passes through and is fitted to rotate in a bearing formed in one of the arms of the wheel 3. To one end of the pin 10 the rocker-arm 7 is rigidly secured, and a similar rocker-arm 11 is rigidly secured to the other end of the pin 10, so that the arms 7 and 11 and the pin 10 form a lever or bell-crank which is adapted to be partially rotated on the axis of the pin or rock-shaft 10. The other end of the arm 11 is pivotally connected by means of a pin 12 with the strap 13 of a stationary eccentric 14, which is secured to a stationary part of the engine or its frame by means of bolts 15.

As shown in Fig. 4, the eccentric 1 is provided with a strap 16 and with a rod 17, which is adapted to be connected with the stem 18 of a slide-valve 19, either directly or by means of a rock-shaft provided with arms, or by any ordinary means usually employed for that purpose.

The link 6 is screw-threaded and adjustably secured at its ends, so that the distance between the centers of the pins 8 and 9 may be varied, and the bearing of the arm 7 on the pin or rock-shaft 10 is split and provided with lugs 21 and 22, so that the arm 7 may be clamped to the pin 10 by means of the bolt 23 in any desired position.

The strap 13 is adapted to rotate or slide around on the stationary eccentric 14, and as the fly-wheel is rotated the strap 13 is moved around in the same direction by means of its connection with the fly-wheel.

The center of the stationary eccentric 14, as shown in the drawings, is to the left of the center of the engine-shaft and in line with the center line of the engine-crank when the crank is on a dead-center or at one end of its stroke, as indicated by the line *a b* in Fig. 1.

When the parts are in the positions shown in Fig. 1 of the drawings, the center of the movable or shifting eccentric 1 is at its maximum distance from the center of the shaft 20, and the central lines of the link 6 and arm 7 lie on the line connecting the centers of the pins 8 and 10. As the fly-wheel is rotated in the direction indicated by the arrow *c*, the strap 13 is rotated on the stationary eccentric 14, and the eccentricity of the eccentric 14 causes the pin 12 to move outward and away from the center of the shaft 20, and the effect of this movement of the pin 12 is to partially rotate the arms 11 and 7 and to throw the pin 9 to the left of the line joining the centers of the pins 8 and 10. The pin 8 is thus drawn toward the pin 10, and the eccentric 1 is swung on the pivot 4, so as to change the eccentricity and angular position of the eccentric 1 relative to the center of the shaft and to the engine-crank. During the time that the crank is making about a quarter of a revolution from the position indicated by the line *a b* in Fig. 1 the eccentric 1 will be shifted so as to decrease its eccentricity—that is, in direction to effect an earlier cut-off than would occur if the position of the shifting eccentric relative to the crank and shaft remained the same as in Fig. 1. This operation will be understood by reference to Fig. 4, in which the parts are in the positions they will occupy when the crank is at half-stroke, and the pin 12 has nearly, but not quite, reached the position in which its distance from the center of the shaft is a maximum. During movement of the crank through the second half of its stroke, or during the movement of the center of the pin 12 from its position on a line passing through the center of the shaft and the center of the stationary eccentric, the pin 9 will be moved back toward the line joining the centers of the pins 8 and 10, and the distance between the centers of the pins 8 and 10 will be increased, and the eccentricity of the shifting eccentric 1 also increased until the center of the pin 9 is again in line with the centers of the pins 8 and 10, when the eccentricity of the shifting eccentric will be a maximum—that is, the shifting eccentric will be in the same position relative to the crank and to the center of the shaft as that shown in Fig. 1. This adjustment of the parts will occur when the crank has reached the end of its stroke. During the first half of the return stroke the eccentric 1 will again be shifted to decrease its eccentricity and in direction to effect an earlier cut-off, but the pin 9 will be moved to the right of the line joining the centers of the pins 8 and 10 until the crank has made about one-half of its return stroke, and during the second half of the return stroke the pin 9 will be moved back to the position it occupies in Fig. 1, and the eccentricity of the eccentric 1 will be increasing during that movement.

In Fig. 4 my improvement is shown in connection with an ordinary D-slide valve. The parts are in the positions which they will occupy when the crank is at half-stroke, the

fly-wheel 3 rotates in the direction indicated by the arrow *c*, and the slide-valve moves in the direction indicated by the arrow *d*. Admission of steam to the port 24 has been cut off, the cut-off having occurred before the crank has reached half-stroke, but the exhaust of steam through the passage 25 will not be cut off at a correspondingly early portion of the stroke for the reason that during the latter half of the stroke of the crank the eccentricity of the eccentric 1 is continually increasing, and before the exhaust-port is closed the eccentric is in a position relative to the crank and shaft which corresponds to a comparatively late closure of the exhaust.

It will be seen that by means of my invention a new and improved distribution of the steam is effected, and with the simplest form of valve device. The relation between the point of cut-off and the closing of the exhaust is such that all of the benefits of an early cut-off are obtained together with the advantage of a correspondingly late closure of the exhaust.

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

1. The combination of a shifting eccentric, a stationary eccentric, an intermediate mechanism between the eccentrics, whereby the position of the shifting eccentric is controlled by the stationary eccentric, substantially as set forth.

2. The combination of a rotary shifting eccentric, a stationary eccentric, a strap on the stationary eccentric, and connections from the strap to the shifting eccentric, whereby the position of the shifting eccentric is controlled by the stationary eccentric, substantially as set forth.

3. The combination of a rotary carrier, a shifting eccentric carried thereby, a stationary eccentric, and connections from the stationary eccentric to the shifting eccentric, substantially as set forth.

4. The combination, with a rotary carrier, of a shifting eccentric mounted thereon, a stationary eccentric, and means for connecting the eccentrics which is mounted on and carried by the rotary carrier, substantially as set forth.

5. The combination, with a rotary carrier, of a shifting eccentric, a stationary eccentric, a lever, or bell crank, mounted on the rotary carrier and connected to the strap of the stationary eccentric and a link connecting the lever, or bell crank, with the shifting eccentric, substantially as set forth.

6. The combination, with a rotary carrier, of a shifting eccentric, a toggle connection between the carrier and the shifting eccentric and means for shifting the toggle connection and thereby changing the adjustment of the shifting eccentric, substantially as set forth.

In testimony whereof I have hereunto set my hand.

EDWIN F. WILLIAMS.

Witnesses:
CLIFFORD W. PERKINS,
LAURA L. SMITH.