No. 686,896. Patented Nov. 19, 1901.

E. G. HARRIS.

CONTROLLING MECHANISM FOR SWITCH VALVES.

(Application filed Nov. 13, 1899.)

(No Model.)

2 Sheets—Sheet 1.

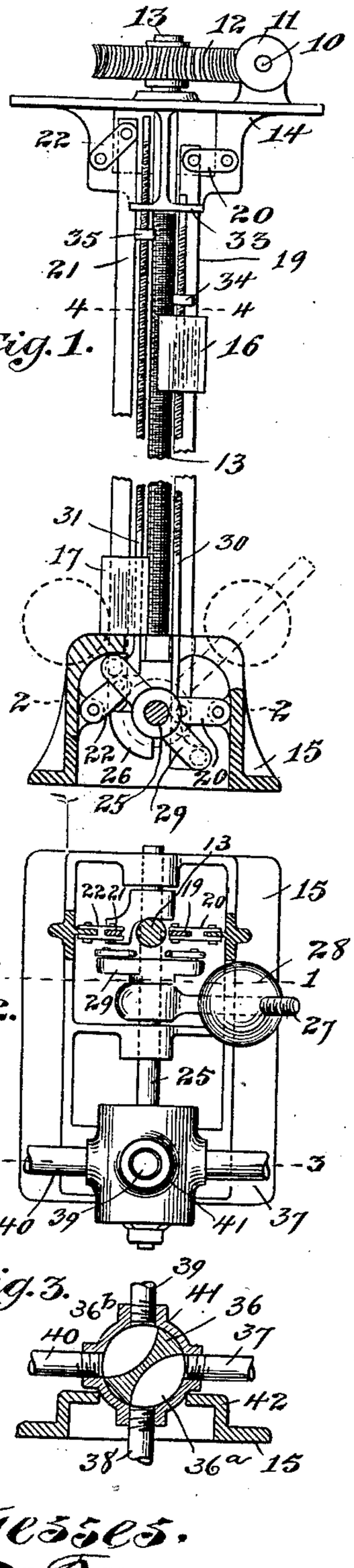

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

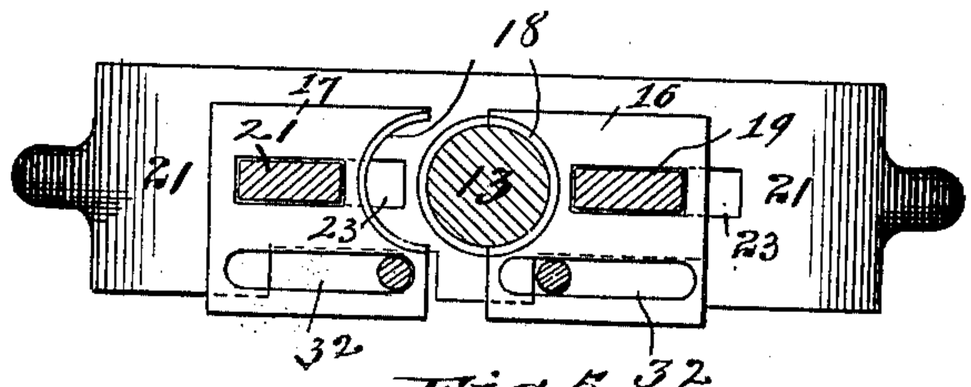

Fig. 5.

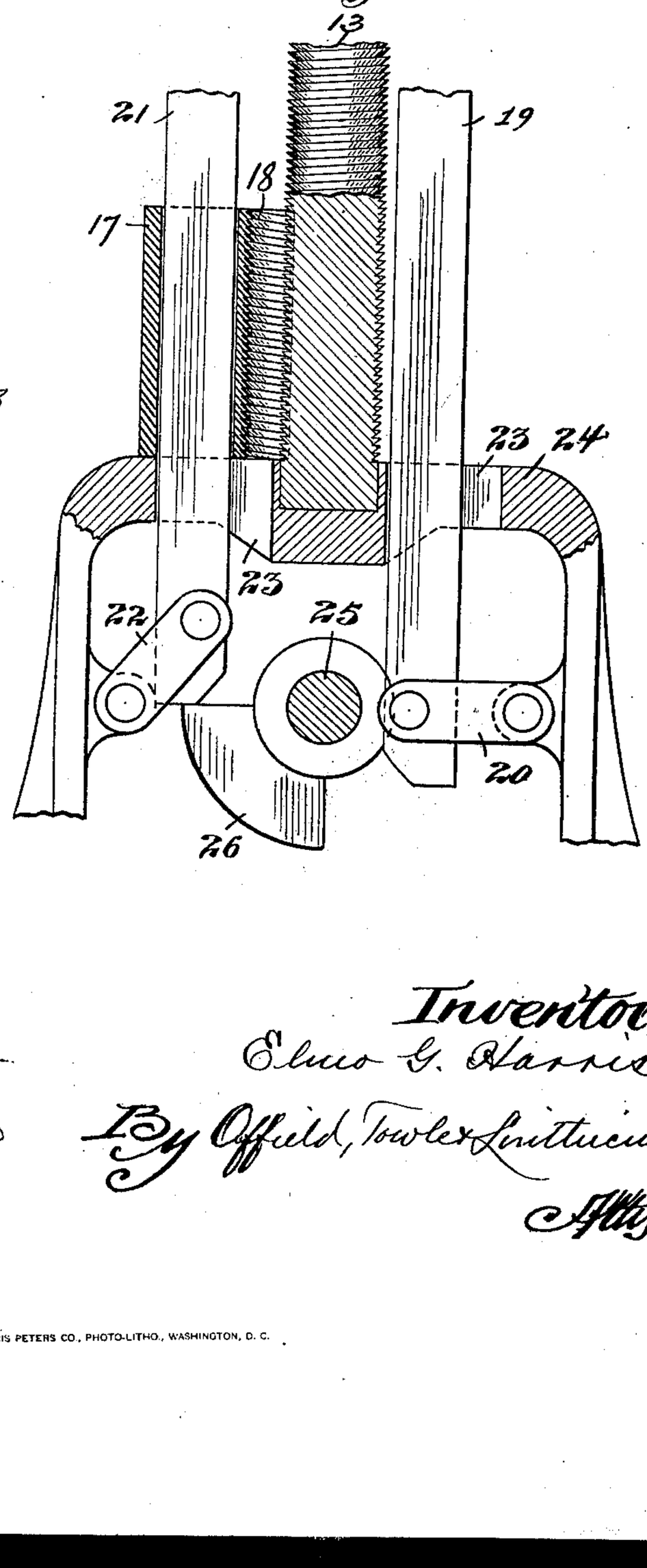

Fig. 6.

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Fig. 6.

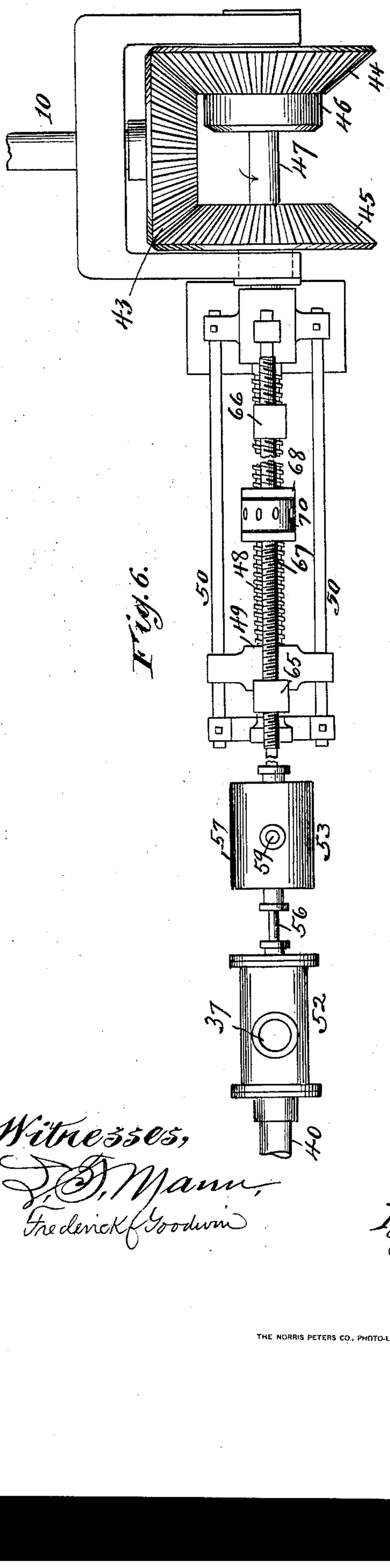
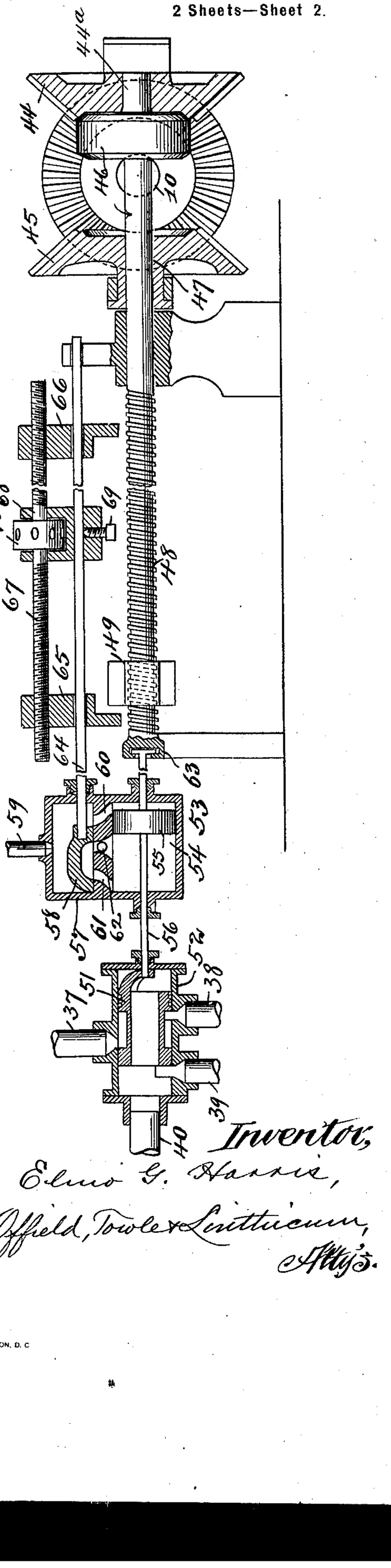


Fig. 7.



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UNITED STATES PATENT OFFICE.

ELMO G. HARRIS, OF ROLLA, MISSOURI.

CONTROLLING MECHANISM FOR SWITCH-VALVES.

SPECIFICATION forming part of Letters Patent No. 686,896, dated November 19, 1901.

Application filed November 13, 1899. Serial No. 736,766. (No model.)

To all whom it may concern:

Be it known that I, ELMO G. HARRIS, of Rolla, in the county of Phelps and State of Missouri, have invented certain new and useful Improvements in Controlling Mechanism for Switch-Valves, of which the following is a specification.

This invention relates to controlling mechanism for switch-valves, and is devised more particularly for use in conjunction with the apparatus set forth in Letters Patent No. 580,687, granted to me April 13, 1897, and has for its object to provide a mechanism actuated from the air-compressor whereby the switch-valve of the system will be shifted after a predetermined number of strokes of the compressor from one of its positions to the other and be returned to its original position after a predetermined number of strokes, either equal to or different from the first number, the shifting of the valve being thus positively effected each time that the compressor has completed a given number of strokes.

To this end my invention consists in certain novel features, which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is an elevation, partly broken away, of a mechanism embodying my invention, the lower portion thereof being shown in section along the line 1 1 of Fig. 2. Fig. 2 is a plan section taken along the line 2 2 of Fig. 1, the lower links and weighted arm being shown in full lines. Fig. 3 is a detail sectional view of the valve, taken on the line 3 3 of Fig. 2. Fig. 4 is a detail sectional plan view, on an enlarged scale, taken on the line 4 4 of Fig. 1 and showing the bridge or table and travelers in full plan and the traveler-rods and tripping-rods in section. Fig. 5 is a similarly-enlarged elevation, partly in vertical section, of the parts shown in Fig. 4 and the mechanism lying underneath the same. Fig. 6 is a plan view of a mechanism embodying my invention in a modified form, and Fig. 7 a central vertical sectional view of the same.

Referring first to the construction shown in Figs. 1 to 5 of the drawings, 10 indicates a shaft, which is driven from or connected with the compressor so as to move at a constant rate relatively to the same. This shaft is connected by suitable gearing, preferably a worm 11 and worm-wheel 12, with a vertical shaft 13, mounted in suitable bearings in a head-casting 14 and base-casting 15. The shaft 13 is threaded, the thread being preferably of the character shown, with a substantially radial upper face and inclined lower face, and is mounted to revolve in its bearings without vertical motion. Coöperating with the screw-shaft 13 are two travelers 16 and 17, located on opposite sides of the screw-shaft and each one provided with a semicircular threaded recess 18 on its inner face to fit said shaft. The traveler 16 is mounted and free to slide longitudinally upon a vertical rod 19, which lies parallel to the screw-shaft 13 and which is maintained in parallelism with said shaft while free to move toward and from the same by means of links 20 at the top and bottom, pivotally connected to the ends of said rod and to the upper and lower castings, respectively. The traveler 17 is similarly mounted upon a vertical rod 21, carried by links 22, corresponding to the links 20, but reversely arranged. The rods 19 and 21 pass through slots 23 in a table or bridge 24, supported from and preferably forming part of the base 15. Mounted longitudinally underneath the screw-shaft 13 is a rock-shaft 25, supported in suitable bearings in the base 15. This rock-shaft may be the valve-stem proper or may be suitably connected, either directly or indirectly, with the switch-valve. The shaft 25 is provided with a lug or projection 26, which is adapted to alternately engage the lower ends of the rods 19 and 21, and is further provided with a radial arm 27, having mounted thereon a weight 28, adapted to maintain said shaft and the parts connected with and operated from the same in either one of two positions at an angle of about ninety degrees to each other. Suitable stops are provided for limiting the motion of these parts to the extent just mentioned. There is secured on the rock-shaft 25 a rocker-arm 29, to the ends of which are respectively connected tripping-rods 30 and 31, which extend upward through slots 32 in the travelers 16 and 17 and through suitable guide-apertures in a plate 33, secured to or forming part of the head 14. The

rod 30 has adjustably mounted on it a stop 34, adapted to be engaged by the traveler 16, while the rod 31 is provided with a similar adjustable stop 35, adapted to be engaged by the traveler 17. As a simple and efficient means for adjusting these stops I prefer to thread the rods 30 and 31 and mount the stops 34 and 35 thereon in the form of nuts, which may be screwed up or down to the desired positions.

As heretofore stated, the rock-shaft 25 may be either directly or indirectly connected to the switch-valve in order to operate the same. In the particular construction shown in Figs. 1 to 5, however, the rock-shaft has the switch-valve 36 mounted directly thereon, or, in other words, the rock-shaft may be considered as constituting the stem of the switch-valve. In this construction the valve 36 is a rotary valve having the ports 36^a and 36^b and adapted to connect either the pipes 37 and 38 and the pipes 39 and 40 in pairs or when reversed to connect the pipes 37 and 39 and the pipes 38 and 40 in pairs in the manner and for the purposes set forth in my prior Letters Patent hereinbefore specified. The valve-casing 41, with which the several pipes connect and in which the valve 36 is inclosed, is itself mounted upon a suitable support 42, formed on the base 15.

The operation of the foregoing mechanism is as follows: Assuming that the parts are in the position shown, with the traveler 16 in engagement with the threaded shaft 13 and held in such engagement by its weight and that of the rod 19, upon which it is mounted, said shaft 13 being rotated by the movement of the compressor, the traveler 16 will be carried upward along the rod 19 until it comes into contact with the stop 34. Further upward movement of the traveler 16 will carry along with it the stop 34 and rod 30 and through the medium of the rocker-arm 29 will rock the shaft 25. This movement of the shaft 25 carries the weight 28 upward until it has passed the vertical position, whereupon said weight will fall to its limit of motion on the other side of the machine, completing the rotation of the rock-shaft through a quarter of a circle. This movement of the rock-shaft not only shifts the valve 36, but it also withdraws the lug 26 from under the rod 21, permitting said rod to move downward and inward, so as to cause the traveler 17 to slide across the table 24 and to engage with the screw-shaft 13. In the meantime, however, the lug 26 comes into contact with the lower end of the rod 19 and, moving the same upward and outward away from the screw-shaft 13, disengages the traveler 16 therefrom, so that the latter falls and rests upon the bridge or table 24 clear of the shaft 13. The continued rotation of the shaft 13 carries the traveler 17 upward until it engages the stops 35 of the rod 31, whereupon the rock-shaft and weighted arm are again carried over, the valve again shifted, and the traveler 16 engaged with the shaft 13, while the traveler 17 is disengaged and falls to its original position on the table. It is obvious that the stops 34 and 35 may be so adjusted upon their respective tripping-rods that the shifting of the valve will occur after any predetermined number of strokes of the compressor, and it is further obvious that if it is desired the number of strokes given to the two sides of the system by the compressor before the shifting of the valve may be different and may be varied according to the requirements of the system.

In the foregoing construction the switch-valve is operated directly by the controlling mechanism; but my invention is not limited to such a constructin, and in Figs 6 and 7 I have shown a controlling mechanism in which the switch-valve is operated by a motor, said motor being governed by a controlling mechanism, which is operated from the compressor, said figures also showing certain modifications in the controlling mechanism proper. In the said Figs. 6 and 7, 10 represents the shaft driven from the compressor, and 43 a bevel-gear mounted on said shaft and meshing with two bevel-gears 44 and 45, which are driven thereby in opposite directions. 46 indicates a friction-clutch adapted to engage with either of the gears 44 and 45, said friction-clutch being mounted on a shaft 47, rotating and adapted to slide longitudinally in suitable bearings. The gear 45 is loosely mounted on said shaft 47, while the gear 44 may be loosely mounted on a short shaft 44^a in direct longitudinal alinement with the shaft 47. The shaft 47 is screw-threaded for the greater portion of its length, as shown at 48, and there is provided a traveling cross-head or nut 49, which is threaded to engage the threaded portion 48 of the shaft 47 and which is prevented from turning by engagement with suitable guiding-ways 50. The switch-valve 51 is mounted in a valve-casing 52 and is constructed substantially as in my Letters Patent hereinbefore referred to to effect a variable connection between the pipes 37, 38, 39, and 40 of the system. 53 indicates a motor comprising a cylinder 54, containing a piston 55, secured to or connected with the stem 56 of the switch-valve 51. The valve-chest 57 of said motor contains a D-valve 58, which controls the passage of the pressure fluid from the supply-pipe 59 through either of the ports 60 or 61 to the opposite ends of the cylinder 54 and also the connection between the interior of said cylinder and the port 62, which communicates with the atmosphere. It will of course be understood that the construction and arrangement of the valve and its ports and of the motor generally may be of any approved construction and that said motor may be operated by fluid-pressure, such as steam or air, or that it may be operated by a vacuum in conjunction with atmospheric pressure, as in my prior Letters Patent hereinbefore referred to. The valve-stem 56, which also forms the piston-rod of the motor 53, is

shown as extending through the cylinder of the motor and as connected to the end of the shaft 47 by means of a suitable coupling 63, which causes the shaft 47 to move longitudinally along with the stem 56 and its connected parts, while at the same time the said shaft is permitted to rotate without imparting rotary motion to the valve-stem 56. The valve 58 of the motor is provided with a stem 64, on which are adjustably mounted two stops or triggers 65 and 66, arranged in the path of and adapted to be alternately engaged by the nut or cross-head 49. The adjustment of the stops or triggers toward or from each other is preferably effected by mounting them to slide upon the stem 64, their movement being effected by means of a shaft 67, screw-threaded in opposite directions at its ends to engage the respective stops or triggers 65 and 66 and mounted so as to revolve without longitudinal movement in suitable bearings in a block 68, adjustably secured to the stem 64 by means of a set-screw 69. The screw-shaft 67 may be rotated to adjust the triggers by means of a disk 70, secured thereon in a suitable recess in block 68 and having radial apertures for the insertion of a pin or other suitable tool, by means of which it may be turned, or other suitable provision for rotating said screw-shaft may be made.

The apparatus thus described operates in the following manner, it being assumed that the motor 53 is operated by atmospheric pressure, the pipe 59 being connected to the exhaust side of the compressor: The parts being in the position shown, with the friction-clutch 46 in engagement with the bevel-gear 44, the shaft 47 rotates in the direction indicated by the arrow, so as to carry the cross-head or nut 49 along the same in the direction of the stop or trigger 66. Each rotation of the shaft 10 is either coincident with or bears a fixed relation to each stroke of the compressor, and consequently the cross-head or nut 49 will come in contact with the stop or trigger 66 after a certain definite number of strokes of the compressor, this number depending upon the position of said stop or trigger and being varied and controlled by the adjustment of said stop through the means provided for that purpose. When the cross-head or nut comes into contact with the stop or trigger 66, it moves the same along with it in the direction of its movement, and thereby through the medium of the stem 64 shifts the valve 58 of the motor, so as to cause the piston 55 thereof to move to the other end of the cylinder 54. This movement will shift the switch-valve 51 to its other position and will at the same time through the connection with the shaft 47 move said shaft longitudinally, so as to bring the friction-clutch 46 thereof into contact with the beveled gear 45. The shaft 47 will then be rotated in the direction opposite to that already described, and the cross-head or nut 49 will move in the opposite direction or toward the stop or trigger 65 and will after the predetermined number of strokes of the compressor come into contact with said stop or trigger and shift the valve of the motor back to its original position, thus causing the motor to not only shift the switch-valve back to its original position, but to also by reason of its connection with the shaft 47 move said shaft and its friction-clutch so as to reëngage said clutch with the bevel-gear 44, and thereby again reverse the direction of rotation of the shaft 47.

It will be seen that by the use of my improved controlling mechanism in either of the forms set forth or in such modified forms as come within the scope of my invention the switch-valve of the system will be shifted from one of its positions to the other after a predetermined number of strokes or movements of the compressor, and it will also be seen that the shifting mechanism may be so adjusted as to cause the shifting of the valve to take place after any desired number of such strokes or movements, while in the form shown in Figs. 1 to 6 the number of strokes made by the compressor while the valve is in one of its positions may be greater or less than the number made when the valve is in the other of its positions. In either of its forms the mechanism described has the advantage of being positive in its action and the further advantage of being adapted to be located at such a point in the system—as, for example, the engine-room—that it will be at all times accessible for purposes of adjustment, inspection, or repair.

I do not wish to be understood as limiting myself to the precise details of construction hereinbefore set forth and shown in the drawings, as it is obvious that these features may be varied without departing from the principle of my invention.

I claim—

1. The combination with a continuously-rotating shaft driven from the compressor and a switch-valve controlling the inlet and discharge from the compressor, of a threaded shaft driven from said continuously-rotating shaft, a traveler adapted to be actuated by said threaded shaft, and mechanism for actuating said switch-valve adapted to be engaged and set in operation by said traveler after a predetermined number of strokes of the air-compressor, substantially as described.

2. The combination with a continuously-rotating shaft driven from the compressor and a switch-valve controlling the inlet and discharge from the compressor, of a threaded shaft driven from said continuously-rotating shaft, a traveler adapted to be actuated by said threaded shaft, and mechanism for actuating said switch-valve adapted to be engaged and set in operation by said traveler after a variable but predetermined number of strokes of the air-compressor, substantially as described.

3. The combination with a continuously-

rotating shaft driven from the compressor and a switch-valve controlling the inlet and discharge from the compressor, of a threaded shaft driven from said continuously-rotating shaft, a traveler adapted to be actuated by said threaded shaft, a rod lying parallel with said threaded shaft and carrying an adjustable stop which extends into the path of said traveler, and valve-actuating mechanism connected with said rod and adapted to be set in operation upon the engagement of the traveler with the adjustable stop, substantially as decribed.

4. The combination, with a switch-valve and a rock-shaft operatively connected therewith, of a vertical threaded shaft driven from the compressor, travelers adapted to alternately engage said threaded shaft, tripping-rods connected to the rock-shaft and provided with stops adapted to be respectively engaged by the travelers, and means actuated by such engagement for disengaging the travelers from the threaded shaft, substantially as described.

5. The combination, with a switch-valve and a rock-shaft operatively connected therewith, of a vertical threaded shaft driven from the compressor, travelers adapted to alternately engage said threaded shaft, tripping-rods connected to the rock-shaft and provided with independently-adjustable stops adapted to be respectively engaged by the travelers, and means actuated by such engagement for disengaging the travelers from the threaded shaft, substantially as described.

6. The combination, with a switch-valve and a rock-shaft operatively connected therewith, of a vertical threaded shaft driven from the compressor, guide-rods supported by links on each side of said shaft, travelers mounted to slide on said guide-rods and adapted to alternately engage said threaded shaft, tripping-rods connected to the rock-shaft and adapted to be respectively engaged by the travelers, a weighted arm on the rock-shaft, and a lug or projection on said shaft to alternately engage the guide-rods, substantially as described.

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