No. 736,958. PATENTED AUG. 25, 1903.

E. GIROD.

PNEUMATIC CLOCK.

APPLICATION FILED SEPT. 12, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

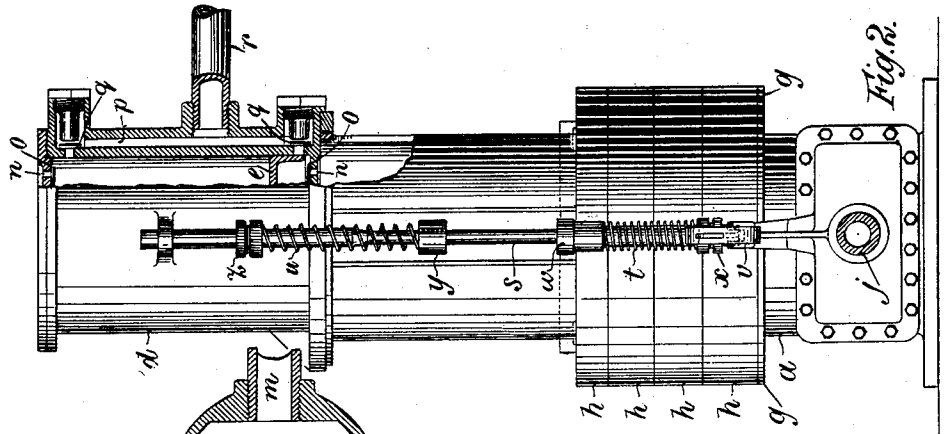


Fig. 2.

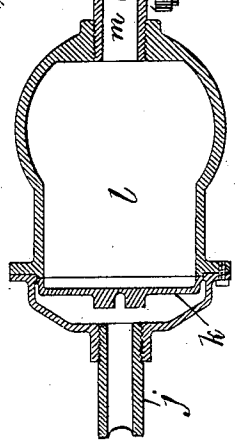


Fig. 3.

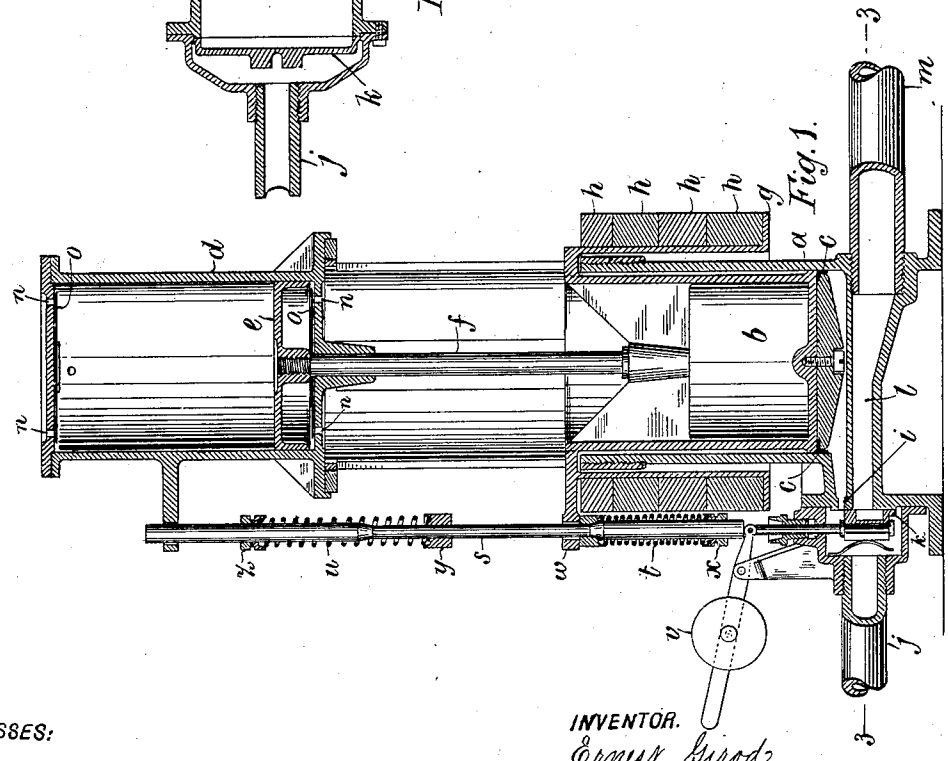


Fig. 1.

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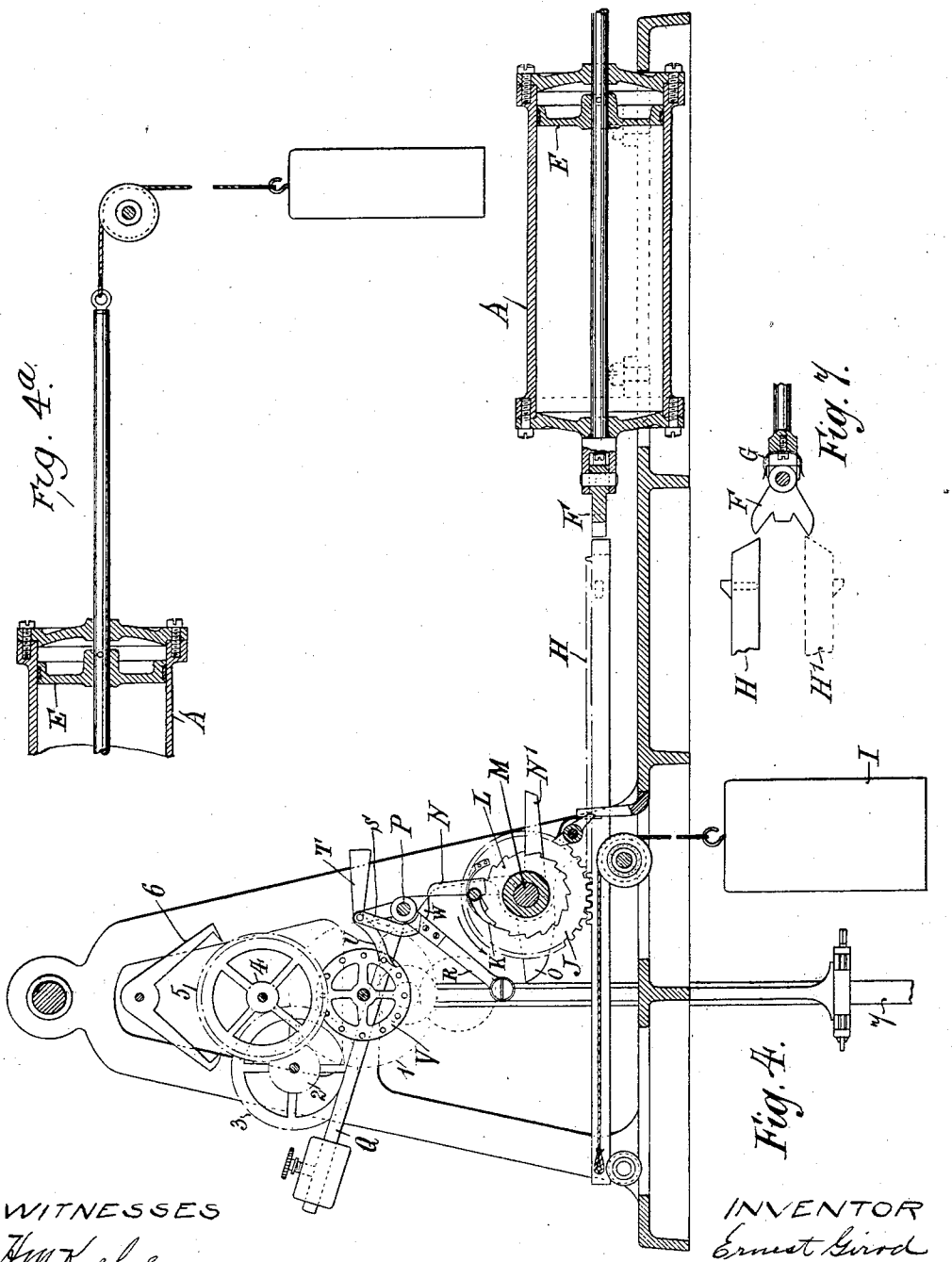
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NO MODEL. 4 SHEETS—SHEET 2.



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NO MODEL. 4 SHEETS—SHEET 3.

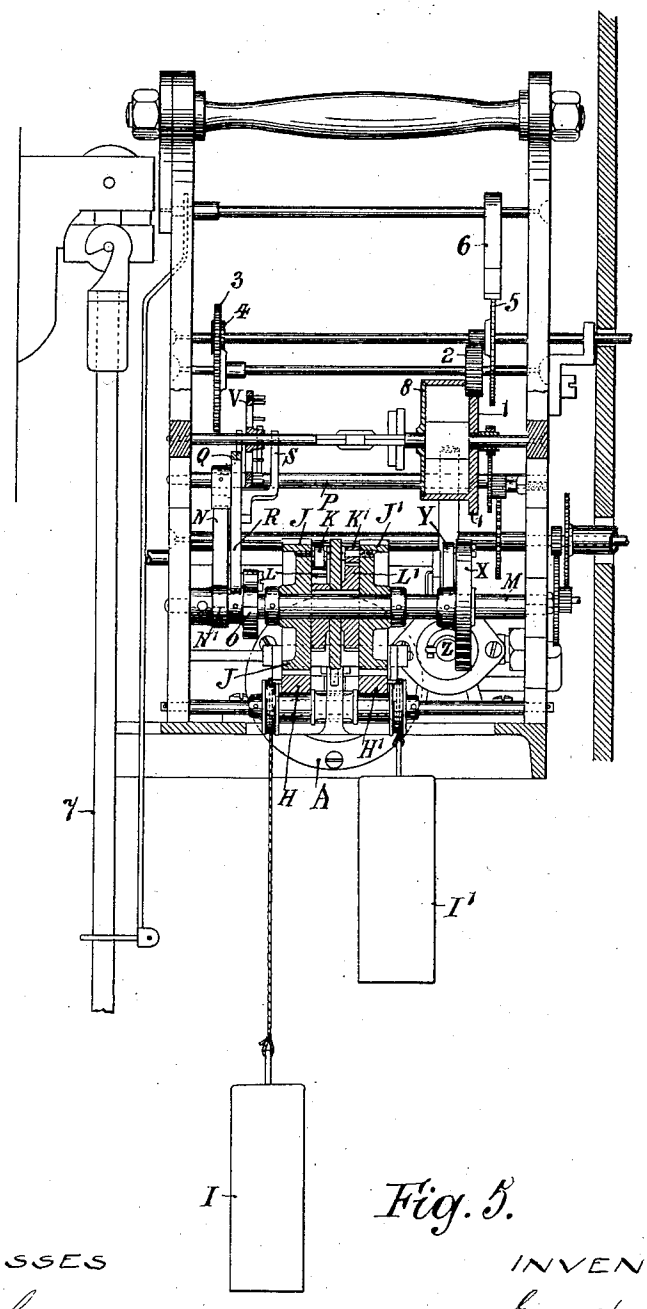


Fig. 5.

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NO MODEL. 4 SHEETS—SHEET 4.

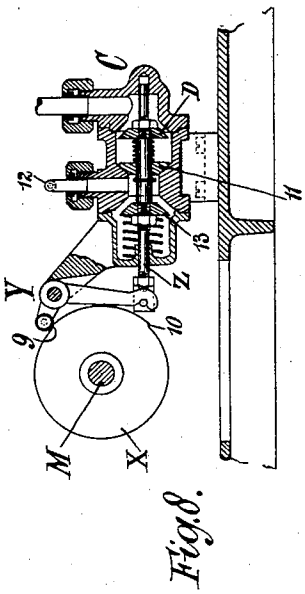


Fig. 8.

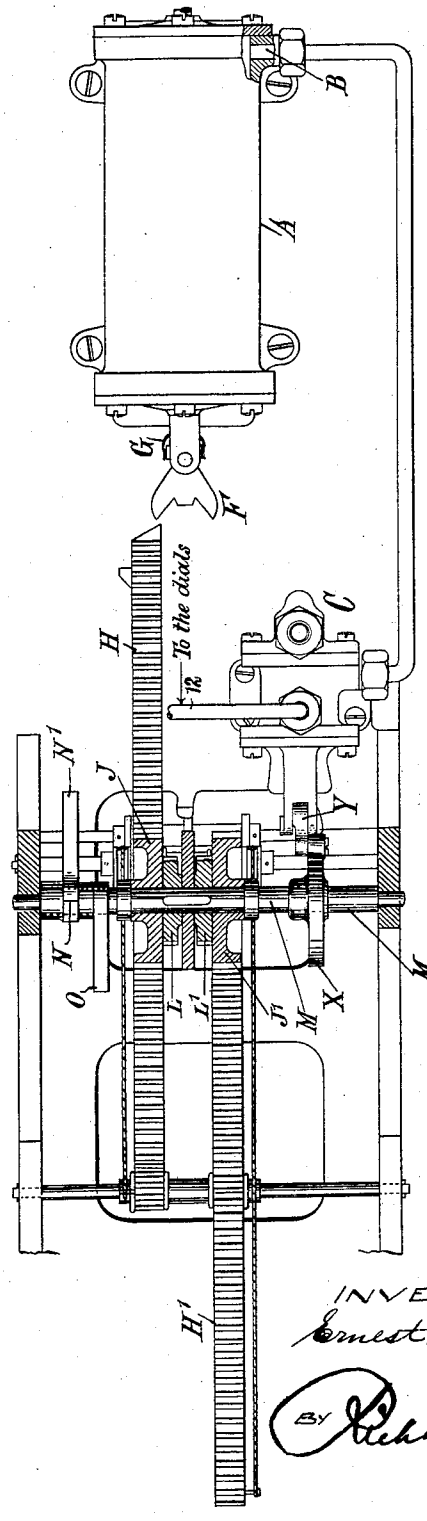


Fig. 6.

WITNESSES

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No. 736,958. Patented August 25, 1903.

UNITED STATES PATENT OFFICE.

ERNEST GIROD, OF HOUNSLOW, ENGLAND.

PNEUMATIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 736,958, dated August 25, 1903.

Application filed September 12, 1902. Serial No. 123,156. (No model.)

To all whom it may concern:

Be it known that I, ERNEST GIROD, of The Lawns, St. Stephen's road, Hounslow, in the county of Middlesex, England, have invented certain new and useful Improved Means for Maintaining Synchronous Movement in a Number of Associated Clocks; 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.

This invention relates to improved means which are adapted to maintain a number of associated clocks in synchronous movement through the medium of air-pressure, the air-pressure being derived from the pressure of water, such as is so largely available from a town's water-supply.

The invention comprises a special design of air-compressor which is automatically operated by the water-pressure and a special design of air-motor which is adapted to maintain in continuous operation the principal governing-clock, the exhaust-air from the motor being admitted at regular intervals to tubes which lead to the associated dials, each of the dials being provided with suitable mechanism of the ordinary kind to indicate the hour and minute of the day and a device, also of the ordinary kind, which is adapted to urge the mechanism a definite amount with each rise and fall of pressure in the conducting air-tube.

The design of the mechanism of the dial and the device by which it is urged by the air-pressure does not form a portion of this invention.

Referring to the accompanying drawings, Figures 1, 2, and 3 show three views of the air-compressor and water-motor, Fig. 1 being a sectional elevation, Fig. 2 an outside elevation as viewed in a direction at right angles to that of Fig. 1 and in which a portion of the air-compressor is shown in section, and Fig. 3 is a partial horizontal section taken along the plane indicated by 3 3 in Fig. 1. Figs. 4 to 8 show various views of the principal governing-clock and the air-motor by which it is maintained in continuous operation. Of these, Fig. 4 is a part-sectional elevation, Fig. 4^a is a sectional view of the end of the cylinder, Fig. 5 is another part-sectional elevation taken at right angles to that of Fig. 4, Fig. 6 is a plan, and Figs. 7 and 8 are separate views of some of the details.

Commencing with the description of Figs. 1, 2, and 3, a water-pressure cylinder *a* is fitted with a hollow trunk-piston *b*, rendered water-tight by leather packing *c*. An air-compressing cylinder *d* is fixed with its axis vertical and in line with that of the cylinder *a*, and its piston *e* is secured by a rod *f* direct to the trunk-piston *b*. The trunk of piston *b* projects through the open upper end of the cylinder *a* and is continued downward outside that cylinder, terminating in a platform *g*, on which a number of ring-shaped weights *h h h h* are placed. The water under pressure is admitted to the lower end of the cylinder *a* through the port *i* from the service supply-pipe *j* when the valve *k* is in the position shown in Fig. 1. When the valve is lifted, the cylinder is cut off from communication with the supply-pipe and through the hollow of the valve is connected to an exhaust-passage *l* and waste-pipe *m*. The weights *h h* are adjusted so that their weight combined with that of the pistons and connecting-rod equals one-half the water-pressure on the piston *b*, with the result that the upward stroke is effected by the excess of the water-pressure and the downward stroke by virtue of the weight, the available force in each stroke being alike. The air-compressor is thus double-acting, the air being drawn in through small apertures *n n* past valves consisting of thin elastic disks *o o*, which are secured, respectively, to the cylinder end and cylinder-cover at the central portion thereof. The compressed air is delivered into the passage *p* past valves *q q* and led by a pipe *r* to a receiver, where it is stored at a constant pressure ready for use in the air-motor, which will be presently described. The valve *k*, which controls the flow of water to and from the cylinder *a*, derives its motion from the pistons in the following way: The valve-spindle *s*, which is guided vertically, is surrounded by two helical springs *t* and *u*, and its weight is counterbalanced by an adjustable weight *v*. The spring *t* is maintained in compression between a lug *w*, projecting from the trunk-piston *b*, and a pair of adjustable lock-nuts

x. This spring tends to keep the valve in its downward position and open for the supply of water to the cylinder. As the pistons rise the downward pressure of this spring becomes relaxed. When the pistons have risen through the major portion of their stroke, the lug w comes in contact with the sliding piece y, which is secured to the lower end of the helical spring u, the upper end of that spring being secured to the valve-spindle by a pair of adjustable lock-nuts z. Until lug w reaches sliding piece y the spring u will be entirely relaxed. Further upward movement of the pistons will cause the spring u to become compressed, and thereby apply a gradually-increasing force on the spindle to lift the valve, which before the completion of the upward stroke of the pistons will become sufficient to overcome the downward pressure, which has been gradually relaxed, of the spring t and cause the valve to be lifted. In the event of failure to shift the valve by the force of the spring u its movement is insured just before the termination of the upstroke of the pistons by the contact of the piece y against an enlargement of the valve-spindle. In the supply-pipe j is fitted a regulating-valve, (not shown in the drawings,) the position of which is determined by the pressure of air in the receiver, so as to be open when the pressure falls below a certain desired amount, and thus allow the air-compressor to operate, and to be closed when that desired pressure is reached, and thus a constant air-pressure will be maintained in the receiver.

By reference next to Figs. 4 to 8 the construction and method of operation of the governing-clock and the air-motor which maintains it at work will be explained. In these figures is a horizontal cylinder A, to which air is admitted at the right-hand end thereof through the passage B from a valve-chamber C, into which it passes from the previously-mentioned air-receiver on the opening of the valve D, Fig. 8. The cylinder A is fitted with a piston E, which is secured to a rod, on one end of which is mounted a pivoted two-horned cross-head F, which normally is retained in a central symmetrical position, as shown in Fig. 7, by means of a spring G. In the central position the horns project sufficiently far on each side to encounter in the forward motion of the piston either one of two toothed racks H and H′, which are mounted on guiding-rollers, so as to be constrained to reciprocate in horizontal lines. To the end of each rack a weight (named, respectively, I and I′) is attached by a cord, which is led over a guiding-pulley, the weight tending always to draw the rack toward the air-cylinder. In the forward motion of the piston under the action of the air-pressure one of the horns of the pivoted cross-head will encounter the end of that rack which is nearer and by tilting through a limited angle will withdraw the other horn out of the way of the second rack. The subsequent movement of the piston E will cause the rack first encountered to be moved from right to left, and the weight which is attached to it will be lifted. The weight thus lifted will tend to draw the rack back toward the cylinder, and the effort thus rendered available is made use of to drive the governing-clock and operate the valves which control the flow of air. The rack is detained, with the weight, in the uplifted position until at appropriate intervals of time it is released in a manner to be presently described. The return stroke of the piston is, when the air-pressure is released, effected by a pulling force applied to the tail-rod by another weight, which is attached to it by a cord passing over a pulley, the latter being shown in Fig. 4ª. When the pressure of the horn on the rack is relieved, the cross-head will resume its central position, and on the next forward stroke of the piston the other horn will encounter the other rack, which will then be the nearer one to the cylinder, and so on repeatedly, the weights I and I′ being alternately lifted, one always being in an uplifted position and operating as an urging force. The rack H gears with a toothed wheel J, to which is secured a pin on which a spring-pressed pawl K is so mounted as to be maintained in contact with a ratchet-wheel L, which is secured to the spindle M. The other rack H′ gears similarly with a toothed wheel J′, and there is a corresponding ratchet-wheel L′ and pawl K′. In the forward motion of the rack when the weight is being lifted the wheel J revolves idly, the pawl sliding over the teeth of the ratchet-wheel L; but when the rack returns under the action of the descending weight the ratchet-wheel and spindle M are driven in an anticlockwise direction as viewed in Fig. 4 by the medium of the pawl. Secured to the spindle M are two radial fingers N and N′, which are in the same plane and at about a right angle apart, the rear finger N′ being slightly longer than the finger N. Also secured to the same spindle is a cam O, having a curved surface which terminates abruptly in a portion which is nearly radial. Above the spindle M another spindle P is mounted, to which is secured a piece which consists of the following parts—namely, an arm Q, which carries an adjustable weight, a second arm R, at the end of which a roller is mounted and which lies in the plane of the cam O, a third arm S, on the end of which is pivoted a balanced lever T, on one end of which a claw U is formed, which engages with the pins of a pin-wheel V, and on the same piece is formed a pallet W, suitably placed to engage with the ends of the fingers N and N′. The operation of this mechanism takes place as follows: In the position shown in Fig. 4 the arm Q is uplifted and in descending causes the claw U on the lever T to press the pin-wheel V in a clockwise direction. This pin-wheel is connected by a series of toothed wheels 1, 2, 3, and 4 with a scape-wheel 5, which engages

with the pallets of an anchor-escapement 6 of a pendulum 7. By means of the urging pressure on the pin-wheel the swing of the pendulum is maintained. In the position shown in Fig. 4 the finger N, which tends to turn anticlockwise by means of one of the weights I or I′, is held detained by the pallet W. The rotation of the clock-wheels will cause the pallet W to be presently sufficiently displaced to release the finger N. This will permit the spindle M to make one-quarter of a revolution, when it will be arrested and again detained by the contact of the longer finger N′ with the same pallet W. A further movement of the clock will cause the pallet to be lifted still higher and effect the release of the second finger N′, which will permit the spindle M to complete its revolution and the lifted weight to sink to the bottom; but just at the moment before the second finger N′ is released the roller at the end of the arm R will have come nearly into contact with the surface of the cam O, and the rotation of the cam will effect the uplifting of the weighted arm Q and place the claw in engagement with another pin of the pin-wheel. In order that a persistent effort may be applied to the scape-wheel and pendulum even when the claw-lever is being lifted, a coiled spring is provided in the barrel 8, one end of which is secured to the barrel, which is formed in one with the gear-wheel 1, and the other end is secured to the spindle, which carries the pin-wheel V. The pin-wheel being prevented by a pawl from undergoing any backward movement and the coiled spring being in a state of strain, a persistent effort on the scape-wheel will be maintained. For the purpose of operating the valves which control the air another cam X is secured to the spindle M. This has a raised portion 9 10 on its periphery, (see Fig. 8,) and a roller on the end of one arm of a double lever Y is caused to press against the cam, the other arm being attached to the end of a valve-spindle Z. The valve-spindle Z carries three valves, the valve D, before mentioned, the valve 11, past which the air is released from the cylinder A and permitted to enter the pipe 12, by which it is conducted to the associated dials under a pressure which is only a few pounds in excess of atmospheric pressure, and a valve 13, past which the air escapes from the pipe of communication 12 after having performed the office of urging forward the hands of the associated dials. When the roller is on the raised portion of the cam X, the valves D and 13 will be open, and during this time the piston E will be performing a forward stroke and lifting one of the weights I or I′. At the same time also, the valve 13 being open, the spent air in the pipes communicating with the dials will be permitted to escape into the atmosphere. When the roller is on the remaining portion of the cam X, the valves D and 13 will be closed and the valve 11 will be open. This will permit the air which has served to lift one of the weights I or I′ to escape from the cylinder A and perform a second duty at a reduced pressure of flowing toward the associated dials and actuating their hands.

I claim—

1. An apparatus of the class described consisting of the combination of an air-compressor operated by water-pressure, an air-motor, a pair of guided weights, a pivoted cross-head on the air-motor adapted to lift each of the two weights alternately, a clock, a pipe leading to time-indicating dials, valves for distributing air to the air-motor and said pipe, a weighted lever adapted to urge the clock, a rotating shaft, cams thereon adapted to open and close the said valves, and a mechanism adapted to permit the weights lifted by the air-motor to rise freely and in descending to drive the cam-shaft.

2. An apparatus of the class described consisting of an air-compressor operated by water-pressure, an air-motor, a pair of guided weights, a pivoted cross-head on the air-motor adapted to lift each of the two weights alternately, a weighted three-armed lever Q R S carrying a detent W, a claw-ended lever T, a pin-wheel V adapted to be urged by the claw and lever, a clock adapted to be urged by the pin-wheel, revolving fingers N and N′, a cam O, a cam X and control-valves D, 11 and 13 as described.

3. An apparatus of the class described consisting of a combination of a double-acting reciprocating air-compressor, a single-acting water-pressure motor, a piston therein, a weight on the said piston which effects the downstroke, an air-motor, a pair of guided weights, a pivoted cross-head on the air-motor adapted to lift each of the two weights alternately, a clock, pipes leading to time-indicating dials, valves for distributing air to the air-motor and said pipe, a weighted lever adapted to urge the clock, a rotating shaft, cams thereon adapted to open and close the said valves and a mechanism adapted to permit the weights lifted by the air-motor to rise freely and in descending to drive the cam-shaft.

In testimony that I claim the foregoing as my invention I have signed my name in the presence of two subscribing witnesses.

ERNEST GIROD.

Witnesses:
R. S. SMITH,
W. J. NORWOOD.