No. 725,402. PATENTED APR. 14, 1903.

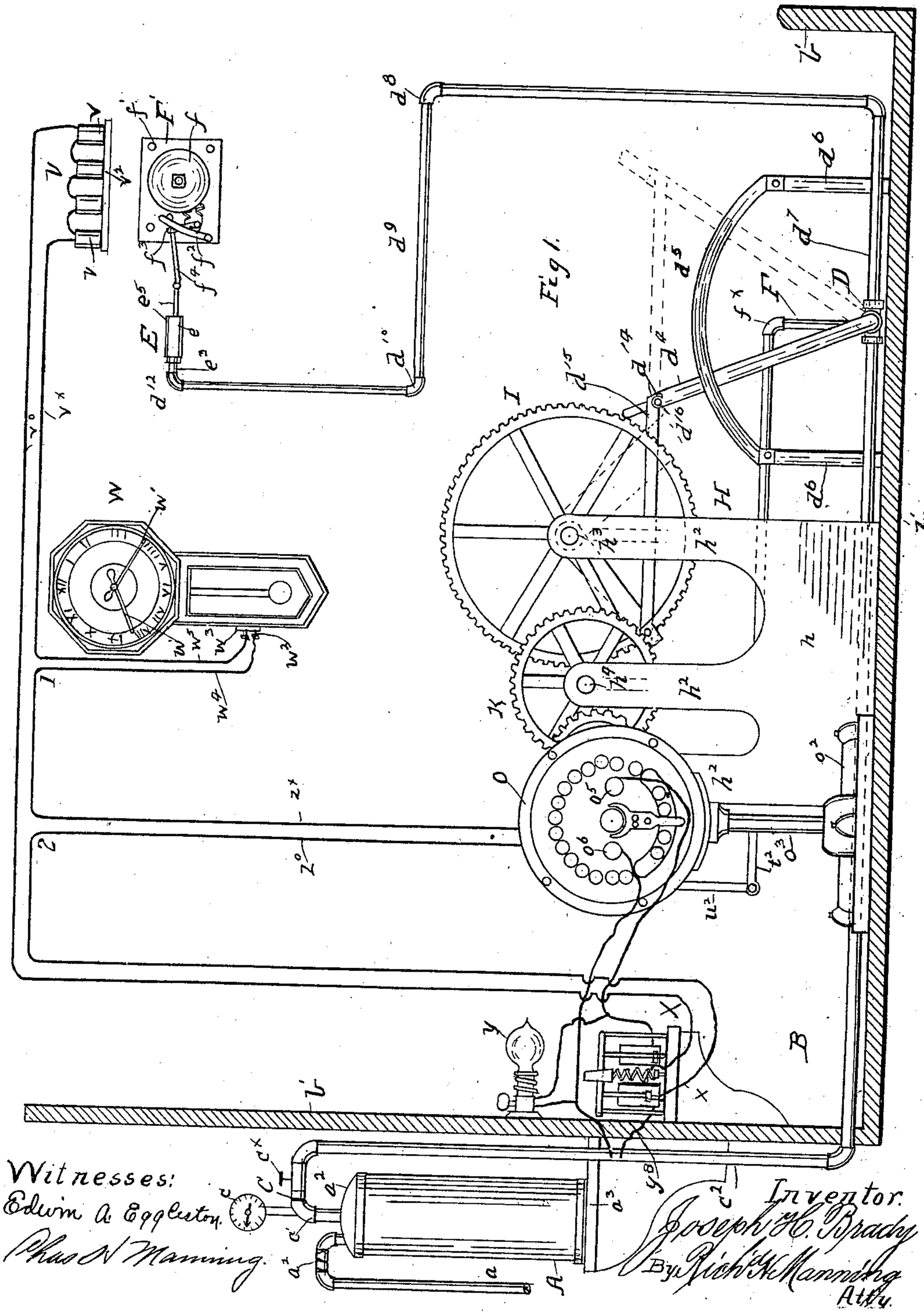
J. H. BRADY.

PNEUMATIC SIGNAL.

APPLICATION FILED APR. 8, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig 1.



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4 SHEETS—SHEET 2.

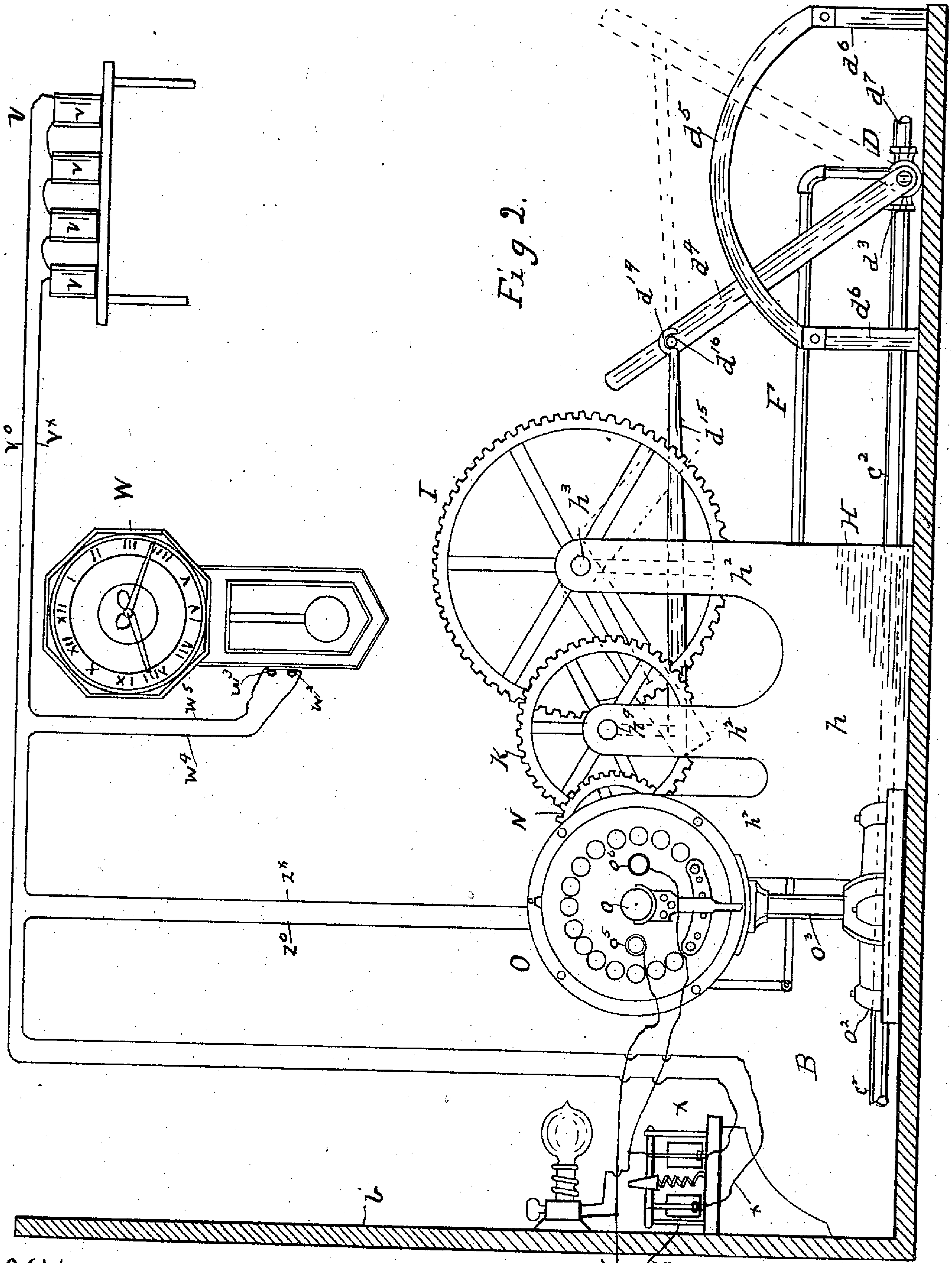

Fig 2.

Witnesses:

Edwin A. Eggleston,

Chas N Manning

Inventor.

Joseph H. Brady

By, Rich'd N. Manning

Atty.

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NO MODEL.

4 SHEETS—SHEET 3.

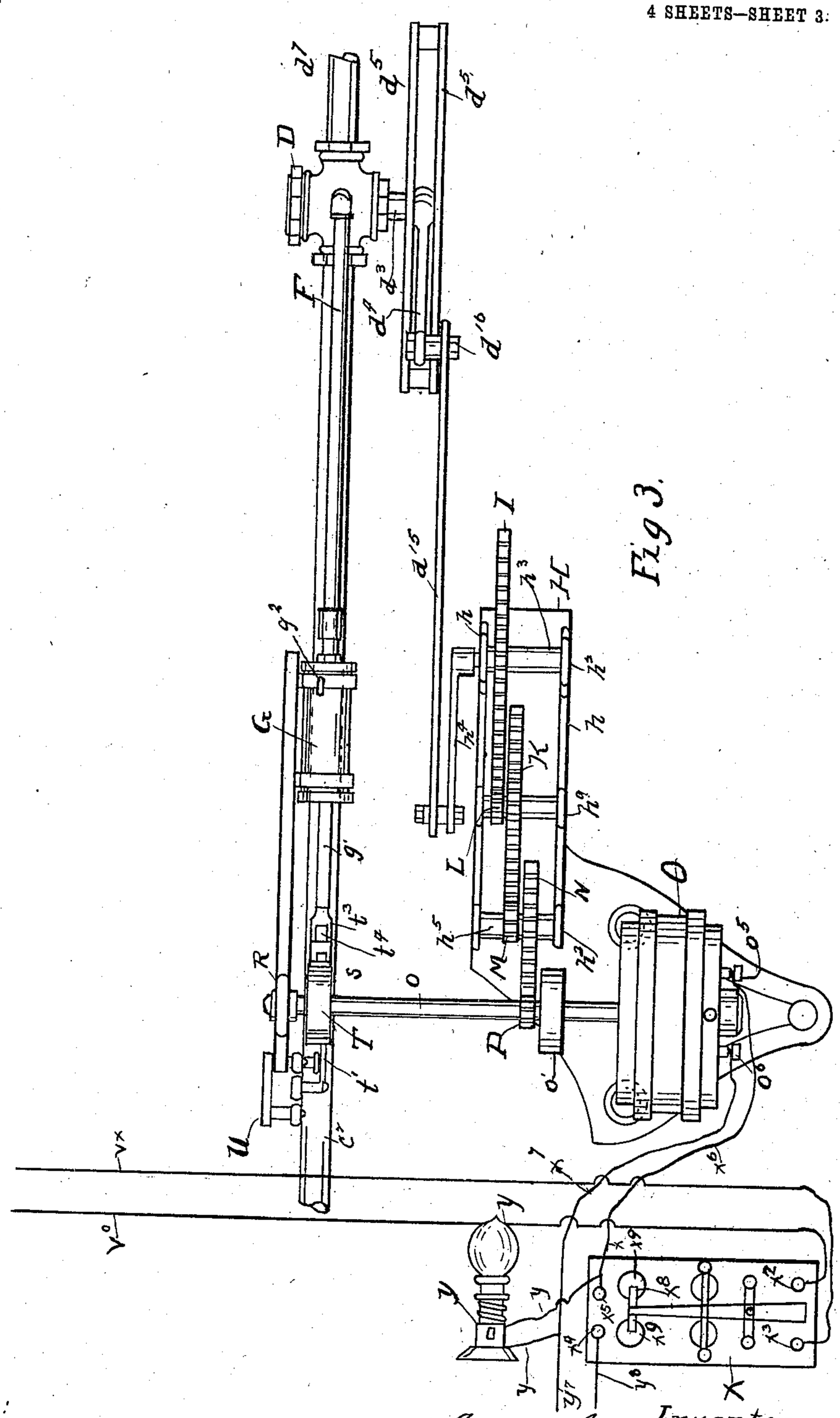

Fig 3.

Witnesses:
Edwin A. Eggleston
Chas. N. Manning -

Inventor.
Joseph H. Brady
By. Richards & Manning
Attys.

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J. H. BRADY.

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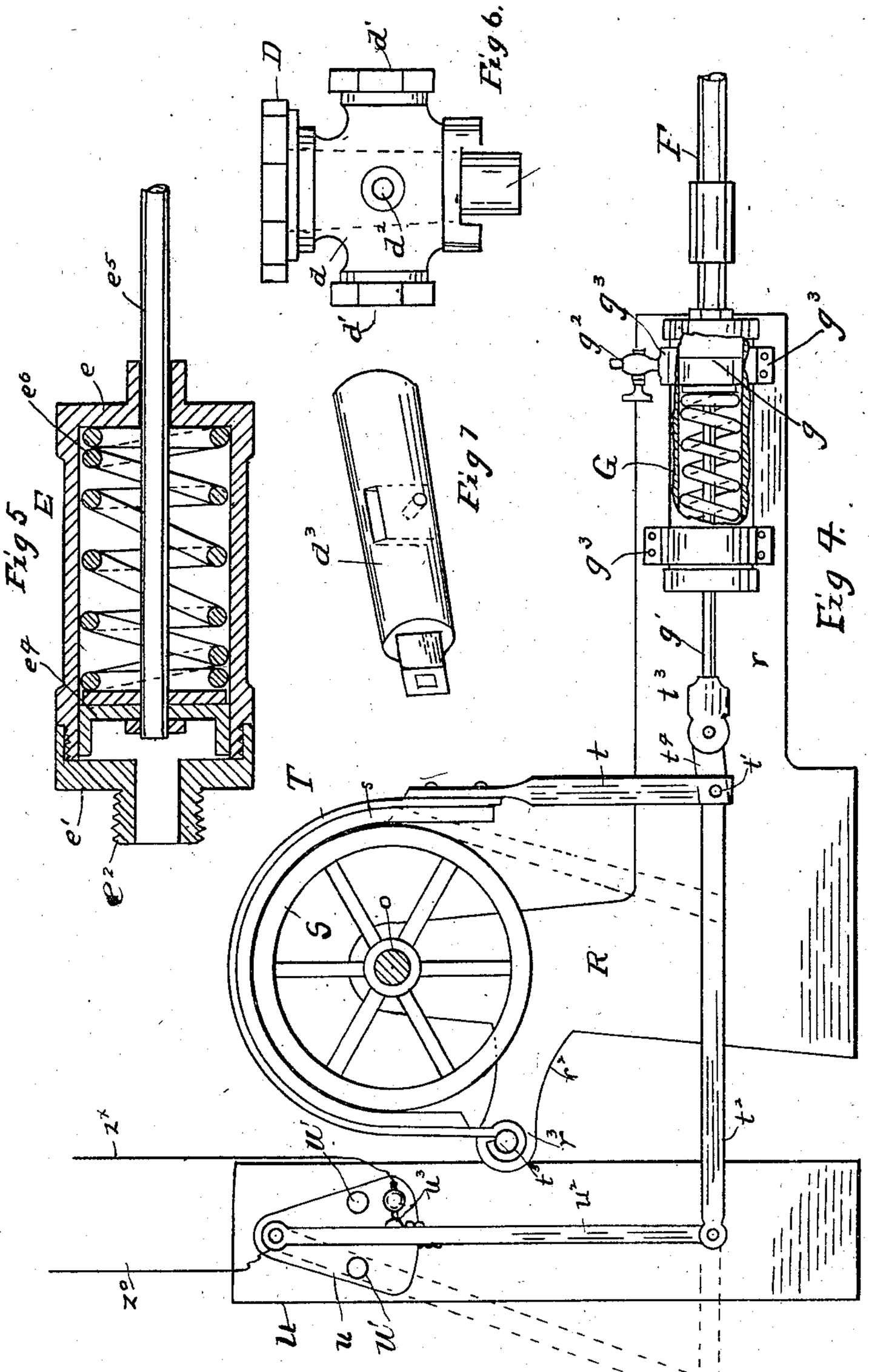

Fig 6.

Fig 7

Fig 5

Fig 4.

Witnesses.
Edwin a Eggleston.
Chas N. Manning -

Inventor
Joseph H. Brady
By Richards & Manning
Attys.

UNITED STATES PATENT OFFICE.

JOSEPH H. BRADY, OF KANSAS CITY, MISSOURI.

PNEUMATIC SIGNAL.

SPECIFICATION forming part of Letters Patent No. 725,402, dated April 14, 1903.

Application filed April 8, 1902. Serial No. 101,873. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. BRADY, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Automatic Devices for Controlling Compressed-Air-Operated Signals; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others to make and use the same, reference being had to the accompanying drawings, forming a part of this specification.

The objects of my invention are, first, to set in motion or communicate power at predetermined intervals of time to signals, signs, or any object which requires an initial movement and to enable its recurrence with greater or less frequency; second, to control the action of compressed fluids in communicating power and to utilize the fluid which escapes to diminish pressure to the arresting of the motor; third, to transmit diminished degrees of speed from the motor to the operating-lever releasing the power; fourth, to utilize in compressed-fluid motors the waste fluid in imparting power to an auxiliary motor; fifth, to intercept electrically between the generator and the motor the action of a lever controlling the action of the signals; sixth, to enable the piston in a fluid-impelled apparatus whose initial movements are actuated by a motor to automatically apply the brake to the motor; seventh, to hold the brake upon a motor in a momentarily-open circuit with the generator during the action of a circuit-closing mechanism; eighth, in a compressed-air-operated signal to control the action of the valve between the air-receiver and the signal automatically.

The invention consists in the novel construction and combination of parts, such as will be first fully described, and specifically pointed out in the claims.

In the drawings, Figure 1 is a view in elevation of the automatically-controlled compressed-air signal-operating mechanism, showing the signal, the electric generator and motor and relay, and the electrically-operated program-clock in an electric circuit, the compressed-air receiver, the lever controlling the action of the compressed air upon the signal actuated by the electric motor, and the speed-regulating train of gear. Fig. 2 is a view in elevation of the invention as seen in Fig. 1 with the exception of the illustration of the compressed-air receiver, the signal and its motor, and the conducting-pipes for the compressed air. Fig. 3 is a plan view in detail of the electric motor, the speed-gear, the relay, the compressed-air-conducting pipe leading to the signal, the combined cut-off and pressure-relief valve, the lever operating said valve and actuated by the electric motor, the fluid-motor actuated by the waste fluid from the relief-valve and the brake, and the controlling devices therefor on the piston-rod of the fluid-motor. Fig. 4 is an enlarged detail view in elevation of the fluid-motor for the waste fluid from the compressed-air pipe, also showing the brake to the piston-rod of the motor and the electrically-controlled brake-bars. Fig. 5 is a sectional view of the fluid-motor actuating the signal. Figs. 6 and 7 are detail views of the pressure-relief and cut-off valve leading to the signal.

Similar letters of reference indicate corresponding parts in all the figures of the drawings.

Referring to the drawings, A represents an upright receiver or tank for compressed air, which is supplied from an ordinary air-compressor (not shown) through the supply-pipe a, said pipe being provided with a check-valve a', preventing the return of the air.

For the purpose of illustration the receiver A is shown mounted upon a bracket a^3 upon the outside of one of the vertical side walls b' to the apartment B, the side walls b' b' being shown in section. With the top a^2 of the receiver A is connected one end of an upwardly-extended delivery-pipe C, upon the upper end of which is a pressure-gage c. With the side of pipe C and the elbow-joint c' is connected one end of a compressed-air supply pipe c^2, which extends outwardly a short distance, thence bent at right angles and extended downwardly to a position upon a line with the upper surface of the floor-line b of apartment B, thence horizontally through the side wall b' and horizontally with said floor-line about two-thirds the distance to the opposite side wall b', and is connected with one end of a pressure-relief and cut-off valve D,

which, as shown in Fig. 6, consists of the casing d, ports d' d', and the escape-opening d^2 in the top in the valve-casing d, which opening receives one end f of a waste or discharge pipe F, hereinafter described.

d^3 is the automatically-operated valve-plug, upon the outer end of which is a lever d^4, the upper end of which moves in the arc of a circle between the outwardly-curved parallel guide-bars d^5 d^5, which are supported by the standards d^6 d^6 at each end. With the other end of the valve-casing d is connected one end of the pipe d^7, which extends horizontally upon the floor-line b from its position near valve D to within a short distance of the side wall b' upon the opposite side of the apartment, thence extended upwardly at a suitable distance above the floor b', thence bent at right angles at d^8, and a portion d^9 extended horizontally above the portion d^7 of the air-conducting pipe, thence bent at right angles at d^{10} and extended upwardly nearly the height of said apartment, and an elbow d^{12} connected with said end. With the elbow d^{12} is connected the fluid-moter E, which consists of a hollow cylinder of the proper size, one end e of which is integral with the sides of the cylinder, the other end being screw-threaded, and upon said end is a screw-threaded flanged cap e', in which is a screw-threaded neck e^2, which is fitted to the screw-threaded end of a short pipe e^3, connected with the elbow d^{12}. Within the cylinder and normally near the end e' is a piston e^4, with which is connected one end of a piston-rod e^5, the other end of which rod extends through the end e of the cylinder E. Between the piston e^4 and the forward end of the cylinder is a spiral spring e^6, which extends around the piston-rod and bears against the piston and serves to energize the back pressure of the compressed air when the air is released.

F' represents the signal, which consists of an ordinary gong or bell f, secured to the board f' and upon which is a spring-actuated pivoted hammer f^2, worked by the pivoted lever f^3, with which it contacts and makes the sound or gives an alarm in the well-known manner. With the lever f^3 is connected one end of a pivoted rod f^4, the other end of which rod is pivotally connected with the piston-rod e^5 of the motor E. The waste-pipe F extends upwardly a short distance above the valve D and is bent at right angles at $f^\times$ and extended horizontally above the portion c^2 of the compressed-air-conducting pipe and connected with the rear end of a fluid-motor G, in the cylinder of which is a piston g, with which piston is connected one end of a piston-rod g', which rod extends through the forward end of the cylinder. Upon the cylinder G, at the rear end of said cylinder, is an air-escape cock g^2, which relieves the back pressure on the piston in the cylinder in the return stroke.

H represents a frame for supporting the operative mechanism to the lever d^4. The frame H consists of the vertical base-plates h h, which are arranged forward of the side of the fluid-motor G and parallel with each other, as seen in Fig. 3. From the upper edges of the base h h extend upwardly the separate standards h^2 h^2 h^2, which vary in height, the standards h^2 h^2 at the rear end of the bases h h extending in height above that of the standards upon the forward ends of said bases, which are proportionately less in height. In the upper ends of the standards h^2 h^2 at the rear end of the base-plates h h are journaled the ends of a transverse shaft h^3, upon which shaft is a large gear-wheel I. Upon the end of shaft h^3 which extends rearwardly through the standard h^2 and a short distance from the rear side of said standard is a crank-shaft h^4. Upon the upper and outer side of the lever d^4 is a pin d^{14}. With the pin d^{14} is connected one end of a bar d^{15}, which is provided with a hook d^{16}, which passes over the pin d^{14}. The forward end of bar d^{15} is pivotally connected with the crank-arm h^4 in the shaft h^3. Journaled in the upper ends of the standards adjoining the rear standards h^2 h^2 is a shaft h^9, upon which is journaled a gear-wheel K, similar in circumference to the wheel I. Upon the shaft h^9 is a small spur-wheel L, and which engages the gear-wheel I. Upon the upper ends of the forward standards h^2 h^2 is journaled a transverse shaft h^5, upon which is a spur-gear M, with which engages the gear K. Upon shaft h^5 is a gear N, which is about one-half the circumference of the gear K.

O represents an electric motor of the usual well-known type, and o is the motor-shaft, which is supported by an upright o', adjacent to the motor. The motor O is mounted upon a base o^2 horizontal with the floor. Upon the base o^2 is a column o^3, which extends upwardly and supports the motor O the proper height for the transmission of power to the train of gear, the shaft o extending transversely to the gear N and a short distance forward of said gear. Upon the shaft o is a spur-gear P, with which meshes the gear on the gear-wheel N. The rear end of the shaft o is journaled in the upper end of an upright or standard R, which is arranged in position a short distance in rear of the compressed-air-conducting pipe c^2 and transversely to the motor O. From the standard R extends rearwardly an extension r, having a flat surface and to which is secured the fluid-motor G by means of the straps g^3 g^3.

The brake mechanism for the piston-rod g' of the fluid-motor G consists of a band-wheel S, which is keyed to the shaft o, and which wheel has a broad periphery upon which is a friction-belt s, composed of brass fastened with leather, which extends over a portion of the periphery of the wheel.

T is a brake-strap upon the outer surface of the belt s, which is composed of spring-steel. With one end of the strap T is connected rigidly the upper end of a brake bar or lever t, the lower end of which bar extends

downwardly to a position opposite the end of the piston-rod g' of the fluid-motor G and is pivotally connected at t' with the side and rear end of the horizontal bar t^2. Upon the forward end of the piston-rod g' is a forked plate t^3, with which is pivotally connected one end of a short plate t^4, the other end of which plate is pivotally connected with the pivot t' and upon the opposite side of the bar t^2, with which the bar t is connected. Upon the other end of the steel brake-strap T is a loop t^5. Extending from the forward side of the standard R is a bracket r^2, upon which is a pin r^3, over which is passed the loop t^5 of the strap T.

U represents a standard a short distance forward of the standard R and in line therewith, upon the upper end and forward side of which is rigidly connected the insulated plate u. With the upper portion of the plate u is pivotally connected the upper end of a swinging metal bar u^2, the lower end of which bar is pivotally connected with the forward end of the horizontal bar t^2, connected with the piston-rod g' of the fluid-motor G. Upon plate U is a platinum pole-plate u', and upon the side of bar u^2 is a platinum plate u^3, which comes into contact with the plate u' when said bar is normally at rest. These plates are brought within an electric circuit, as hereinafter described.

V represents the generator of electricity for the time mechanism and which, as illustrated, comprises a series of storage or cell batteries $v\ v\ v\ v$, located upon the bracket v^2, which is upon the rear wall of apartment B and at the highest point of elevation above the floor. The cells are connected, as usual, in series, and from the opposite end cells extend the separate conducting-wires $v^0\ v^\times$. Upon the rear wall of the apartment is the electrically-operated time mechanism or program-clock W, of the ordinary and well-known description, the hour-hand w and minute-hand w' opening and closing the circuit. Upon the side of the clock W are the binding-posts w^2 w^3, with which are connected the branch conducting-wires $w^4\ w^5$, which wires are connected, respectively, with the conducting-wires $v^0\ v^\times$ of the batteries V.

X represents a relay or switch of the ordinary and well-known description, which is arranged upon the bracket x upon the side wall b' of the apartment. The ends of the conducting-wires $v^0\ v^\times$ are connected with the magnetic plates $x^2\ x^3$ at the rear end of the relay X. With the binding posts or poles x^4 x^5 at the forward end are connected the branch wires $x^6\ x^7$, which are also connected with the binding-posts $o^5\ o^6$ of the electric motor O. With the binding-posts $x^4\ x^5$ of the relay are also connected the inner ends of conducting-wires $y^7\ y^8$, the outer ends of which wires extend to and are connected with a generator of electricity (not shown in the drawings) and which supplies the usual source of power to a street system of light and power and is known herein, in connection with the motor, as the "main current" or "electric circuit."

Y is an ordinary incandescent lamp upon the wall of the apartment, with which is connected the branch wires $y\ y$, leading from the poles $x^4\ x^5$ at the forward end of the relay X. $z^0\ z^\times$ are branch wires connected at their upper ends with the wires $v^0\ v^\times$, one wire, v^0, being connected at its lower end with the upper end of the vibrating bar u^2 on the plate u and the other wire, $v^\times$, with the contact-plate u' on said plate u, the circuit when the plates $u^3\ u'$ are in contact being normally closed.

In operation the tank A is supplied with compressed air from an ordinary compressor. The valve $c^\times$ in the pipe c^2 is then opened, admitting the air under pressure to the valve D, where it is held in check until the exact time the signal or gong is to be sounded. The ordinary contact-points upon the minute-hand of the program-clock W, upon reaching the contact-point upon the face of the clock and at the point indicating by any figures any hour or part of an hour of the day, the circuit through the clock is closed through the hour-hand and the contact-point which is in contact with a like contact-point upon the face of the clock indicating the hour of the day. This circuit being closed, the current passes through the conducting-wire w^4, through the clock and the wire w^5, thence to the forward end of the relay X, causing the vibrating plate x^8 to close into the mercury-cups $x^9\ x^9$ and act as switch to the motor O, thus opening communication through the branch wires $x^6\ x^7$ to the poles $o^5\ o^6$ of the motor O and at the same time through the branch wires $y\ y$ to the incandescent lamp Y. Power from the motor O is transmitted through the spur-gear P on the motor-shaft to the brake-wheel S and to the train of gear M, K, and I, and a slower degree of speed is transmitted and the rotation of the wheel I effected within the time the circuit-closing hands of the clock are in contact, and the power is communicated through the crank-shaft h^4 and the connecting-bar d^{15}, with the lever d^4, and the upper end of said lever is moved forwardly, opening the ports in the valve D for the passage therethrough of the compressed air, which instantly passes through the pipe d^7 and d^9 to the motor E, the piston-rod of which is moved outwardly by the action of the compressed air upon the piston, and the lever f^2 strikes the gong f and giving the signal during the time the minute-hand is upon the contact. As soon as the forward stroke of the lever d^4 is accomplished and the lever is returned to its limit of movement in a rearward direction or from the dotted position in Fig. 2 to the position seen in full lines in the rotation of the wheel I the said lever d^4 opens the passage in the valve D to the pipe F, and the pressure of the compressed air in the pipe d^7 is relieved, and the air so relieved enters the pipe F and the cylinder G. The

piston is moved forward, compressing the spring therein and forcing the piston-rod g' forward, which action moves the brake bar or lever t of the brake-strap T forward, and drawing upon said strap the leather band is brought in close contact with the periphery of wheel S, and the movement of said wheel is arrested and also the movement of the motor-shaft o, and the swinging bar u^2 is moved forward by the bar t^2 into the position seen in dotted lines in Fig. 4, and the plate u^3 on said bar is moved from contact with the contact-plate w', and the circuit is opened from the generator and clock and the relay X, cutting out the incandescent light Y and the motor O and stopping the action of the motor. The minute-hand of the program-clock then moves away from the contact upon the clock at the hour of twelve or an hour or part of an hour, and the circuit is opened through the clock. The action of the spring in the cylinder G causes the piston g' to move rearwardly, and the air escapes through the cock g^2, and the piston being thus relieved the brake-strap T releases its tension on the wheel S, and the swinging bar u^2 moves backward in position until the plates u' u^3 are again in contact and a circuit is completed through the branch wires z^0 $z^\times$.

In the back pressure of the air from the motor E in the form of motor herein employed to actuate the signal the spring in said motor acts against the air and assists in its expulsion from the pipe d^7. Other forms of fluid-motor may, however, be employed, in which the back pressure is reinforced by the initial pressure from the receiver and the power employed of the compressed air to actuate the opening and closing of electric circuits or such other devices as are applicable to the purpose.

The frequency of the action of the signals at stated periods is controlled by the time mechanism or program-clock. The lever d^{15} may be removed from engagement with the hook d^{14} on lever d^4 when required and the lever employed by hand to relieve the compressed air against the valve D. It is obvious that the incandescent lamp may be omitted from the electric circuit, its office being to indicate the strength of the circuit. That from the battery V being a gentle current will not burn out the time mechanism or clock.

Such modifications of the invention may be employed as are within the scope of the invention.

Having fully described my invention, what I now claim as new, and desire to secure by Letters Patent, is—

1. In pneumatic signaling devices, a receiver for the fluid under compression, a cylinder and a spring-retracted piston in said cylinder, a piston-rod, a signal actuated thereby, a conductor of air connected with said receiver and also with said cylinder, a combined cut-off and back-pressure relief-valve in said conductor, a valve-stem, a lever connected with said stem, a motor and its shaft and speed-changing mechanism substantially as described for operating said lever in power connection with said shaft.

2. In pneumatic signals, a receiver for the fluid under compression, a cylinder and a spring-retracted piston in said cylinder, a piston-rod, a signal actuated thereby, a conductor of the fluid connected with said receiver and also with said cylinder, a combined cut-off and back-pressure relief-valve in said conductor, a valve-stem, a lever connected with said stem, a motor and its shaft, a brake and a brake-operating lever, and means substantially as described for changing the degrees of speed communicated by the motor to the brake-operating lever.

3. In a pneumatic signaling apparatus, a receiver for the fluid under compression, and a cylinder, a spring-retracted piston in said cylinder, a piston-rod, a signal actuated thereby, a conductor of air connected with said receiver and also with said cylinder, a combined cut-off and back-pressure relief-valve in said conductor, a pneumatic-brake-operating cylinder and its piston, and a conductor of air connected with the cut-off and back-pressure relief-valve and energizing the piston in the brake-operating cylinder.

4. In a pneumatic signaling apparatus, a receiver for the fluid under compression, and a cylinder, a spring-retracted piston in said cylinder, a piston-rod, a signal actuated thereby, a conductor of the fluid connected with said receiver and also with said cylinder, a combined cut-off and back-pressure relief-valve in said conductor, a valve-stem, a pneumatic-brake-operating cylinder and its piston and a conductor of air connected with the pressure-relief valve and also energizing the piston in the brake-operating cylinder, and a power-actuated lever operating said valve-stem.

5. In signaling apparatus, a signal, a lever actuating the signal, a motor and its shaft, a brake and a brake-operating lever, and speed-changing devices actuated by the shaft of the motor and communicating power to and operating said brake-operating lever.

6. A pneumatic apparatus for signals, &c., comprising a signal, a receiver for compressed fluid, and a fluid-conductor, a combined cut-off and back-pressure relief-valve in the conductor, a lever operating said valve, a cylinder connected with said conductor, a piston within said cylinder and a piston-rod actuating the signal, a motor and its shaft, and power-conveying devices connected with the motor-shaft and said valve-operating lever, a separate cylinder for the back pressure of the fluid released by the valve, and a spring-retracted piston in said cylinder, and a piston-rod, and a conductor of the fluid connected with said cylinder and the said cut-off and

back-pressure valve, and a brake upon the shaft of the motor connected with the piston-rod.

7. In pneumatic devices for operating signals, a conductor of the fluid under compression, and a combined cut-off and back-pressure relief-valve in said conductor, a lever operating said valve, and a motor and its shaft, power-conveying devices connected with the motor-shaft and said lever, a cylinder receiving the fluid discharged by the pressure-relief valve, and a spring-retracted piston in said cylinder, and a piston-rod, a conductor of the fluid connected with said cylinder, and said relief-valve, a brake on the motor-shaft, and a vibrating support for said brake connected with the piston-rod in said cylinder, and suitable means for arresting the movements of the vibrating support automatically and thereby arresting the action of the motor.

8. A compressed-air-controlled signaling apparatus comprising a receiver for compressed air, a signal, a cylinder, a spring-retracted piston in said cylinder, a piston-rod actuating said signal, a conductor of compressed air connected with the receiver and said cylinder, a combined cut-off and pressure-relief valve in said conductor, a cylinder for the back pressure of the compressed air, and a spring-retracted piston, and an escape-cock upon said cylinder, a conductor of air connected with the cut-off and pressure-relief valve and said cylinder for the back pressure, a lever connected with and operating the said valve, a motor actuating said lever, and a motor-shaft, a brake on said shaft, a brake-operating bar connected with the brake, and also connected with the piston-rod in the cylinder for the back pressure of compressed air, and a vibrating bar connected with the brake-operating bar, suitable means for arresting the action of the said bar automatically and thereby arresting the action of the motor, and speed-changing mechanism controlling the action of said lever intermittently.

JOSEPH H. BRADY.

Witnesses:
THEO. C. SPARKS,
WALTER J. ADAMS.