No. 667,442. Patented Feb. 5, 1901.

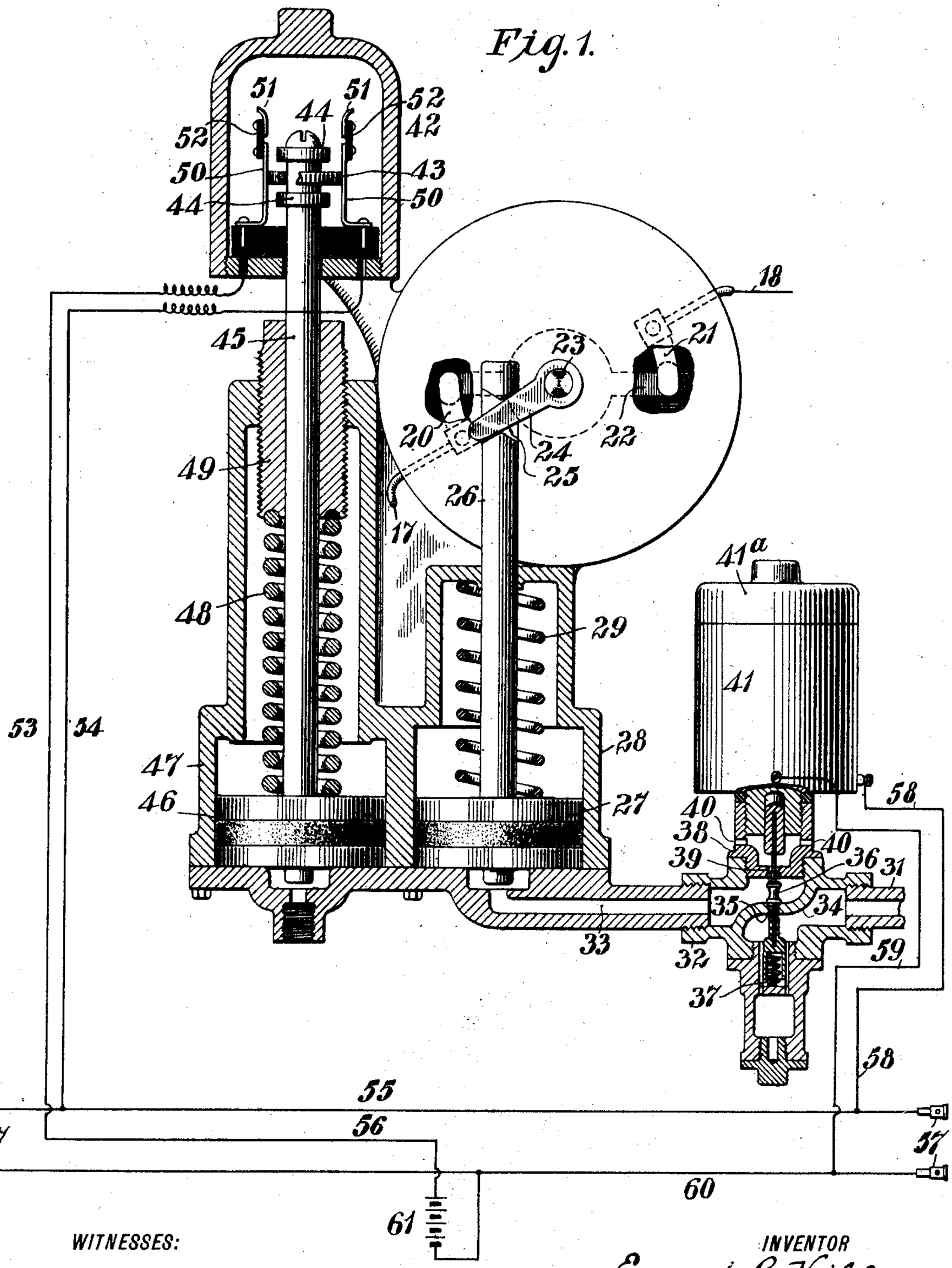
E. R. HILL.

PUMP GOVERNING MECHANISM.

(Application filed July 9, 1900.

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

C. L. Belcher
Birney Hines

INVENTOR
Ernest R. Hill
BY
Huley & Elam
ATTORNEY.

No. 667,442. Patented Feb. 5, 1901.

E. R. HILL.

PUMP GOVERNING MECHANISM.

(Application filed July 2, 1900.)

(No Model.) 2 Sheets—Sheet 2.

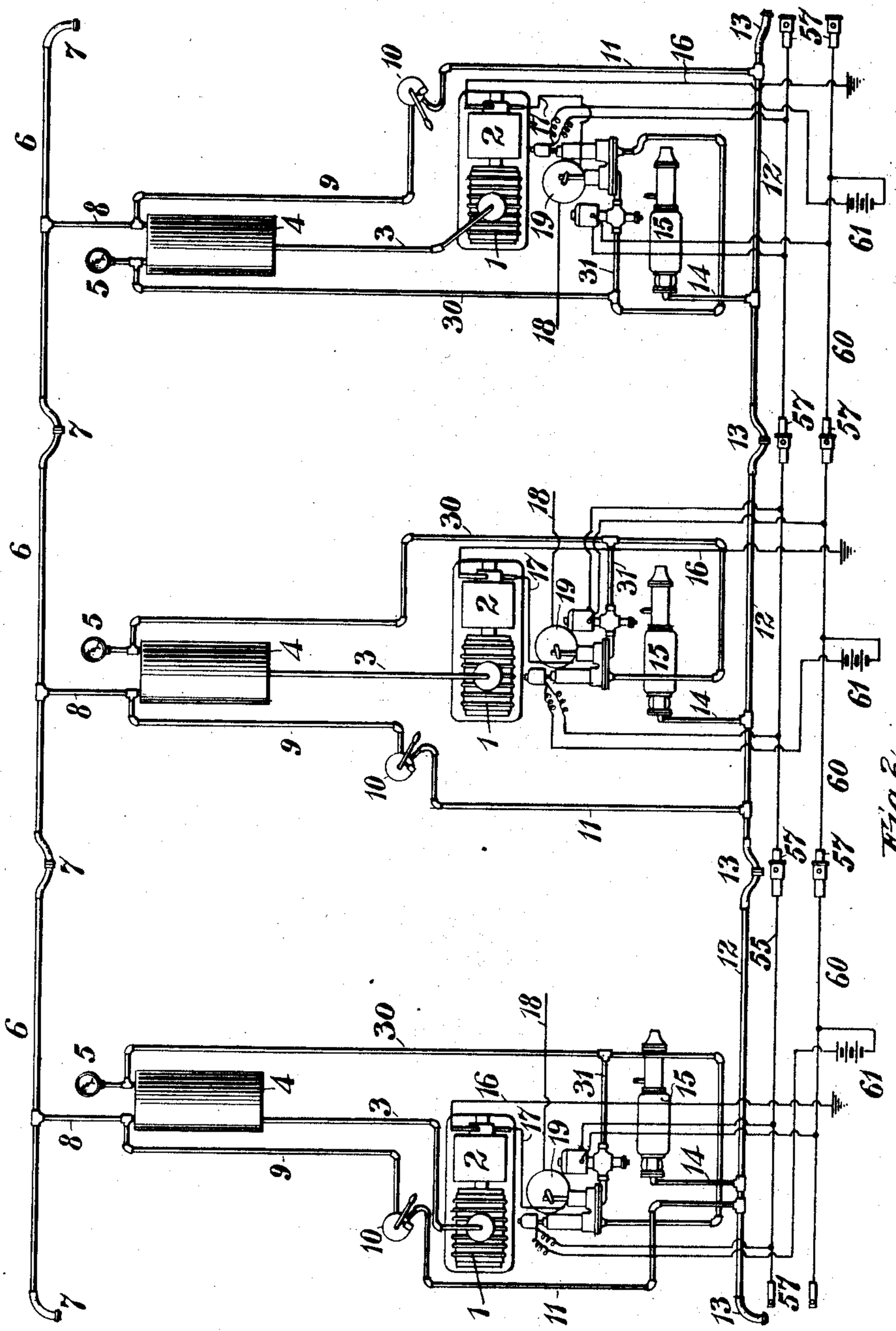


Fig. 2.

WITNESSES:

C. L. Belcher

Birney Hines

INVENTOR

Ernest R. Hill

BY

Shelby G. Carr

ATTORNEY.

UNITED STATES PATENT OFFICE.

ERNEST R. HILL, OF WILKINSBURG, PENNSYLVANIA.

PUMP-GOVERNING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 667,442, dated February 5, 1901.

Application filed July 2, 1900. Serial No. 22,310. (No model.)

To all whom it may concern:

Be it known that I, ERNEST R. HILL, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Pump-Governing Mechanism, of which the following is a specification.

My invention relates to electrically-driven air-pumps, and more particularly to electropneumatic systems in which a plurality of electrically-driven pumps are operated in synchronism to feed small reservoirs, the air-pressure in which is maintained approximately constant.

The object of my invention is to provide a means for automatically starting and stopping each of the electric motors employed for driving a plurality of air-pumps in an electropneumatic system, so that the air-pressure of the system shall never fall below a predetermined minimum and never rise above a predetermined maximum.

My invention is primarily designed and intended for use in connection with a controlling system for railway-vehicles or trains of such vehicles—such, for example, as that set forth in the patent granted to George Westinghouse May 2, 1899, No. 624,277.

In electropneumatic systems of train control in which each of two or more cars is provided with its own motors and electric controller or controllers it is desirable that each motor-car should also be provided with its own air pump and reservoir in order that such cars may be transferred from one train to another without impairing the operation of the controlling system from or to which the transfer is made. By supplying each motor-car with a complete equipment of controlling devices the individual pumps and reservoirs may be of comparatively small capacity, provided the devices are so constructed and arranged that the pumps shall operate synchronously and that the reservoirs shall be interconnected.

My invention is designed to meet the foregoing conditions and is illustrated in the accompanying drawings, in which—

Figure 1 is a view, partially in side elevation and partially in section, of the motor-governing mechanism; and Fig. 2 is a view, mainly diagrammatic in character, of a system embodying three air-pumps, their operating-motors, and the associated mechanism.

The air-pumps 1 are indicated as of the rotary type and as directly driven by electric motors 2, the air being pumped through pipes 3 into reservoirs 4, provided with pressure-gages 5, as is usual in such apparatus. Pumps of any other suitable type may obviously be employed, if desired. The reservoirs 4 are shown as connected by lengths of pipe 6, connected by suitable flexible hose and couplings 7 between cars in order that all of the reservoirs may contain the same air-pressure, the pipes 6 being connected to the several reservoirs by branch pipes 8.

The system is illustrated as embodying air-brake mechanism, and for this purpose pipes 9 lead from the reservoirs 4 to the engineer's valves 10, and pipes 11 lead from the engineer's valves to a train-pipe 12, provided with the usual flexible hose and couplings 13 and connected by branch pipes 14 to brake-cylinders 15.

In order that the air-pressure in the cylinders 4 may be kept within certain well-defined limits, I provide the means now to be described, the apparatus hereinbefore referred to being of a well-known type heretofore employed in the art.

The power for operating each of the motors 2 is derived from the main circuit, one of the brushes of the motor being connected to the ground by conductor 16 and the other brush being connected to the current-collector (not shown) by means of conductors 17 and 18 and a switch 19, the conductor 17 being connected to one stationary terminal 20 and the conductor 18 to the other stationary terminal 21 of the switch. The movable member 22 of the switch 19 is mounted upon a shaft 23, having an arm 24, that projects through a slot 25 in the outer end of the rod 26, here shown as attached to a piston 27, that is located and movable in a cylinder 28.

Any other suitable device that is actuated by a spring or its equivalent to move the switch-arm in one direction and by fluid-pressure to move said arm in the other direction may obviously be employed in lieu of the piston 27.

The stem 26 is surrounded by a coiled spring

29, that bears at one end against the piston and when free to act serves to close the switch and maintain it in its closed position, as indicated in Fig. 1. Fluid-pressure is supplied to the cylinder 28 in front of the piston 27 from the reservoir 4 through a pipe 30, a branch pipe 31, a valve-casing 32, and a passage 33. The valve-chamber 32 is provided with a partition or diaphragm 34, having an opening 35, that is closed by the valve 36. The valve-chamber also has a cap-piece 38, provided with an opening 39, that is closed by the valve 36 when forced upward by a spring 37, the cylinder 28 exhausting through this opening and openings 40 into the atmosphere when the valve is depressed. The valve 36 is connected to the armature 41^a of an electromagnet 41, so that when the magnet is energized it will move the valve downward against the action of the spring 37, and thus exhaust the cylinder 28 and permit the spring 29 to close the switch 19. When the magnet is deënergized, the port 35 is uncovered, and the fluid-pressure is thus admitted to the cylinder 28 and serves to compress the spring 29 and open the switch.

In order that the circuits of all of the motors 2 may be interrupted when the pressure in any one of the cylinders 4 reaches the predetermined amount and in order that all of the motor-circuits may be maintained closed until the pressure in each of the reservoirs reaches the limit desired, I provide an auxiliary switch 42 for governing each magnet 41, the movable contact member of this switch being shown as a disk 43, of conducting material, mounted between two collars 44 on the end of a stem 45 of a piston 46, this piston being located in the cylinder 47. The stem 45 is surrounded by a coiled spring 48, one end of which bears upon the piston and the other end of which bears against an adjustable plug 49, that constitutes a bearing-sleeve for the stem. The stationary contact members 50, with which the disk 43 makes engagement, are provided with extension-pieces 51, separated from the portions 50 by insulating-pieces 52, these extensions being employed in order to retard the disk 43 when the piston moves downward and at the same time insure smoothness in the operation of the parts. The location of the disk 43 loosely between the collars 44 provides a lost-motion construction, as will be readily seen, whereby the separation of the switch-contacts when the piston moves upward and the bringing of them into engagement when the piston moves downward is delayed until the piston has practically or very nearly completed its stroke. The stationary contact members of the switch 42 are respectively connected by means of conductors 53 and 54 to conductors 55 and 56, the former of which extends throughout the train and embodies suitable couplings 57 between the cars of the train.

Any other suitable device that is movable under the action of fluid-pressure may obviously be employed in lieu of the piston 46 for breaking the circuit 53 54, if desired.

The conductor 55 is connected to one terminal of each of the electromagnets 41 by means of a branch conductor 58. The other terminal of each magnet 41 is connected, by means of a conductor 59, to train-conductors 60, the various sections of which are connected between cars by means of suitable couplings 57. Each car of the train or system is preferably provided with a battery or other source of electrical energy 61, the respective terminals of which are connected to conductors 56 and 60.

With this construction and arrangement of the apparatus when the pressure in each of the reservoirs 4 is below that for which the apparatus is designed and adjusted each of the switches 42 is closed by the action of spring 48, and consequently each of the magnets 41 is energized by current from the corresponding battery 61, whereby the pressure is exhausted from the cylinders 28 and the switches 19 are closed by reason of the action of the springs 29. When one or more of the pumps has operated a sufficient length of time to increase the reservoir-pressure, so as to effect the upward movement of the piston 46 against the action of the spring 48 and the consequent breaking of the circuit, including the electromagnets 41, pressure will be admitted to the cylinders 28 and the pistons 27 will move upward and open the switches 29.

By reason of the electrical and pneumatic connections between the motor-cars of a train and the governing-switches it follows that all pumps on the train will be started when the pressure in any one reservoir falls sufficiently to permit the spring 48 to close the corresponding switch 42, since all the magnets 41 are connected to the corresponding battery through the said switch and the conductors 55 and 60. It follows also that all of the switches 19 will remain closed until all of the switches 42 have been opened.

While I have illustrated a system in which batteries are employed for energizing the controlling-magnets, it will be understood that energy from the power-circuit might be utilized for this purpose, if desired.

The reverse arrangement to that shown, in which the energizing of the magnets 41 will serve to admit air to the cylinders 28, and thus break the motor-circuit, is obviously within my invention, and I desire it to be further understood that other changes in the details of the apparatus may be made without departing from the spirit and scope of the invention and that my invention is not limited to systems in which fluid-pressure is employed for operating the motor-controlling devices, or, in fact, to any specific use of the fluid-pressure that is provided by the pumps and motors that are governed by means of the invention.

I claim as my invention—

1. In an electropneumatic system, the combination with a normally-closed switch and fluid-pressure-actuated means for opening the same, of an electromagnet for controlling the application of the fluid-pressure to said switch-opening means, a normally-closed governing-switch for said magnet and means for operating said governing-switch in accordance with the degree of fluid-pressure in the system.

2. In an electropneumatic system, the combination with an electric motor and a pump driven thereby, of a switch for making and breaking the circuit of said motor, fluid-pressure-actuated means for opening said switch, an electromagnetically-controlled valve for effecting the application and withdrawal of fluid-pressure and a governing-switch the operation of which is dependent upon the degree of fluid-pressure in the system.

3. In an electropneumatic system, the combination with an electric motor, a pump driven thereby and a reservoir supplied by said pump, of a switch for the circuit of said motor, an actuating device for said switch, a valve for effecting the application of fluid-pressure to and the withdrawal of the same from said actuating device, an electromagnet for actuating said valve, a governing-switch for said magnet and actuating means for said governing-switch having a permanently-open pipe connection with the reservoir.

4. In a controlling system for electrically-propelled trains, the combination with a plurality of electric motors, a plurality of air-compressors severally driven thereby and a plurality of connected reservoirs respectively supplied by said compressors, of a pneumatically-operated circuit making and breaking switch for each motor, controlling magnets and valves for the respective switches and a plurality of pneumatically-operated governing-switches for said magnets so connected with each other and with said magnets that they may operate either individually or collectively to make and break the circuits of all the magnets of the system.

5. In a controlling system for electrically-propelled trains, the combination with a plurality of electric motors, a plurality of pumps severally driven thereby and a plurality of connected reservoirs respectively supplied by said pumps, of normally-closed switches for the several motors, governing apparatus for the several motor-switches and connecting means therefor whereby all of the motors are started and stopped in accordance with the minimum and maximum fluid-pressure existing at any point in the system.

6. The combination with a pneumatically-connected series of air pumps and reservoirs, a series of motors for said pumps and a series of electrically and pneumatically connected governing devices for said motors each of which comprises a motor-circuit switch, a spring for closing and a fluid-pressure-actuated device for opening it, an electromagnetically-actuated valve for controlling the application of said fluid-pressure, a controlling-switch for the valve-operating magnet and operating means for said switch dependent upon the degree of fluid-pressure of the system.

In testimony whereof I have hereunto subscribed my name this 23d day of June, 1900.

ERNEST R. HILL.

Witnesses:

L. C. CARUANA,

WM. H. CAPEL.