No. 775,878. PATENTED NOV. 22, 1904.

S. T. WELLMAN.

ELECTRICAL VALVE OPERATING DEVICE FOR BLOWING ENGINES.

APPLICATION FILED SEPT. 9, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

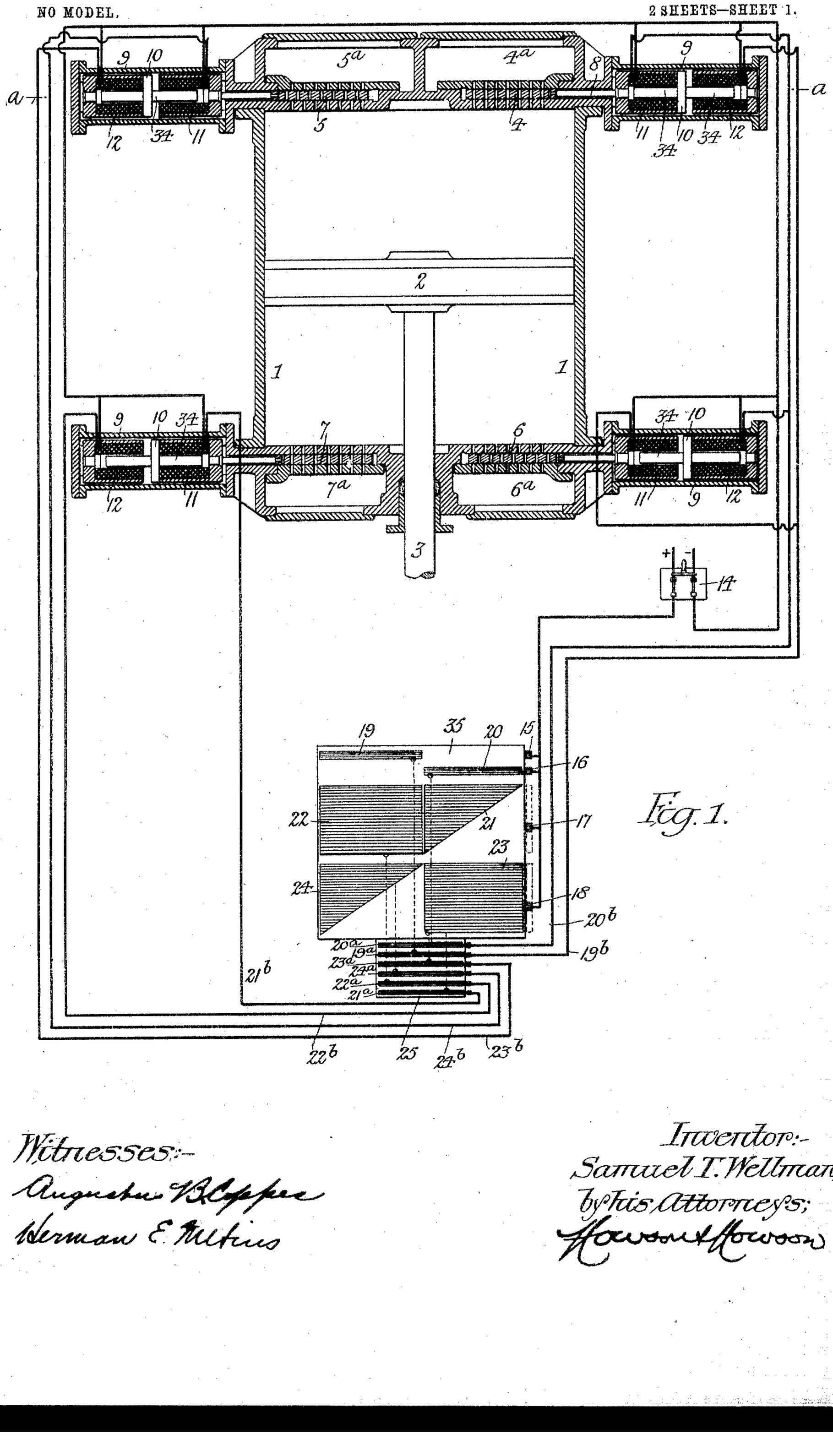

Fig. 1.

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Herman E. Miller

Inventor:-
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Howson & Howson

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

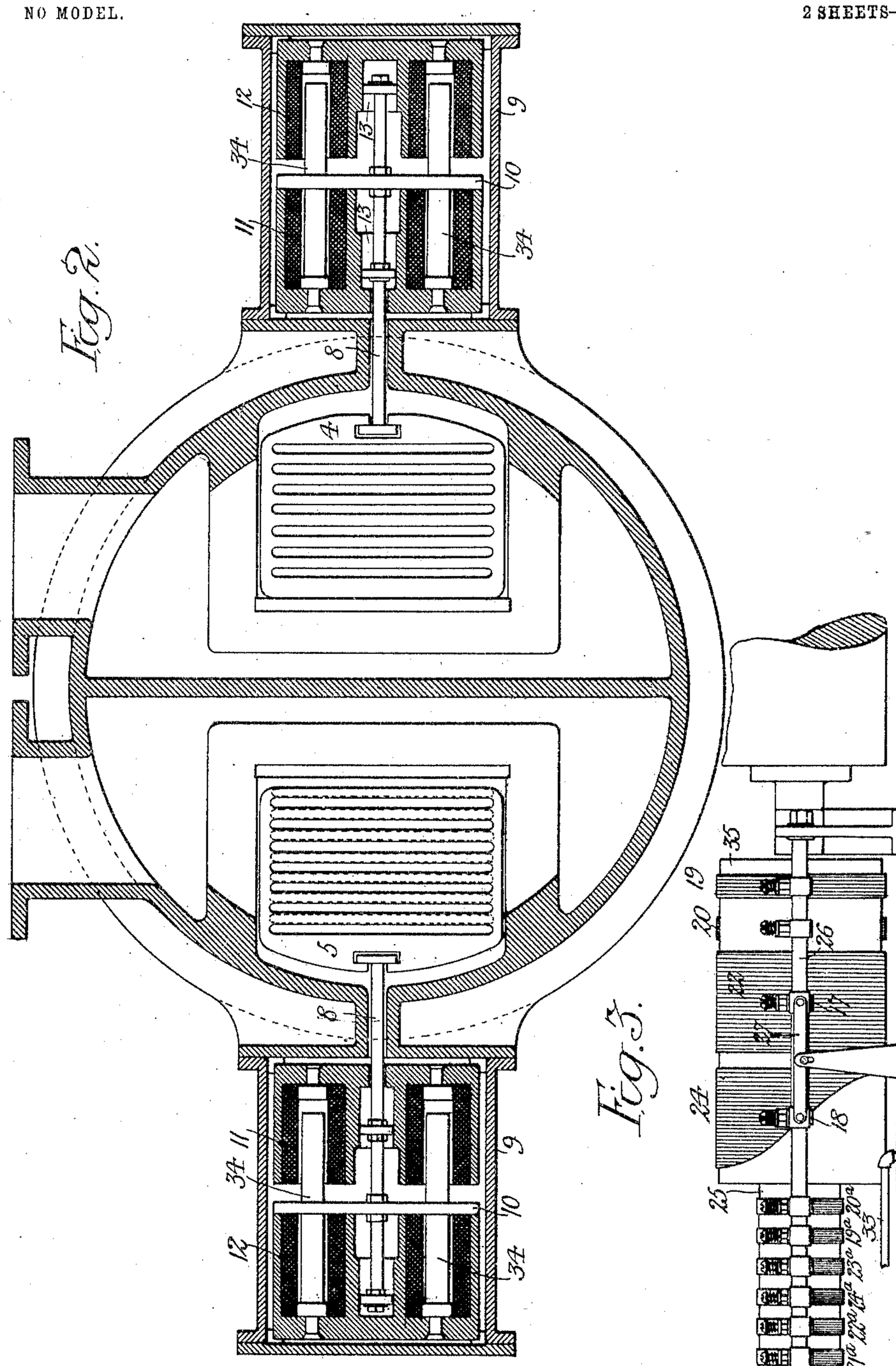

Fig. 3.

Witnesses:-
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No. 775,878. Patented November 22, 1904.

UNITED STATES PATENT OFFICE.

SAMUEL T. WELLMAN, OF CLEVELAND, OHIO, ASSIGNOR TO THE WELLMAN-SEAVER-MORGAN COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRICAL VALVE-OPERATING DEVICE FOR BLOWING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 775,878, dated November 22, 1904.

Application filed September 9, 1903. Serial No. 172,450. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL T. WELLMAN, a citizen of the United States, and a resident of Cleveland, Ohio, have invented certain Improvements in Electrical Valve-Operating Devices for Blowing-Engines, of which the following is a specification.

The object of my invention is to provide simple and effective means for operating electrically the inlet and outlet valves of the blowing tub or cylinder of a blowing-engine.

This object I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of the blowing tub or cylinder of a blowing-engine with valves and electrical operating devices therefor in accordance with my invention, the current controlling or directing device being shown as developed upon a flat plane in order to more clearly illustrate the operation of the same. Fig. 2 is a transverse section on the line *a a*, Fig. 1; and Fig. 3 is a side elevation of the current controlling or directing device.

1 represents the blowing tub or cylinder of a blowing-engine, 2 the piston of the same, and 3 the piston-rod, the latter being reciprocated either by direct connection with the piston of a steam or other power cylinder or by connection with a crank-shaft or other power-transmitting device operated thereby. The cylinder has at one end an inlet-valve chest 4^a, with valve 4, and an outlet-valve chest 5^a, with valve 5, the other end of the cylinder being provided with an inlet-valve chest 6^a, having a valve 6, and an outlet-valve chest 7^a, having a valve 7. Each valve has a stem 8, which projects into a closed casing 9 and is there connected to an armature 10, which can be acted upon by either of a pair of electromagnets 11 or 12, one of these magnets constituting the valve-opening magnet and serving to move the armature in one direction, and the other constituting the valve-closing magnet and serving to move the armature in the opposite direction, movement in either direction being retarded to some extent by means of plungers secured to the valve-stem and contained in dash-pots 13, which in the present instance are located between the coils of the magnets 11 and 12.

The electrical connections whereby the various magnets are energized at the proper times to open and close the inlet and outlet valves are as follows: 14 is a switch controlling the flow of current from the supply-line, the positive and negative lines leading from this switch being indicated by appropriate characters. The negative line is permanently connected to one terminal of each of the magnets, the positive line being alternately connected to or disconnected from the other terminal of each magnet, depending upon whether or not said magnet is to be energized. Said positive line has four terminals 15, 16, 17, and 18 adjacent to the current controller or distributer, which, as shown in Fig. 3, is in the form of a rotating drum 35, intended to be connected to the crank-shaft or other rotating member of the engine, so as to make one revolution for each complete back-and-forth stroke of the piston 2. On this drum are contacts 19, 20, 21, 22, 23, and 24, extending but half-way around the drum, the contact 19 being in line with the terminal 15, the contact 20 being in line with the terminal 16, the contacts 21 and 22 being in line with the terminal 17, and the contacts 23 and 24 being in line with the terminal 18, and said contacts 19, 20, 21, 22, 23, and 24 are connected to contacts 19^a, 20^a, 21^a, 22^a, 23^a, and 24^a, respectively, on a smaller drum 25 at one end of the drum 35.

The contact 20^a is in line with the terminal of a line 20^b, which communicates with one terminal of the closing-magnet 12 of the inlet-valve 6 and with a terminal of the opening-magnet 11 of the other inlet-valve, 4.

The contact 19^a is in line with the terminal of a line 19^b, which is connected to a terminal of the opening-magnet 11 of the inlet-valve 6 and to a terminal of the closing-magnet 12 of the inlet-valve 4.

The contact 23^a is in line with the terminal of a line 23^b, which communicates with the terminal of the closing-magnet of the outlet-valve 5.

The contact 24^a is in line with the terminal of a line 24^b, which connects with the terminal of the opening-magnet 11 of said outlet-valve 5.

The contact 22^a is in line with the terminal of a line 22^b, which communicates with the terminal of the closing-magnet 12 of the outlet-valve 7, and the contact 21^c is in line with the terminal of a line 21^b, which connects with a terminal of the opening-magnet 11 of said outlet-valve 7.

As a result of this construction the upper inlet-valve 4 will be held in the open position, and the lower inlet-valve 6 will be closed during the stroke of the piston 2 from the top to the bottom of the tub or cylinder 1—that is to say, during one half-revolution of the drum 19—whereupon the position of these valves will be changed, the valve 4 being closed and the valve 6 opened and the valves retaining this position during the upward stroke of the piston.

Each of the outlet-valves 7 is retained in a closed position during that stroke of the piston 2 which is away from the valve; but during that stroke of the piston which is toward each outlet-valve said valve is closed for a portion of the stroke and open for a portion of the stroke—that is to say, it is closed during the earlier portion of the stroke until the air has been compressed in the cylinder to the same extent as in the receiver and is then opened, so as to permit flow of this compressed air from the cylinder to the receiver.

While each of the inlet-valves is therefore held open during a complete half-turn of the drum 35, the time during which the outlet-valve remains open must be determined by the pressure of air in the receiver—that is to say, the greater this pressure the longer will be the time and the greater the extent of stroke of the piston 2, during which the outlet-valve remains closed, and the lesser the pressure the lesser the time during which said valve remains closed.

In order to accomplish this result, the contacts 21 and 24 are of tapering form—that is to say, they present an edge which is oblique to their respective terminals 17 and 18, and the latter are movable in line with the axis of the drum 35, so that the position of the terminals longitudinally in respect to the drum and its contacts 21 and 24 will determine the fractional part of the rotation of the drum, during which the outlet-valve controlled by either contact is permitted to remain open. Thus if the terminal is adjusted to a position adjacent to the wide end of the contact the valve will remain open during almost the entire half-revolution of the drum 35 and the entire stroke of the piston 2 from one end of the tub or cylinder 1 to the other; but if the terminal is adjusted to a position adjacent to the narrow end of the contact the valve will remain open only for a very limited period near the end of the stroke of the piston. This adjustment of the terminals 17 and 18 is effected by mounting them upon a guide-rod 26 in front of and parallel with the drum 35 and connecting them by means of a bar 27, which is under control of one arm of a three-armed lever 28, a second arm of said lever being acted upon by a spring 29 and a third arm of the lever being connected by a link 30 to a piston 31, which is within the cylinder 32, the latter being open through a pipe 33 to the pressure in the receiver.

As the pressure increases, therefore, there will be such movement of the lever 28 as to carry the terminals 17 and 18 toward the narrow ends of the contacts 21 and 24, thereby gradually decreasing the period of time during which the outlet-valves 5 and 7 remain open, and consequently increasing the extent to which the air is compressed in the cylinder before being permitted to escape therefrom, and, on the other hand, decrease of pressure in the receiver will permit movement of the lever 28 under the influence of the spring 29, so as to carry the terminals 17 and 18 toward the wide ends of the contacts 21 and 24, thereby increasing the period that the outlet-valves are permitted to remain open during each stroke of the piston, and thus permitting escape of air from the cylinder when the same has been subjected to a lesser degree of compression than when the outlet-valves remain closed for a longer time.

The coils of the magnets 11 and 12 are tubular, and each armature 10 has projecting bars 34 entering said tubular coils, and, if desired, these bars may act as solenoids to increase the attractive power of magnets upon the armature.

While I prefer in all cases to use electromagnets for effecting the movements of the valves in each direction, such magnets may be employed for moving the valves in but one direction only, movement of the valves in the opposite direction being effected by means of a spring, weight, or other mechanical pressure device.

The chambers within the magnet-casings 9 are in open communication with the respective valve-boxes, so that no stuffing-boxes for the valve-rods 8 are necessary, and hence there is no friction upon said valve-rods.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination of the blowing tub or cylinder of a blowing-engine, with outlet-valves, valve-operating electromagnets, and connections whereby each valve is opened during only a portion of the stroke of the piston, and such period of opening is varied in accordance with the pressure in the receiver, substantially as specified.

2. The combination of a blowing tub or cylinder, of a blowing-engine, valves therefor,

electromagnets for operating said valves, and a rotating current-distributer having contacts thereon, some of which present oblique faces, terminals movable in respect to said oblique faces of the contacts, and air-pressure devices for effecting such adjustment of the terminals, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMUEL T. WELLMAN.

Witnesses:

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W. A. JONES.