July 1, 1930. F. S. DENISON 1,768,949

CIRCUIT CONTROLLING MEANS

Filed Dec. 10, 1923

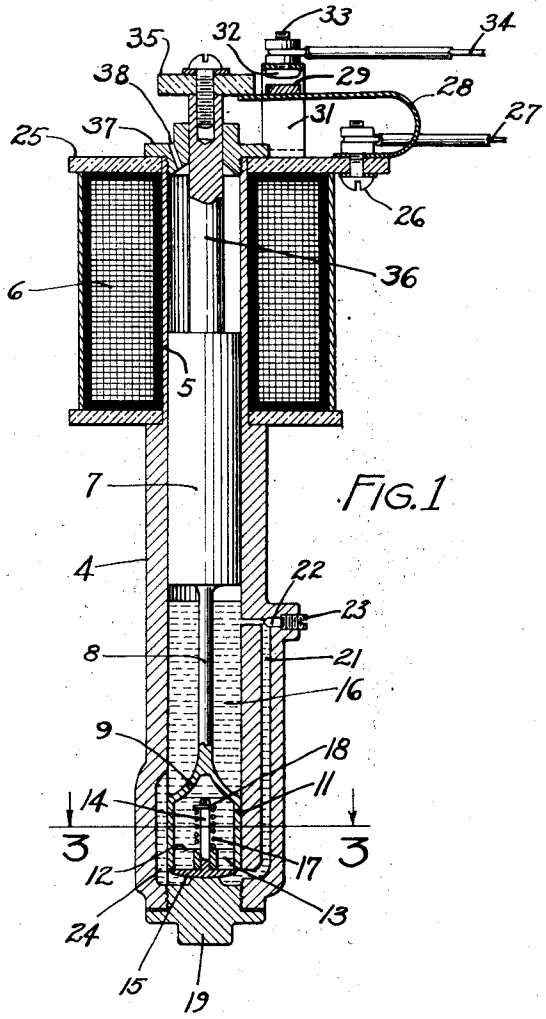


FIG. 1

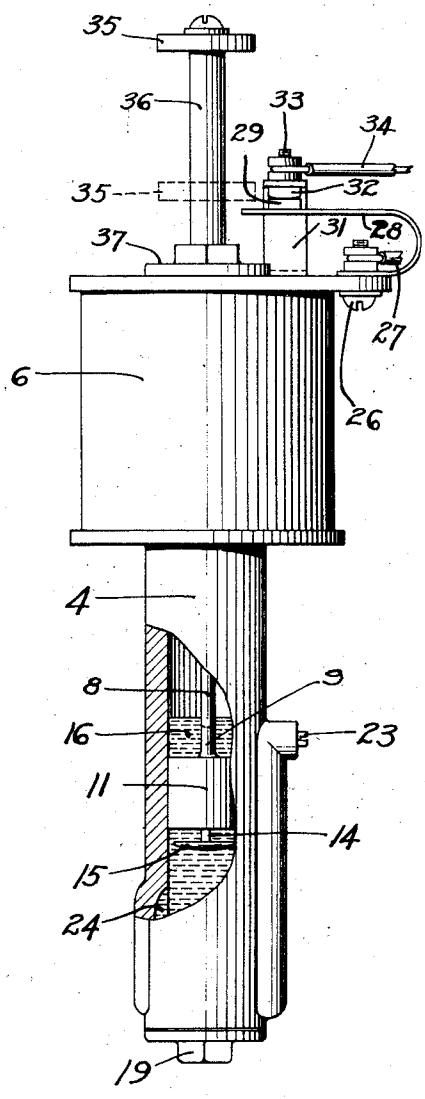


FIG. 2

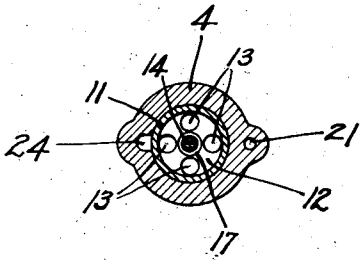


FIG. 3

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UNITED STATES PATENT OFFICE

FREDERICK S. DENISON, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF DELAWARE

CIRCUIT-CONTROLLING MEANS

Application filed December 10, 1923. Serial No. 679,658.

This invention relates to improvements in circuit-controlling devices which are of the general type set forth in applicant's prior co-pending application, Serial Number 603,588, filed November 27, 1922. The device here disclosed is particularly adapted for use in conjunction with heating plants of the oil-burning type now in common use, in such installations a pilot light of gas from the usual city mains may be employed to ignite the vaporized fuel when the supply thereof is turned on. Or, in place of such a pilot light, a spark plug may be employed for such ignition purposes as is set forth in the prior co-pending application of Harold W. Sweatt, Serial Number 580,344, filed August 7, 1922. It is desirable that the spark plug be energized to provide the necessary sparking during an appreciable interval in order to assure ignition of the vaporized fuel. In order to avoid waste of electric energy, the spark plug is only energized for a predetermined interval, its circuit being thereafter interrupted. Furthermore, as is set forth in applicant's above-mentioned prior application, a solenoid may be used and adapted for momentary energization to raise an armature to permit the spark plug circuit to be closed. After de-energization of the solenoid, the armature returns to normal position again opening the spark plug circuit. The time-interval between the start of the return travel of the armature and its attainment of normal circuit-breaking position is controlled by a plunger and fluid cylinder. The fluid within the cylinder, as is set forth in applicant's above-mentioned application, is slowly ported from the front of the descending plunger-head through a constricted by-pass to the other side of the plunger-head.

In this new and improved construction disclosed herein, means are provided for expediting or hastening the descent of the plunger. The specific means shown consists of a supplementary by-pass around the plunger-head adjacent the end of its travel to normal position. Such accelerated travel affords the desirable sharp, circuit-breaking and avoids a slowly drawn-out arc, while preserving the desired time-interval.

The object therefore of the invention is to provide improved circuit-controlling means.

Other objects of the invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings, there has been disclosed a structure designed to carry out the objects of the invention, but it is to be understood that the invention is not confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a vertical sectional view through the device when in normal circuit-breaking position;

Figure 2 is a view in side elevation of the device when in circuit-closing position and having a portion of the casing broken away to show the position of the parts; and

Figure 3 is a cross-section on the line 3—3 of Figure 1.

The selected embodiment of the invention shown in the accompanying drawings consists of a metallic casting providing a cylinder 4 and a reduced portion forming a lining 5 for the solenoid 6 preferably mounted upon this casting and having its base supported by the shoulder upwardly presented by the juncture of the cylinder and lining.

The plunger comprises a barrel 7 having a depending stem 8 connected by arms 9 to the cylindrical plunger head 11. The outer surface of both the plunger barrel and head effect a close running fit with the inner annular face of the cylinder and lining. The plunger-head 11 is hollow or sleeve-like throughout its major portion and its lower end is closed by a web 12 having a plurality of apertures 13 therethrough. The web is also axially bored to provide a bearing for the stem 14 of a valve 15, having an annular seat presented by the end of the head 11. The function of the valve 15 is to open or close the apertures 13 to passage of the fluid 16 placed within the cylinder. The valve is held in its normally seated position, shown in Figure 1, by means of a compression spring 17 coiled about the valve stem and held

compressed between the washer 18 pinned to the valve stem and the upper face of the web 12. An abutment for the valve is provided on the inner face of the cap 19 which is received in threaded engagement with the end of the cylinder casting and effects a fluid-tight closure therefor.

When the ascent of the plunger occurs within the cylinder 4 from the position shown in Figure 1 to that shown in Figure 2, the fluid 16 above the plunger-head passes downwardly through the apertures 13 and unseats the valve 15 so that the fluid may pass through the plunger-head as the head is raised. Subsequent descent of the plunger would be prevented by the seated valve unless a by-pass were provided around the plunger head. By-pass 21 is provided within the wall of the cylinder 4 and at one side thereof. This by-pass opens into the fluid-chamber above the highest point of travel of the plunger-head, and below the normal position of the head. The rate of flow of the fluid through this by-pass may be adjustably predetermined by means of the needle-valve 22 carried by the screw 23 received in threaded engagement within the counterbored aperture leading to the by-pass. The adjusted control of the rate of flow of the fluid determines the length of time required for the descent of the plunger to its normal position.

Means are provided for accelerating or hastening the descent of the plunger shortly before it reaches its normal position. This is simply effected by means of a supplemental by-pass 24 formed in the wall of the cylinder casting and longitudinally extending from a point below the normal position of the plunger-head upwardly to a distance slightly in excess of the length of the plunger-head. This supplemental by-pass is larger than the by-pass 21 and is adapted to permit a greater rate of flow of fluid therethrough than through the constricted by-pass 21. Thus, it will be obvious that, when the upper end of the head 11 passes below the upper end of the by-pass 24, a large pass is presented for upward travel of the fluid with the result that the remainder of the descending travel of the head is relatively very rapid. It is this relatively rapid final travel of the plunger-head that is employed to make a quick break of any electric circuit, and thus to prevent any slow arc-drawing by the contacts of the circuit. The plate 25 forming the upper part of the solenoid is provided with a binding-post 26 having a wire 27 electrically connected thereto. A metallic spring 28 is also secured to this binding-post 26 and carries a contact button 29 adjacent its end. This spring 28 forms a relatively movable member of a switch. The other, or relatively fixed, member of this switch is provided by an arched-metallic strip 31, carrying a downwardly presented contact button 32 which is electrically connected to a binding post 33 for the wire 34 from the other side of the circuit from the wire 27. The resiliency of the spring 28 tends to hold the contact buttons 29 and 32 together, but they are normally held in the separated, opened position shown in Figure 1, by means of a detent 35, screwed to the upper end of the plunger rod 36 forming a reduced integral part of the plunger. A bearing for this rod 36 is provided by the screw cap 37, which preferably has a port 38 therethrough in order to permit escape of air which would otherwise be confined within the lining 5.

When the solenoid 6 is energized, the armature-plunger is raised so that the switch is closed, across the spark-plug circuit formed by the wires 27 and 34, as set forth in applicant's co-pending application. When the solenoid is de-energized, the plunger immediately starts its return to normal descended position. The fluid below the plunger-head passes upwardly through the by-pass 21 and the desired predetermined interval of the plunger descent is obtained by adjustment of the needle 22. However, as the detent 35 arrives at its dotted line position shown in Figure 2, the upper end of the plunger-head passes below the opening of the supplemental by-pass 24 so that the fluid is afforded an additional passage with the result that the remainder of the downward travel is relatively rapid. Therefore, the detent 35 moves the end of the spring 28, which projects within its path, very rapidly to the position shown in Figure 1 so that there is a quick break between the contact buttons 29 and 32.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is:

1. Circuit-controlling means comprising a solenoid, a cylindrical member containing a displaceable fluid extending below the solenoid, a reciprocable member adapted to be lifted upon energization of the solenoid and carrying a hollow-head immersed in the fluid of the cylinder, a spring controlled valve for closure of said hollow-head, a by-pass through which fluid in the cylinder is directed beneath the hollow head into the cylinder above said head to quicken the downstroke of the reciprocable member near the final downward stroke of said member, an armature carried by the reciprocable member at its upper end, and electrical contacts positioned to be actuated by said armature for breaking contact in movement of said reciprocable member in one direction and permitting contact to be made in its movement in an opposite direction.

2. Circuit-controlling means comprising a solenoid, a reciprocable member positioned within said solenoid and movable in one direction by energization of the solenoid, an armature carried by the upper end of the re-

ciprocable member, electrical contacts one of which is carried by a resilient member projected into the path of travel of said armature, the movement of the reciprocable member in one direction effecting engagement between the armature and projected resilient member to break electrical circuit between the contacts and movement in an opposite direction effecting disengagement between the armature and projected resilient member to permit the latter to establish electrical circuit between the contacts, a fluid containing cylinder extending below the solenoid, a plunger piston carried by the reciprocable member and operable in the fluid of the cylinder, a by-pass positioned for passage of fluid from beneath the piston to the interior of the cylinder at a point adjacent to the upper portion of the plunger-piston to reduce fluid pressure beneath the plunger and accelerate movement of the plunger-piston near the end of its stroke to effect a final quick break between the electrical contacts.

In witness whereof, I have hereunto set my hand this 15th day of August, 1923.

FREDERICK S. DENISON.