

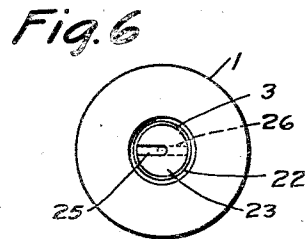
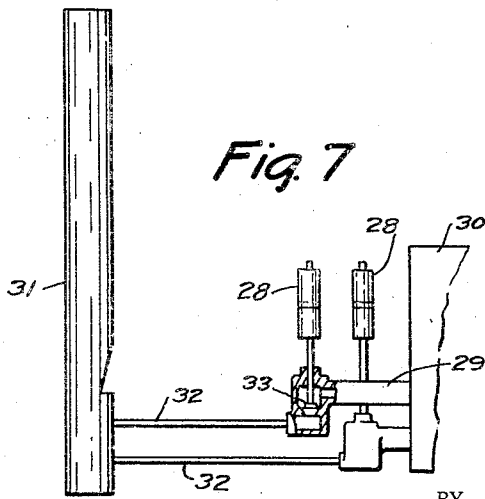
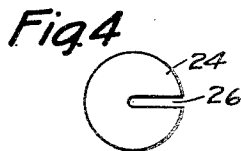
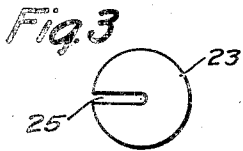
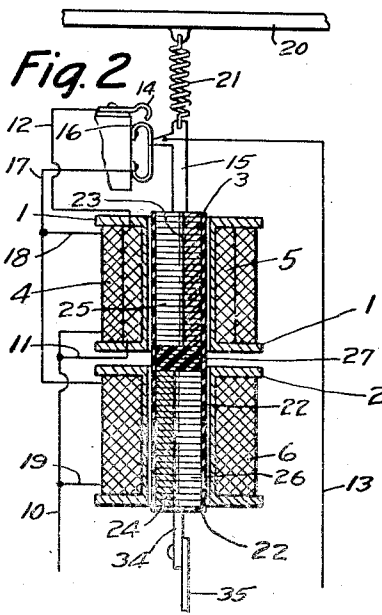
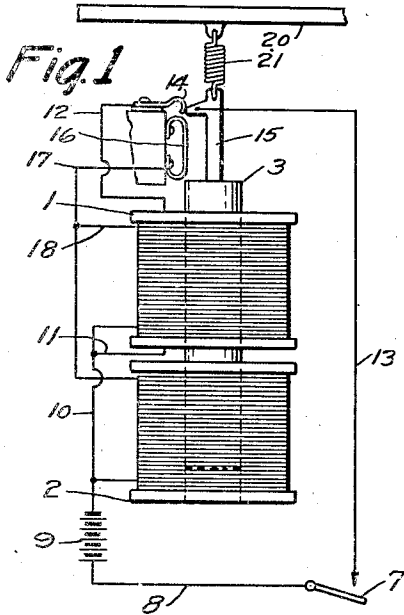
Feb. 20, 1940.

P. T. CAREW ET AL

2,190,650

DOUBLE SOLENOID

Original Filed May 18, 1936



BY

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UNITED STATES PATENT OFFICE

2,190,650

DOUBLE SOLENOID

Paul T. Carew and William F. Werner,
Orange, N. J.Original application May 18, 1936, Serial No.
80,389. Divided and this application Septem-
ber 26, 1936, Serial No. 102,780

1 Claim. (Cl. 175-341)

The purpose of this invention is to provide a quick acting solenoid in which the movement of the core is accentuated as the coil or coils are energized.

5 The invention is a solenoid comprising two coils consecutively arranged or positioned end to end about a core, in which an auxiliary coil is incorporated in one of said coils, and means is provided for connecting a circuit through the
10 coils so that the auxiliary coil will be energized to influence the core an instant before the remaining coils are energized.

This is a divisional application, being separated from our co-pending application with the Serial Number 80,389 in which this solenoid is used to accentuate the movement of the keys of a typewriter.

Solenoids are ordinarily provided with a coil positioned about a core in which the core is influenced by magnetism of the coil and in which the coil is energized when it is desired to move the core, or operate something by the movement of the core. Other solenoids have been provided with cores divided into a plurality of sections and coils have been provided around the cores and consecutively energized for extending the movement of the core, as with such an arrangement the travel of the core may be extended indefinitely, and other devices have been provided
20 for reversing the current flow of solenoids, however, the construction of these devices does not make them applicable for accentuating the movement of the core, and it has been found that by providing a small preliminary solenoid for starting the movement of the core from rest and then as soon as the movement is started applying the full force of the coil, a much more rapid movement is obtained and this is particularly desirable for electrically operated typewriter keys,
25 organ pipes, and for many other purposes.

The object of the invention is, therefore, to incorporate within a solenoid a small auxiliary coil adapted to start the movement of the core from rest and then applying the full force as soon as the movement of the core is started.

A further object is to provide a solenoid in which the core is divided into sections, making it operable by either alternating or direct current.

50 And a still further object is to provide a solenoid having a quick acting movement, which is of a relatively simple and economical construction.

With these ends in view the invention embodies
55 a solenoid having a core divided into two sec-

tions, with non-magnetic separators between the sections, having separate coils positioned about the respective sections, an auxiliary coil also positioned about said core, a spring for returning the core, and suitable electric connections through which the auxiliary coil is first energized and then the remaining coils automatically energized as the movement of the core is started.

Other features and advantages of the invention will appear from the following description taken in connection with the drawing, wherein:

Figure 1 is a view showing the core and coils in elevation in a typical arrangement.

Figure 2 is a view showing a cross section through the solenoid shown in Figure 1.

Figure 3 is a plan view of one of the discs in one section of the core.

Figure 4 is a similar view showing one of the discs in another section, in which the slot is positioned on the opposite side of the center.

Figure 5 is a view showing one of the discs in perspective showing the relative thickness thereof.

Figure 6 is a plan view of the upper end of the solenoid with the connections thereto omitted.

Figure 7 is a view showing a typical application of the solenoid to the valves of a pipe organ with the action of the solenoid reversed.

In the drawing the solenoid 1 is shown as it may be made, wherein numeral 1 indicates the upper section, numeral 2 the lower section, and numeral 3 the core. The solenoid is formed with the coil in two sections and with the upper section of the coil compound wound and it will be noted that one section of the upper coil is first energized and this starts the core downward and then as soon as the core has traveled a short distance a circuit is completed through the other section of the upper coil and the lower coil thereby accentuating the movement and moving the core downward with a short, quick, or staccato movement; and as soon as the current is released, a spring at the upper end returns the core to the normal position.

The upper coil 1 is formed by a coil of wire 4 on the outer part of the spool 1, and with an inner coil 5, and on the lower spool is one complete coil 6, and these coils are connected in a circuit in such a manner that as a switch 7 is closed a circuit is completed through a wire 8, a battery 9, wires 10 and 11 to the coil 5, and through wires 12 and 13 back to the switch 7. The wire 12 is connected to a contact 14 which engages a projection on a bar 15 extending upward from the core 3 as shown. With this cir-

cuit completed, the coil 5 will be energized and this will start the core 3 downward, and as the core moves downward the projection on the bar 15 will engage a contact 16, as shown in Figure 2, and this will complete a circuit through the other section of the upper coil and through the lower coil through the wires 13, from the switch 7, a wire 17 from the contact 16, to the coil 4 through a wire 18, and from the coil 4 through the wire 10 to the battery and through the wire 8 to the switch. The wire 17 also connects to the coil 6 of the lower solenoid and the opposite end thereof is connected by a wire 19 to the wire 10 so that the circuit is also completed through this coil. It will be appreciated, therefore, that the action of the core is accentuated because it is first started from the stationary position with a relatively slow movement, and then as the force from the other coils is applied the movement is speeded up.

The upper end of the bar 15 is attached to a stationary member 20 through a spring 21 and it will be noted that as soon as the current is released the core will be returned to the position shown in Figure 1 with the circuit through the lower coil and through the sections of the upper coil broken.

In this design the core 3 is formed with an outer tubular shell 22 and this is filled with a plurality of discs or washers 23 and 24 having slots 25 and 26 extending inwardly from one side, and these discs are separated by a plurality of complete insulating discs 27 as shown in Figure 2. The discs 27 are of fibre or any non-magnetic material, whereas the discs 23 and 24 are of material having magnetic attraction, and with the slots oppositely positioned in the upper and lower portions the complete cycle of the magnetic flux is broken and the solenoid will operate with greater efficiency. The discs 23 and 24 are relatively thin and fit snugly within the tubular casing 22 and it is preferred to make these discs of soft iron, however, they may be made of any material. The casing 22 is preferably made of fibre or any non-magnetic material, however, this may be made of any material and an insulating lining may be used on the inner surface if desired.

Figure 7 shows a typical application of the solenoid which in this design is indicated by the numeral 28, and this is positioned in an outlet connection 29 of a compressed air tank 30 which is shown connected to a tube 31 of a pipe organ through a connection 32, and the solenoid is shown connected to a valve 33 that may be opened thereby, the operation, however, being in the opposite direction from that shown in Figures 1 and 2. The core shown in Figure 2 may be provided with an extension 34 that may be connected to a bar 35 and this bar may be adapted to operate a valve or any device with a positive movement. It will be understood, there-

fore, that the device may be mounted to operate in either direction and used for any purpose.

It will be understood that changes may be made in the construction without departing from the spirit of the invention. One of which changes may be in the use of any number of coils, another may be in the use of a core of any other construction, and still another may be in the use of other means for connecting the respective circuits through the coils.

The construction will be readily understood from the foregoing description. In use the device may be provided as shown and described, and it will be noted that with the bar at the lower end of the core attached to a lever or other object and with the current connected through the coils as illustrated, the current will first be applied to the auxiliary coil which will start the movement of the core, and then the current will automatically be applied to the other coils, accentuating the movement of the core, and making it possible to operate the lever or device to which the core may be connected with an unusually quick movement. It will also be appreciated that this device may be made of any size, shape, or design, and may be connected to any suitable device.

Having thus fully described the invention, what we claim as new and desire to secure by Letters Patent, is:

A solenoid divided into two parts comprising two coils in axial alignment, and a common core extending through both of said coils, said core formed of laminated discs in a tubular casing, with a radial longitudinal slot extending through a plurality of the discs at each end of the core, and with the slot at one end oppositely positioned in diametric relation to the slot at the other; said solenoid characterized in that one of said coils comprises two concentric windings forming an inner and an outer coil, and in combination with said solenoid a plurality of contacts positioned to be engaged by a contact point on the core, and a spring for drawing the core outward to a position at which the core contact point is in engagement with one of said contacts when the solenoid is deenergized; said solenoid further characterized in that the contact engaged by the contact point of the core with the solenoid deenergized is connected to the said inner coil of one of the said coils and adapted to energize the said inner coil only momentarily whenever current is supplied to the device, said inner coil adapted to start the movement of said core so that the contact point of the core will engage another contact to energize the outer coil of the coil containing an inner and outer coil, and also the other coil of said solenoid, thereby providing a starting movement and then an accentuated movement of said core.

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