

Oct. 24, 1933.

F. T. PASCOE

1,931,701

SOLENOID

Filed Sept. 29, 1932

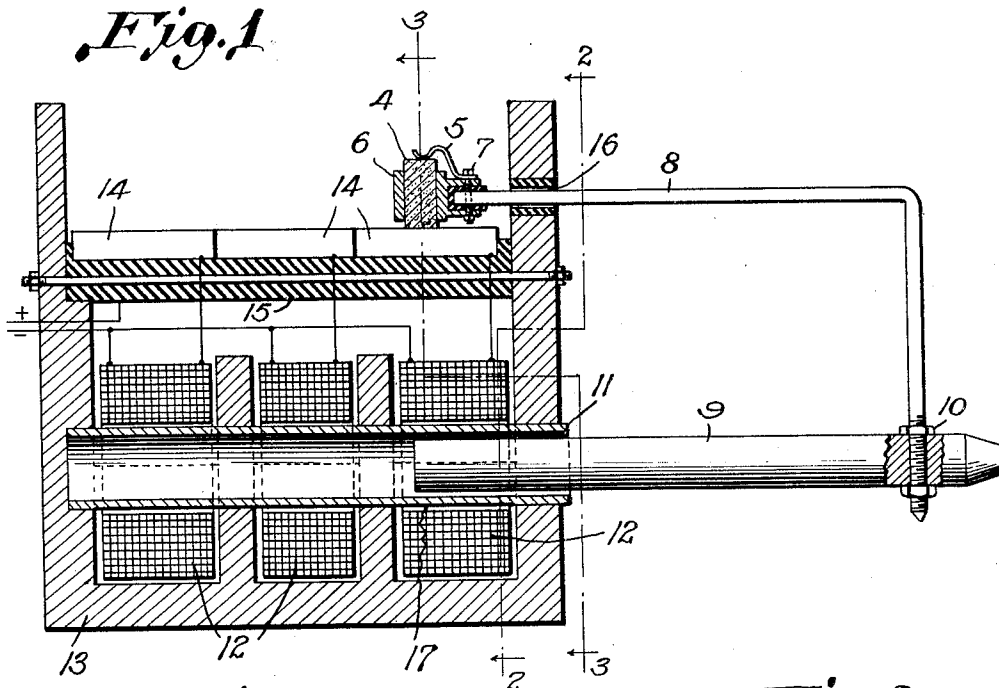


Fig. 2.

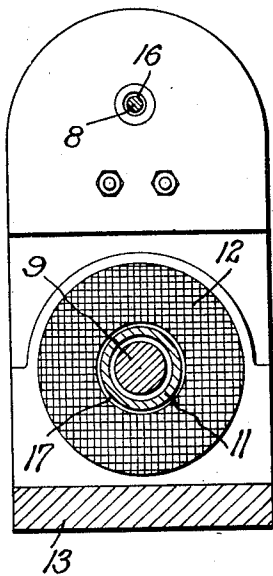
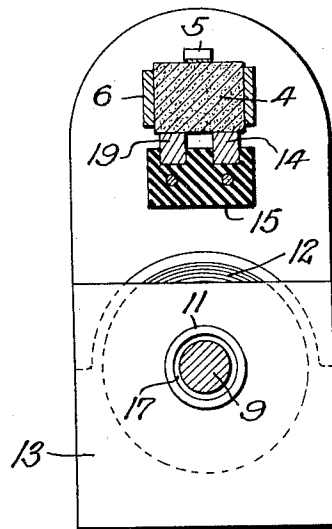


Fig. 3.



Inventor:
Frank T. Pascoe

UNITED STATES PATENT OFFICE

1,931,701

SOLENOID

Frank T. Pascoe, Pittsburgh, Pa.

Application September 29, 1932

Serial No. 635,400

6 Claims. (Cl. 175—337)

My invention relates to improvement in solenoids.

An object is to provide a solenoid particularly adapted to give a longer stroke with less electrical energy consumed, and one specific object is to provide a solenoid wherein a plurality of coils are placed in each slot of the case, as specified in the drawing. The material between each coil, and the brush arrangement tends to propel the plunger far enough for the coil ahead of it to pick it up without losing the pressure of the pull.

Another object is a provision of such a solenoid, where the movement of the brush members, over the successive commutator bars, is provided by the movement in conjunction with the plunger. The brush advancing on the commutator bars, on the outside of the coils, serves to successively throw the winding ahead of the plunger into the circuit, while the plunger advances through the coils.

My improved solenoid is a simple self-contained device wherein all the parts are effectively protected and insulated. It is inexpensive and easily built and can be used where an object requires a long stroke to propel it.

Other objects, advantages and meritorious features of my invention will more fully appear from the following description and illustrated embodiment shown in the drawing.

In the drawing:—

Fig. 1 is the longitudinal cross section through my device.

Fig. 2 is a cross section taken at 2—2 Fig. 1.

Fig. 3 is a cross section taken at 3—3 Fig. 1.

The case 13 is made of metallic material so that magnetic flux will flow through and slots are made in the case to place coils 12 so as to have the similar material between each coil.

A relatively long strip 15 of insulating material is made with two grooves for the purpose of placing bars 14 and 19 as shown in Fig. 3. This is fastened in case 13 by bolts or other-wise securing, to compose a commutator bar holder.

A relatively long bar 19 of conductive material is fastened in one of the grooves in 15 by bolts or otherwise securing, to compose a segment and the plurality of short bars 14 of similar material having the proper amount of insulating material between them are fastened in commutator bar holder 15 by bolts or otherwise securing. These short bars form the commutator sections.

The coils 12 are placed in slots of case 13 arranged for this purpose. One end of each coil 12 is connected to its proper commutator section.

The other ends of coils 12 are connected together and connected to the negative side of the circuit. Bar 19 shown in Fig. 3 is connected to the positive side of the circuit.

A relatively long rod 8 of metallic material bent and threaded on the end is fastened by lock nuts 10 in hole of plunger 9 provided for this purpose. This rod forms the commutator arm.

Brush 4 is a piece of conductive material long enough to cover bars 14 and 19 as shown in Fig. 3. 6 is a strip of metallic material encircling brush 4 and fastened by clamp 7 to commutator arm 8. This forms a brush holder. Clamp 7 of metallic material encircles the end of brush holder 6 and the end of commutator arm 8 and contains a bolt to tighten the clamp. Insulating material is placed between commutator arm 8 and brush holder 6 to insulate the circuit from the commutator arm. Spring 5 of metallic material is bent so one end is fastened under clamp 7 and the other end is on brush 4 to hold it tight against bars 14 and 19. Rod 9 of material so the magnetic flux will easily flow is constructed to make a plunger. Brass tube 11 lines inside of coils so that the plunger will not damage the coils. Hole 16 in Fig. 2 is arranged for commutator arm 8 to slide through. Hole 17 is arranged for plunger 9 to slide through. The device illustrated is in operating position as soon as electrical energy is applied. Plunger 9 will be drawn through the first coil whereupon brush 4 will be moved to the next segment 14 energizing this segment thus energizing the second coil. Then brush 4 cuts out the first coil. The cycle being thus repeated until plunger 9 has been drawn into the last coil.

The device herein-before shown and described is particularly adapted to give a longer stroke in solenoids with less electrical energy consumed and can be used where an object requires a long stroke to propel it.

The structure shown embodies the principle of my invention and attains the object set forth. It is my purpose to claim all structural variations within the spirit of my invention. With this object in view, I claim:—

1. A solenoid having a winding divided into a plurality of coils axially placed in a case, a case comprising slots arranged to embed said coils, a plurality of commutator sections axially placed in a commutator holder and one arranged for each coil and connected to the coil, a commutator holder on out side of said coils and fastened in said case comprising grooves for said commutator sections, a plunger of magnetic material arranged

- to be drawn through said coils and carrying a commutator arm on the out side of said coils, and a brush carried by said commutator arm over said commutator whereby the said coils are successively energized as the plunger advances.
2. A solenoid comprising, in combination, a series of coils axially placed in a case, a case of metallic material comprising slots for embedment of said coils so as to have the same material the case is composed of between each coil, and holes in front of said case for a plunger and a commutator to slide through, a plurality of commutator sections axially placed in a commutator holder and one arranged for each coil and connected to the coil, a commutator holder on out side of said coils and fastened in said case comprising grooves for said commutator sections, a plunger of magnetic material adapted to be drawn through said coils carrying a commutator arm on the out side of said coils, and a brush carried by said commutator arm over said commutator whereby the said coils are successively energized as the plunger advances.
3. A solenoid comprising, in combination, a series of coils axially placed in slots of a case, a case of metallic material comprising slots for embedment of said coils, a commutator comprising two parallel axially extending bars insulated from each other, the one bar being divided by transverse cuts into detached sections insulated from each other and substantially corresponding to the coils in number and connected thereto one to one end of each coil the somewhat longer section at the end being connected to one end of the last coil, the other bar being connected to the positive lead wire, the other end of said coils being connected together and being connected to the negative lead wire, a commutator holder on out side of said coils comprising grooves for said commutator bars, a plunger of magnetic material arranged to be drawn through said coils and carrying a commutator arm on the out side of said coils, and a brush carried by said commutator arm over said commutator bars whereby the said coils are successively energized as the plunger advances.
4. A solenoid comprising, in combination, a series of axially placed coils in slots of a case, a case of metallic material comprising slots for embedment of said coils, a commutator comprising two parallel axially extending bars insulated from each other, the one bar being divided by transverse cuts into detached sections insulated from each other and substantially corresponding to said coils in number and connected thereto, one to one end of each coil, the somewhat longer section at the end being connected to the one end of the last coil, the other bar being connected to the positive lead wire, the other ends of the said coils being connected together and being connected to the negative lead wire, a commutator holder on the out side of said coils comprising grooves to place and insulate the said commutator bars and axially extending from one end of said case to the other on the out side of said coils and fastened in the said case, a plunger of magnetic material arranged to be drawn through said coils and carrying a commutator arm on the outside of said coils, and a brush carried by said commutator arm over said commutator bars whereby the said coils are successively energized as the plunger advances.
5. A solenoid comprising, in combination, a series of coils axially placed in a case, a case of metallic material for embedment of said coils, a commutator comprising two parallel axially extending bars insulated from each other, one bar being divided into independent sections insulated from each other and corresponding to the said coils in number one arranged for each coil and connected thereto, the other bar being connected to the positive lead wire, a commutator holder on the out side of said coils comprising grooves for said commutator bars, a plunger of magnetic material arranged to be drawn through said coils and carrying an arm extending over said commutator, and a brush carried by said commutator arm over said commutator bars whereby the said coils are successively energized as the plunger advances.
6. A solenoid comprising, in combination, a series of coils axially placed in a case, a case of metallic material for embedment of said coils, a commutator comprising two parallel axially extending bars insulated from each other, one bar being divided into independent sections insulated from each other and corresponding to the said coils in number one arranged for each coil and being connected to one end of its coil, the other bar being connected to the positive lead wire, the other ends of said coils being connected together and being connected to the negative lead wire, a commutator holder on the out side of said coils and fastened in said case, a plunger of magnetic material arranged to be drawn through the said coils and carrying a commutator arm extending over said commutator, and a brush bridging said commutator bars and carried by said commutator arm to convey current from said positive lead wire bar to that said section which is connected to that coil which is at any-time immediately ahead of said plunger.

FRANK T. PASCOE.

60 135

65 140

70 145

75 150