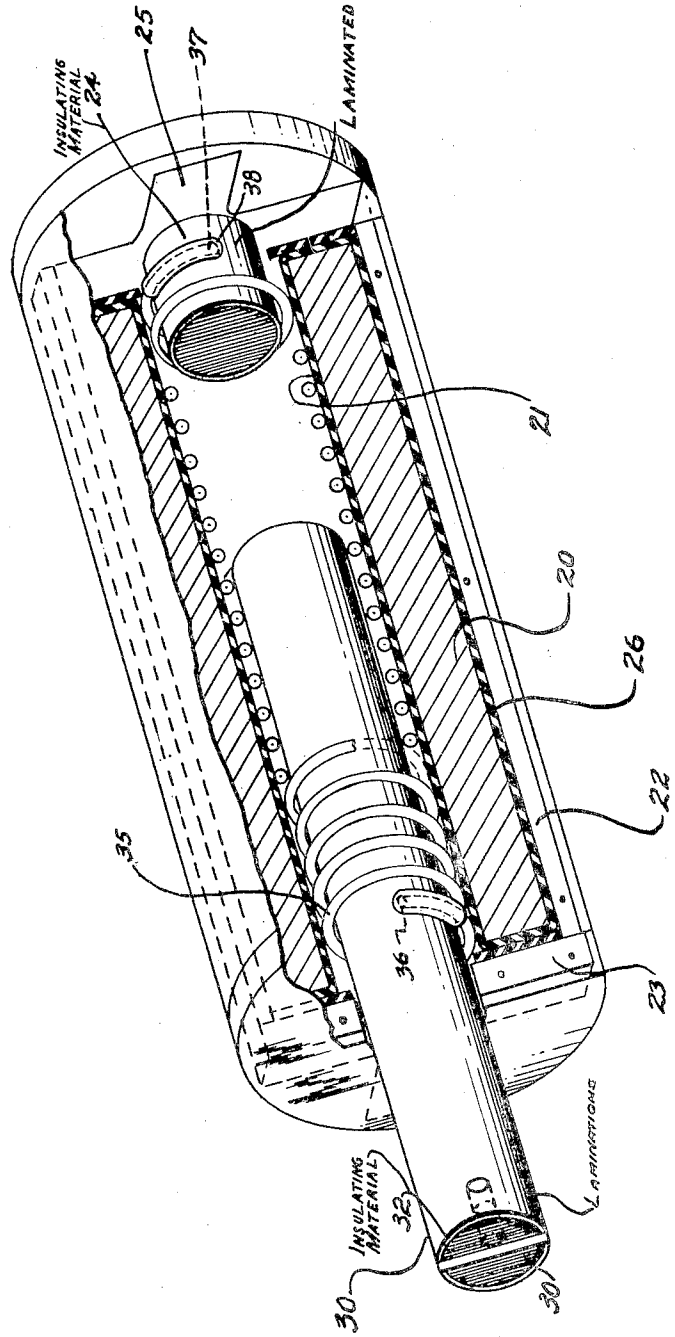
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PLUNGER-TYPE ELECTROMAGNET

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PLUNGER-TYPE ELECTROMAGNET

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This invention relates to a solenoid construction.

In present solenoid design the problems include a high pull and efficiency requirement with a small space allotment for the solenoid winding. Other requirements of rapid and continuous operation necessitate a construction which avoids the building up of too much heat. In a primary coil or winding of a solenoid, there are around 500 turns. A supporting assembly for the winding serves as a secondary element in the circuit even though it is not intended as such. When alternating current is used, a current flows in this element and since it consists of only one turn the current is extremely high. For example, if the current in the primary is one quarter of an ampere, the secondary current for a single turn would amount to 125 amperes. The heating thus produced in this portion of the solenoid construction is extremely destructive and results in a loss of efficiency.

Other problems in this connection involve the shielding or bypassing of flux from the winding away from the solenoid plunger within the winding. If a steel sleeve is used of magnetic or non-magnetic characteristics it has this tendency to bypass the flux and thus reduce the number of pounds of pull. One attempt to solve this problem of heating and low pull resulted in an open circuit secondary in the form of a slotted sleeve. This reduced somewhat the temperature developed but the resistance of the sleeve because of local eddy currents in the sleeve existed even though it was slotted along its entire length.

It is an object of the present invention to provide a supporting construction for a solenoid winding and a guide for the solenoid plunger of a nature that there is no flux shielding and no heat build-up within the solenoid. Other features of the invention include a reduction in wattage loss, a reduction in chattering and a uniform pull along the entire length of the solenoid plunger. The magnetic hum of the solenoid is reduced and the overall weight is reduced.

Other objects and features of the invention relating to details of construction will be evident from the following description and claims:

In the drawings:

The figure shows a perspective cut-away view of the solenoid construction.

Having reference to the drawings a solenoid winding **20** has a cylindrical opening **21**. Around the winding are arranged iron laminations **22** and **23** to provide the outer circuit of the solenoid. A pole piece **24** is connected to cross shaped lami-

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nations **25**, the pole piece being formed of laminated iron. That is, it is made up of thin steel punchings approximately .025 in thickness. Around the winding an insulation material **26** such as laminated mica, linen tape and varnish is provided. The plunger of the solenoid is shown designated **30** and this is made up of thin steel laminations of the same nature as that of the pole piece **24**.

Expanded against the cylindrical opening of the winding **20** is a coil length of wire **35** having ends **36** and **37**. One end of the wire slips over the pole piece **24**. The other end lies within the opening or entrance of the solenoid winding **20**. The coil **35** is an extended coil preferably as shown and is made up of very high resistance non-magnetic wire. It is preferably not spring steel wire since that has been found to cause magnetic shielding or flux absorption although it operates and functions better than the old types of guide sleeves. The ends **36** and **37** of the coil **35** are insulated at **38** to prevent contact with metallic parts in order that there will be no short circuiting: The wire used for the coil **35** is preferably high resistance wire having a resistance of 50 to 150 times that of copper.

The plunger **30** is coated with an insulating material **32** which can be subjected to very high temperatures and should be arranged to ride freely in the coil **35**.

I claim:

1. In a solenoid construction having a cylindrically shaped winding, a plunger to reciprocate in said winding, and a guide for said plunger comprising an extended coiled length of wire contained within the winding.

2. In a solenoid construction having a cylindrically shaped winding, a plunger to reciprocate in said winding, and a guide for said plunger comprising an extended coiled length of high resistance non-magnetic wire.

3. In a solenoid construction having a cylindrically shaped winding, a plunger to reciprocate in said winding made up of thin laminated steel punchings, and a guide for said plunger and secondary for the solenoid comprising a coiled length of high resistance, non-magnetic wire contained within the winding and means insulating the ends of the secondary coil from contact with metallic surfaces.

4. In a solenoid construction having a cylindrically shaped winding coil, a pole piece at one end of said winding, a plunger to reciprocate in said coil, and a secondary liner and guide for said plunger comprising a coiled length of wire hav-

ing both ends insulated from the solenoidal circuit, one end of the coil being telescoped over the pole piece.

5. In a solenoid construction having a winding with a cylindrical opening, a plunger to reciprocate within said opening, and an extended secondary coil expanded against the walls of the cylindrical opening to furnish support to the winding and to serve as a guide to the plunger, and means insulating the ends of the secondary coil from contact with metallic surfaces.

6. In a solenoid construction having a cylindrically shaped winding, a plunger to reciprocate in said winding and a guide for said plunger comprising an extended coil length of wire contained within the winding, and having a relatively high resistance of over 50 times that of copper.

7. In a solenoid construction having a winding with a cylindrical opening with a plunger to reciprocate within said opening, a coil expanded against the walls of the cylindrical opening to furnish support to the winding and serve as a guide to the plunger, said coil being made of a high resistance wire.

8. In a solenoid construction having a winding with a cylindrical opening, a plunger to reciprocate within said opening, having a high resistance insulating coating on the outer surfaces thereof and a coil of wire expanded against the walls of the cylindrical opening to furnish support to the winding and to serve as a guide to the plunger.

9. In a solenoid construction having a winding with a cylindrical opening, a plunger to reciprocate within said opening, having a high resistance insulating coating on the outer surfaces thereof and a coil of wire expanded against the walls of the cylindrical opening to furnish support to the winding and to serve as a guide to the plunger, said wire having a relatively high electrical resistance of over 50 times of that of copper.

10. In a solenoid construction having a cylindrically shaped winding, a plunger to reciprocate in said winding, having a high resistance coating on the outer surfaces thereof, and a guide for freely receiving said plunger comprising a coil length of wire contained within the winding.

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