

Feb. 20, 1951

J. F. TRITLE ET AL
ELECTROMAGNETIC EXCITING COIL

2,542,733

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2 Sheets-Sheet 1

Fig. 1.

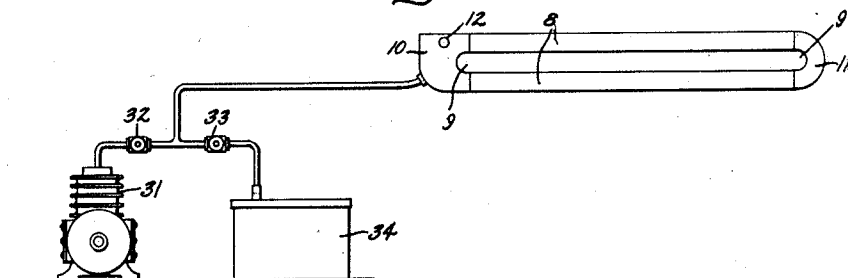
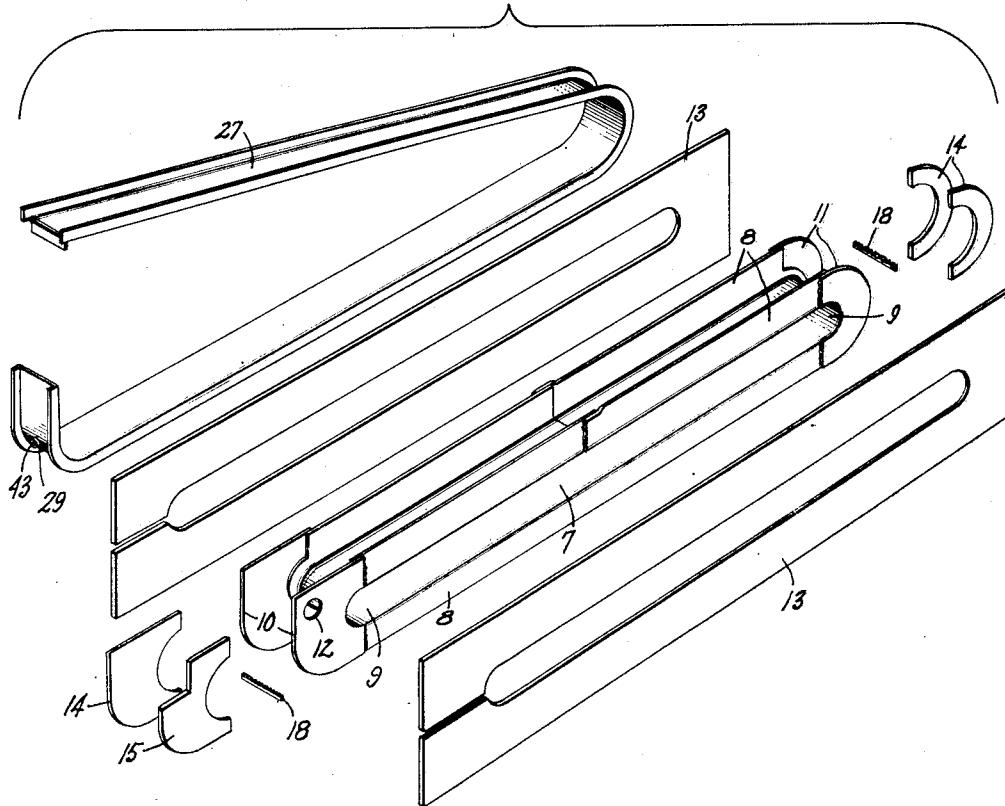


Fig. 2.



Inventors:
John F. Trittle,
Guy Bellows, Jr.
by *Penwell S. Mack*
Their Attorney.

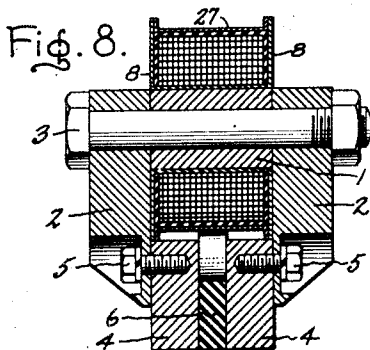
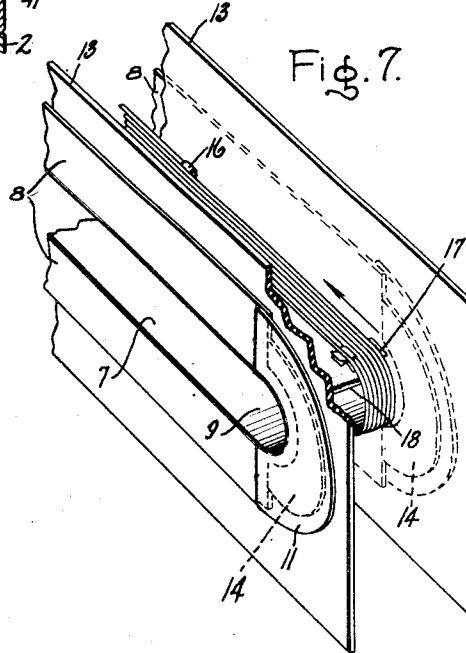
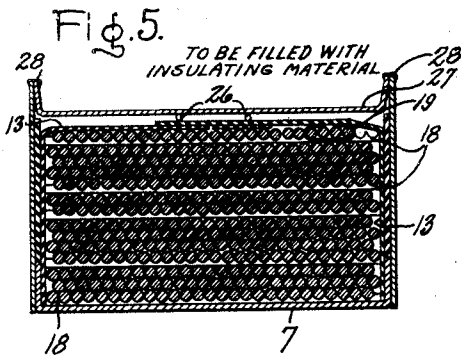
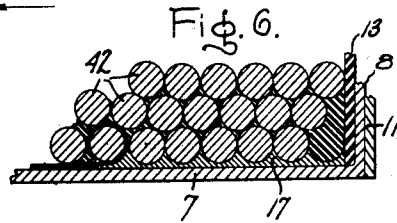
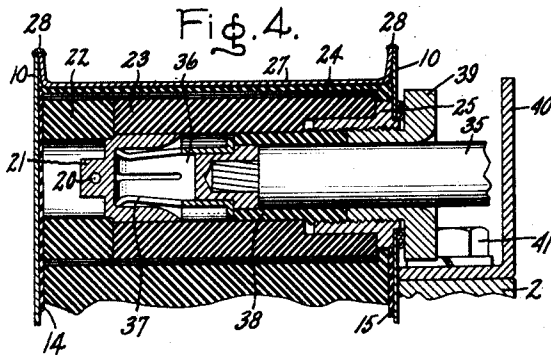
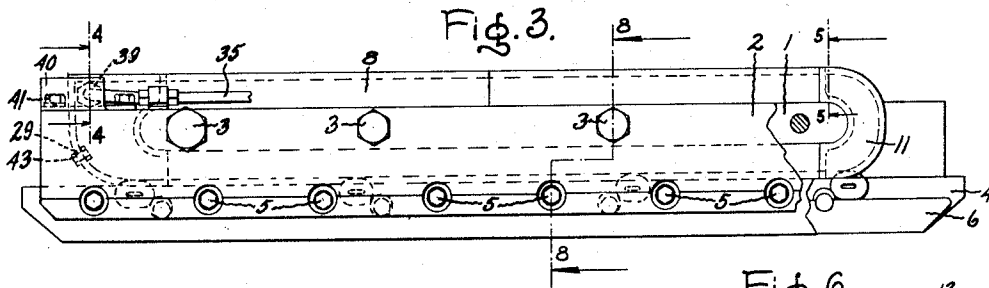
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Inventors:
John F. Trittle,
Guy Bellows, Jr.
by *Correll & Mack*
Their Attorney.

UNITED STATES PATENT OFFICE

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ELECTROMAGNETIC EXCITING COIL

John F. Tritle and Guy Bellows, Jr., Erie, Pa., assignors to General Electric Company, a corporation of New York

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1 Claim. (Cl. 175—21)

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Our invention relates to improved coil constructions for electromagnets and particularly such as are used in this type rail brake.

An object of our invention is to provide an improved electromagnetic coil construction, such as may be used for rail brakes or other types of electromagnets.

Further objects and advantages of our invention will become apparent and our invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 schematically illustrates an arrangement for evacuating an electromagnetic coil construction embodying our invention and filling it with an insulating material; Fig. 2 is an exploded perspective view of an electromagnetic coil container and insulating elements used in an embodiment of our invention; Fig. 3 is a side elevational view, partly broken away, illustrating an electromagnetic rail brake provided with an embodiment of our invention including the coil container shown in Fig. 2; Fig. 4 is an enlarged sectional view taken along line 4—4 of Fig. 3; Fig. 5 is an enlarged sectional view taken along line 5—5 of Fig. 3; Fig. 6 is an enlarged partial sectional view showing the first few turns of the winding in one corner of the container for the coil; Fig. 7 is a partial perspective view of an end of the spool and its insulation with a few turns of wire wound around the spool; and Fig. 8 is an enlarged sectional view taken along line 8—8 of Fig. 3.

Referring to the drawings, we have shown our invention in connection with an electromagnetic rail brake which is provided with an improved electromagnetic exciting coil construction and a core together with wear plate shoes adapted to be used as traction equipment, such as with railway cars. In the illustrated embodiment of our invention, the rail brake is shown as comprising a longitudinally extending core 1 of magnetic material around which a suitable electromagnetic exciting coil is arranged. This coil also includes a number of improved features to which our invention is directed and is retained in position on the core 1 by longitudinally extending side plates 2 formed of magnetic material and arranged one adjacent each longitudinal side of the core 1 and removably secured thereto by a plurality of through bolts 3 which extend through openings in the core 1 and the side

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plates 2. Wear plate shoes 4 of magnetic material extend longitudinally of the brake and are removably secured by a plurality of bolts 5, one to each of the inner sides of the side plates 2 and are transversely spaced apart by an air gap and by a nonmagnetic spacer and wear plate element 6. These wear plate shoes 4 are adapted to engage the upper surface of a rail when the coil is energized to provide a drag on the brake which is suitably transmitted to the vehicle to which the brake is applied.

Since many rail brakes are required to operate under very adverse conditions, such as in very humid atmospheres or even under water which sometimes may contain various salts or acids, it is desirable that the electrical portions of the brake be protected from these elements as completely as possible. In order to obtain such an arrangement in our simplified and improved rail brake, we have provided an improved electromagnetic exciting coil construction which is hermetically sealed against the entrance of all foreign substances. Primarily this improved coil comprises a metal container which is hermetically sealed against the entrance of foreign substances and in which the exciting coil winding is wound and insulated with a suitable material which substantially fills the space in the container around the coil to the substantial exclusion of gas from the interior of the container. As shown in detail in Figs. 2, 4, and 5, this coil may be wound on a spool made of a nonmagnetic material, such as a thin sheet metal member of stainless steel having an inner base side 7 integrally connected to outwardly extending end walls 8 at each end thereof and formed with a central opening 9 therethrough in which the core 1 is adapted to be arranged. As shown in Fig. 2, the end walls may be extended by small end plate elements 10 and 11 integrally secured to the end walls 8, as by welding, and one of the end plates 10 is formed with an opening 12 therein to provide for the electrical connection to the winding of the coil by a terminal socket which is adapted to be integrally and hermetically connected to the spool, as is shown in detail in Fig. 4. In making this electromagnetic coil, the spool is thoroughly cleaned and then is preferably given a coating of air-drying varnish of any suitable type, after which two insulating sheets 13 of paper or other suitable insulating material are inserted over the base side 7 of the spool and inside the two end walls 8 to a position such as that shown in Fig. 7, and small end insulating elements 14 and 15 are placed over the ends 10 and 11, and

these insulating sheets and elements are held firmly against the varnish on the side 8 of the spool until the varnish is dry, or these insulation details may be held away from the winding area by suitable adapter plates on the coil winding machine thus eliminating necessity for the varnish. The insulated spool then is placed on any suitable winding fixture and an end of an insulated electrical conductor is brazed to the spool in any suitable manner, as shown at 16 in Fig. 7.

In this type equipment, a considerable amount of magnetic energy is stored in the coil when it is energized, and this must be dissipated when the circuit is broken in order to release the brake. This sudden release of magnetic energy may cause a very high peak voltage which may go as high as 25 to 50 times normal volts. In order to eliminate this undesirable peak voltage, a short circuit turn of relatively high cross section is effectively made by winding the first few turns, which may be about five turns, around the inner base side of the spool and then these first five turns are scraped bare of their insulation for a short distance and are brazed together and then to a silver solder pad 17, as shown in Fig. 6, which is securely brazed or welded to the metal of the inner wall 7 of the spool. After this, the desired predetermined number of additional turns are wound around the spool, and a plurality of insulating spacer bars 18 have indentations thereon, as shown in Fig. 5, are arranged at spaced intervals through the ends of the windings in order to provide a somewhat symmetrical arrangement of wire. After the desired number of turns have been wound around the spool, the last few turns may be anchored together by a suitable binder 19, and the end of the conductor is secured to a terminal socket in any suitable manner and may be brought in by a terminal lead which is secured to a terminal socket opening 20 formed in a socket terminal 21 held in position within annular insulating members 22 and 23 and within a socket shell 24 and a socket terminal nipple 25 which is hermetically sealed to the casing side of the spool 8. The sides of the paper insulating members 13 then are folded down and tied in position in any suitable manner as by a twine 26 or gummed tape, after which the outer cover side 27 is arranged around the coil and integrally connected by a hermetic seal to the spool end walls in any suitable manner, as by welding, as shown at 28, to form a hermetically closed container, except for a pipe plug opening 29 in one end of the outer cover. Thus, the predetermined number of winding turns are completely enclosed and protected by the sides of the spool and the cover 27 which are particularly resistant to corrosion and other destructive elements which may come in contact with the exterior of the electromagnetic coil.

In order to assure further against the entrance of foreign substances into the electromagnetic coil which might be destructive to the winding or might cause grounds or short circuits therein, the winding preferably is given a special treatment which includes a pre-baking of eight to sixteen hours at about 130° C. to remove volatile matter from the insulation and to anneal the wire insulation. This baked coil then is allowed to cool to about 60° C. or less, after which a filling nozzle 30 is screwed into the pipe plug opening 29 in the cover of the container, and the coil is connected to a suitable vacuum pump 31 and a connecting valve 32 to the pump is opened while another valve 33, which connects to an insulat-

ing material tank 34, is closed. The coil container then is substantially evacuated, after which the valve 32 connecting the container to the vacuum tank 31 is closed and the valve 33 which connects to the insulating material container 34 is opened and a suitable insulating varnish or compound, such as a solventless varnish insulating material, which may be polymerized to a solid or substantially solidified condition, is pumped into the container under pressure. If desired, the amount of vacuum and the length required for evacuating the container may be varied depending upon the type of evacuating equipment which is utilized. Also, the insulating material may be inserted into the container under a different pressure and for a different length of time, depending upon the material which is used as the solventless varnish. The preferred solventless varnishes which may be used for filling the evacuated container of the electromagnetic coil are polymeric materials, such as a polymerizable composition comprising an unsaturated alkyd resin and may include polymerizable systems of a relatively low vapor pressure, comprising polymerizable esters of a polyhydric alcohol, or a plurality of polyhydric alcohols, and an alpha-unsaturated alpha, beta-polycarboxylic acid; polymerizable esters of an unsaturated monohydric alcohol, e. g., allyl alcohol and an organic polybasic acid, e. g. a saturated or unsaturated aliphatic polycarboxylic acid, an aromatic polycarboxylic acid, a halogenated aromatic polycarboxylic acid, an inorganic polybasic acid, e. g. phosphoric acid, etc., and others, or mixtures of these which are generally known in the art as permafils and which can be polymerized in place by the application of heat without the liberation of gases by the polymerization process to form a substantially solid insulating material around the winding of the coil. After insulating compound or varnish has been injected into the coil container, the coil is removed from the filling fixture and is baked for a suitable length of time, which may be about six hours as a minimum, with the coil held in a vertical position with the opening 29 at the top of the coil to prevent the escape of any of the insulating material during this baking process. The baking can be very effectively obtained by applying substantially 50 volts, direct current, to the winding coil by connecting this 50 volts between the socket terminal 21 and the grounded casing, such that the coil attains a suitable temperature or by placing the coil in a ventilated oven at a suitable temperature. After the solventless varnish or other insulating material has been properly baked to provide a substantially solidified or polymerized material which substantially fills the space in the container around the coil and the insulation therein to the substantial exclusion of gas from the container, the pipe plug opening 29 is closed by a pipe plug 43 which may also be welded in position to assure a hermetic seal of the coil container.

In order to energize the coil of the electromagnetic, any suitable plug connector may be inserted into the opening in the socket terminal which corresponds to the opening 12 in the coil container. As shown in Figs. 3 and 4, such a plug terminal may be attached to a suitable lead 35 and comprise a terminal plug clip 36 having fingers 37 which are adapted to provide a good electrical contact with the terminal socket member 21 and to be held in position therein by an insulating sleeve 38 which is secured in position by

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a retaining nut 39 which threadedly engages the terminal socket nipple 25 to assure against the accidental displacement of the terminal plug from the terminal socket due to vibrations or other causes. This type plug terminal connector can also be protected against displacement by the addition of a protective wall 40 which extends around the end of the connector and the leads 35 and may be bolted to the side plate 2 by a plurality of bolts 41.

Thus, the finished brake is provided with a simplified and easily demountable number of parts which includes a simplified and improved electromagnetic coil construction, in which the winding conductor turns 42 and the insulating elements are securely held in position by an insulating material and when a solventless varnish is used it has properties characteristic of such material having been injected into the container prior to polymerization thereof and after evacuation of the container and then having been polymerized in place therein to provide a substantially gas-free hermetically sealed container for the winding of the coil. This permafil type insulating filler has additional advantages in that it adheres to the surface of the metal container and forms an enclosure for the winding which is substantially crack-free and can also provide a certain amount of flexibility thereto. In addition, it provides a backing-up protection for the insulation of the winding and extends into the minute openings between the various parts which form the container and thereby further assures against the entrance of foreign materials therinto.

While we have illustrated and described a particular embodiment of our invention, modifications thereof will occur to those skilled in the art. We desire it to be understood, therefore, that our invention is not to be limited to the particular arrangement disclosed, and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

An electromagnetic coil construction including a thin metal spool having an inner base side integrally connected to outwardly extending end walls at each end thereof, an opening for a terminal socket in said spool, a terminal socket hermetically sealed to said spool and arranged with the socket opening in communication with said open-

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ing in said spool for the insertion of a plug terminal connector therinto, a coil winding formed of an insulated electrical conductor having a substantially predetermined plurality of turns around said spool inner base side between said end walls, the inner end of said coil winding being grounded to said spool and the outer end thereof being electrically connected to said terminal socket, an outer cover side arranged around said coil and integrally connected by a hermetic seal to said spool end walls forming a container, means for electrically grounding to said spool a predetermined number of turns of said coil adjacent said spool base side for minimizing transient voltage effects on said coil, insulation between said spool end walls and said coil, and means including a solidified thermoset polymerized insulating material for substantially filling space in said container around said coil and insulation to the substantial exclusion of gas from said container, said polymerized material having properties characteristic of such material having been injected into said container prior to polymerization and after evacuation of said container and having been polymerized in place to a solid condition in said container.

JOHN F. TRITLE.
GUY BELLOW, JR.

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