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R. VARLEY.

MACHINERY FOR MAKING ELECTROMAGNETS.

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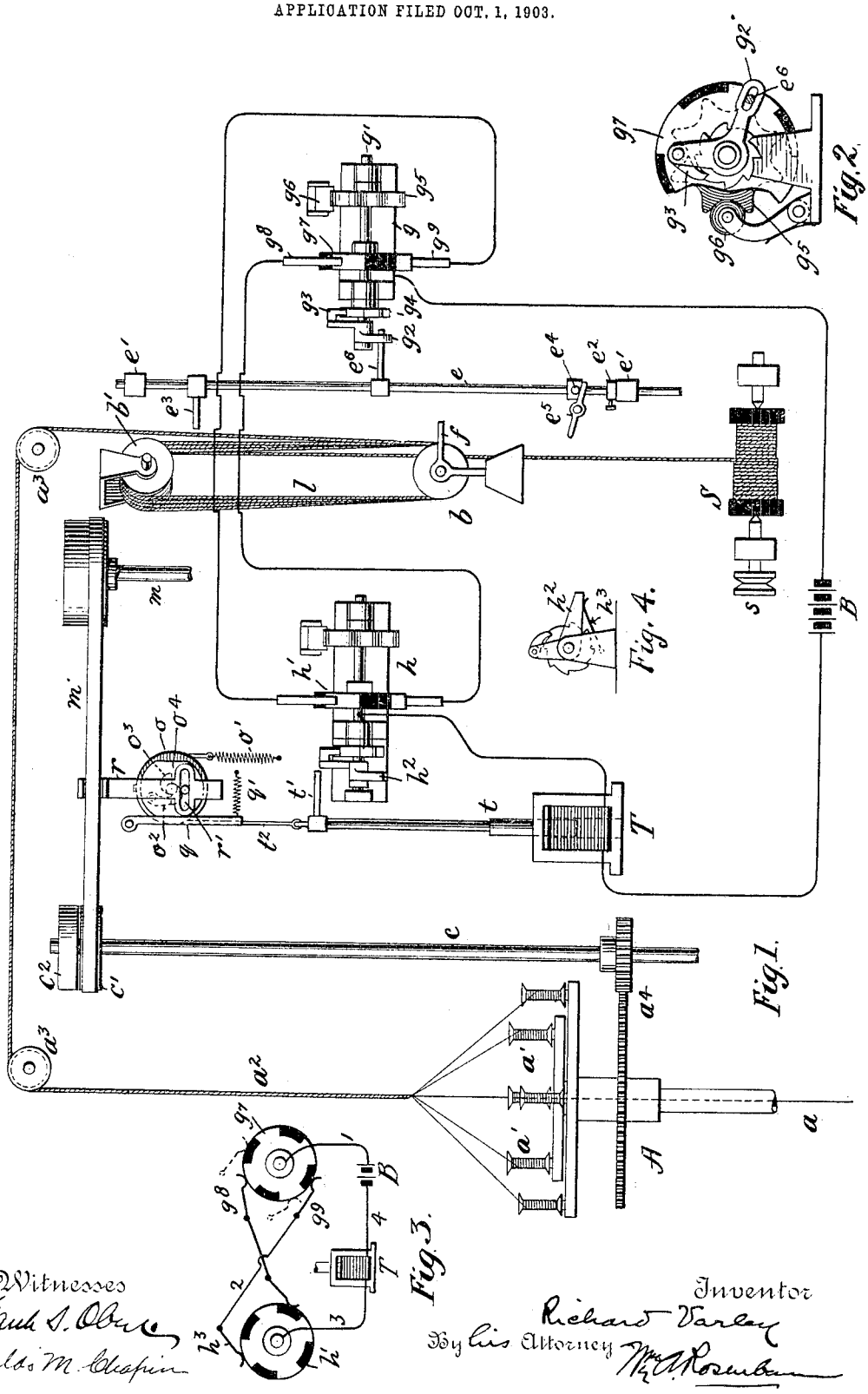

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3.

Witnesses

Frank S. Ober

Walter M. Chapin

Inventor

Richard Varley

By his Attorney

Wm. A. Rosenbaum

UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO VARLEY DUPLEX MAGNET COMPANY, A CORPORATION OF NEW JERSEY.

MACHINERY FOR MAKING ELECTROMAGNETS.

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To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Machinery for Making Electromagnets, of which the following is a full, clear, and exact description.

This invention relates to machinery for covering or insulating magnet-wire and winding the same into magnet-coils.

The ordinary practice in manufacturing magnet-coils is to cover or insulate the wire in an ordinary machine for that purpose, then to store the covered wire in long lengths upon reels for an indefinite time until it is required for the purpose of making up the magnet-coils. Ordinarily small magnet-coils are most economically wound at a high speed of the winding-mandrel; but certain kinds of coils—such as the helices of induction-coils, field-magnet coils of motors and dynamos, arc-lamp coils, and the larger sizes of coils generally—are more practically wound at a much slower speed, so slowly, in fact, that the wire can be lead directly from the slow-running covering-machine to the magnet-winding spindle and both operations carried on simultaneously, thus avoiding the expense of any intermediate handling and storing of the covered wire. There are, however, various obstacles in the way of such a process. For instance, the covering and winding cannot be carried on successfully at exactly the same speeds. Hence there must be a compensation to allow for such differences in the speeds as occur. Also irregularities and imperfections of wire will sometimes cause a delay or temporary stoppage of one of the operations, which must also be compensated for. Without such compensations the two operations could not be successfully carried on together from a commercial standpoint, since it would require extraordinary diligence of the operator to keep the machines running properly. For these and other reasons it has not been feasible heretofore to wind the wire into magnet-coils directly as it comes from the covering-machine. I have, however, provided a system for this kind of winding, and the same constitutes the subject of the present invention.

My invention introduces between the covering-machine and the winding-spindle an expansible take-up device or reservoir for excess of covered wire and an automatic stopping and starting mechanism which comes into play whenever extraordinary conditions arise which cannot be compensated for by the reservoir to stop or start either the covering-machine or the winding-spindle. These compensating devices thereby render it possible and feasible to simultaneously cover the wire and wind it into magnet-coils.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1 is a conventional representation of the complete system. Fig. 2 is an end view with parts broken away of one of the circuit-controlling devices. Fig. 3 is a diagram of the circuits of the stopping and starting mechanism Fig. 4 is a detail.

At A is shown an ordinary wire-covering machine, the bare wire being indicated by a and the covering material being carried by the spools a', which are revolved around the wire to either twist or braid the material upon the wire. The covered wire (indicated by a^2) leads over suitable guides a^3 and thence is looped a number of times around a suspended movable sheave b and a fixed sheave b', and leads thence finally to a winding spindle or spool S, upon which it is wound into an electro-magnet-coil. The spool S may be driven by means of a belt passing around the pulley s. The covering-spools a' are driven through suitable interposed gearing a^4 from the counter-shaft c, which carries a fast and a loose pulley c' and c^2, the counter-shaft being driven from the main shaft m by belt m'. The speed at which the spool S is rotated is such as to correspond as near as possible with the speed of the covering-machine A, so that the spool S will take up the covered wire about as fast as it is delivered from the covering-machine; but these speeds do not always correspond, because the diameter of the coil on the spool S is gradually increasing and the wire is in consequence taken up faster and faster. A mean speed is, however, adopted for the best results.

The sheaves b and b', with the loops l of covered wire passing around them, constitute an expansible or flexible take-up device or reservoir for the covered wire. The sheave b carries a weight which whenever there is any slack in the loops takes up the same by causing the sheave to move downward. Likewise

when the tension of the looped strands becomes abnormal the weight is overcome and the sheave b lifted. By providing a certain travel for the sheave b and a certain number of loops of the wire around the sheaves the device will compensate for the ordinary variations between the speeds at which the wire is covered and taken up by the winding-spindle, an excess of speed of the winding-spindle causing the sheave b to rise and feed the wire faster to the winding-spindle, while an excess of speed of the covering-machine will allow the sheave b to fall and take up the excess of wire.

In connection with the winding-spindle there is usually a device for leading the strand to the spool in such a manner as to lay the wire in uniform layers. This device is not shown in the drawings, since it forms no part of the invention; but it is a delicately-acting apparatus which is liable to be disturbed by irregularities in the wire or its covering, and thus cause a delay or temporary stoppage of the winding-spindle. For a similar reason there may be a delay in the action of the covering-machine. These and other extraordinary occurrences are provided for by the devices now to be described.

Adjacent to the vertical loops l is a rod e, arranged to slide freely in its bearings e' and having a collar e^2, determining its normal vertical position in the bearings. This rod also carries two pins e^3 and e^4, fixed thereon, respectively, at points adjacent to the limits of travel of the sheave b. A pivoted lever e^5 rests against the pin e^4. The frame of sheave b carries a laterally-projecting finger f, which when the sheave reaches the lower limit of its travel strikes a lever e^5 and imparts a short upward stroke to the rod e. At the upper limit of travel the finger f also strikes the pin e^3 and again lifts the rod e. Adjacent to rod e is a frame g, carrying a shaft g', upon the end of which is a crank-arm g^2, having a slot in its end, into which projects a pin e^6, carried by the rod e. The crank carries a pawl g^3, which engages with a ratchet-wheel g^4 on shaft g'. On this shaft there is a star-wheel g^5, against which bears a spring-pressed roller g^6. There is also on the shaft a commutating-switch g^7, consisting of a disk of metal having non-conducting segments inserted at equal distances apart in its periphery. g^8 and g^9 are two contact-brushes bearing upon the periphery of the commutator at such positions that when one of them is on a conducting portion of the periphery the other is on a non-conducting portion. The number of teeth on the star-wheel g^5 is equal to the number of conducting and non-conducting segments on the commutator, and the length of each tooth or each segment is equal to twice the length of movement imparted to the crank g^2 by the pin e^6, so that the motion of the crank acting through the pawl and ratchet will move the segments under the brushes and one tooth of the star-wheel under the roller until the peak of the tooth passes the roller, when the motion is accelerated and finished by the pressure of the roller upon the star-wheel, thus causing a quick change of the circuits on the commutator and preventing serious sparking. Another apparatus of exactly the same character is mounted upon a frame h, its commutator-wheel being indicated by h' and its crank h^2 being actuated in one direction by a finger t', attached to the core t of a solenoid T, and in the other by a spring h^3. To the core of this solenoid is attached a cord t^2, passing over and fixed to a pulley o, and thence attached to a spring o'. The pulley o carries a pawl o^2, adapted to engage with a ratchet o^3, having two teeth and carried by a disk o^4, both the pulley and the disk being loose on the same axis.

r is a belt-shifting bar having a fork embracing the belt m'. It also has a transverse slot r', into which a pin carried by the disk projects.

When the solenoid is energized, the core is pulled downward and the disk is rotated a half-turn by the engagement of the pawl and ratchet, which moves the belt-shifting arm and throws the belt from one of the pulleys c' c^2 to the other, to either stop or start the covering-machine. The belt-shifter is held in one position or the other by a lever q, held against a flat portion of the disk o^4 by a spring q'.

The solenoid T is in circuit with a battery B and the two commutators g^7 and h', but in such a manner that the circuit is normally open. The rotation of one commutator through the space of one segment will throw the solenoid into circuit, while the rotation of either commutator thereafter will again throw the solenoid out of circuit.

The operation of the apparatus is as follows: The covering-machine and the winding-spool are driven at the mean speeds hereinbefore described. In the ordinary variations of the speeds the sheave b rises and falls to compensate therefor, the finger f playing back and forth between the limits of travel without actuating the rod e. When, however, the spool S is delayed abnormally or the covering-machine runs ahead of it, the sheave b will lower until finger f strikes the lever e^5 and lifts the rod e. This will turn the crank g^2 a short distance, and the motion communicated to shaft g' will be finished quickly by the roller g^6 to change the position of the brushes on the commutator g^7. If we assume the position of the brushes normally to be as shown in Fig. 3, the new position will be as indicated by the brushes in dotted lines, and a complete circuit will be established through the solenoid as follows: from the battery B by wire 1 to the frame g and the metal part of the commutator g^7, thence by brush g^9 and

wire 2 to brush h^3, thence to disk h', wire 3, solenoid T, and wire 4 to battery. The solenoid being energized, its core is pulled downward and the position of the belt m' shifted to the loose pulley c^2, and thus stopping the covering-machine. The downward motion of the core of the solenoid above mentioned finally brings finger t' against crank h^2, rotates the commutator h', and again shifts the relative position of the brushes in the circuit, so that the circuit is opened shortly after having been closed, as can easily be traced. The core t is then lifted by the spring o', permitting the pawls on the belt-shifter and circuit-changer to slip back on their ratchets to the next tooth. The winding-spool, however, continues rotating until the excess of wire in the reservoir is consumed, whereupon sheave b having traveled to its upper limit, finger f strikes the pin e^3 and again lifts the rod e, (which has previously fallen back by reason of its own weight to its normal position.) This action again shifts the commutator-brushes, and the solenoid being again energized the belt is shifted and the covering-machine started. The reservoir will then continue to compensate for ordinary variations until the stopping mechanism is again brought into action by an abnormal condition.

Having described my invention, I claim—

1. The combination of a wire-covering machine and a winding device adapted to operate at different relative speeds, and a take-up or reservoir interposed between them, through which the wire leads from the covering-machine to the winding-spindle, and a stopping and starting device actuated automatically when the reservoir is "full" and "empty" respectively.

2. The combination of a wire-covering machine, a winding device adapted to operate at different relative speeds, a take-up device or reservoir for the wire interposed between the covering-machine and winding device and through which the wire leads from the covering-machine to the winding device, a stopping and starting device, an electromagnet actuating the same to alternately stop and start the mechanism, and a circuit-controller actuated by said take-up device or reservoir when it is "full" and "empty."

In witness whereof I subscribe my signature in presence of two witnesses.

RICHARD VARLEY.

Witnesses:
M. M. CROSWELL,
WILLETT CHADWICK.