May 31, 1927. 1,630,912

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METHOD AND APPARATUS FOR MAKING EDGEWOUND COILS

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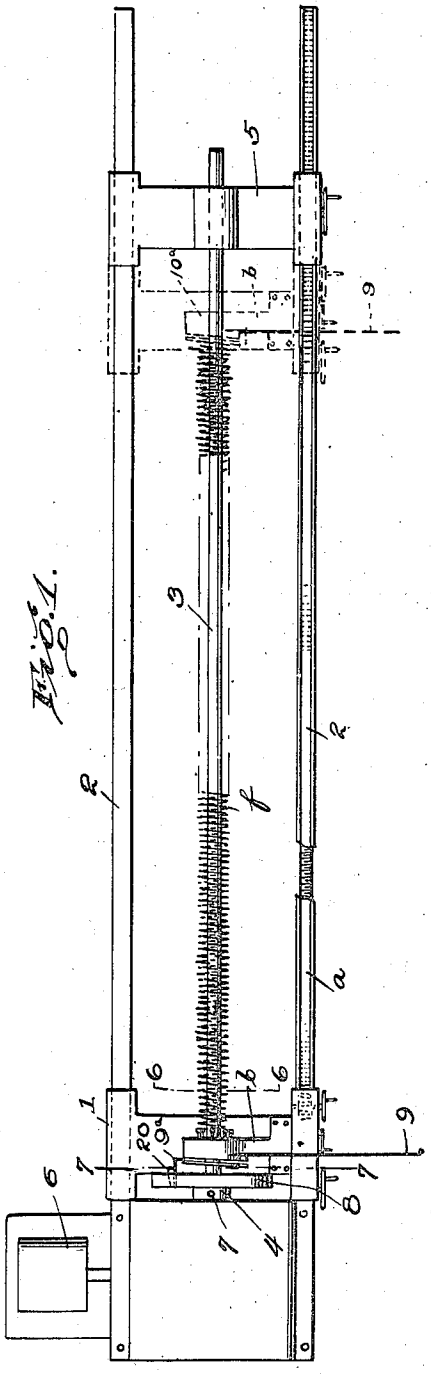


Fig. 1.

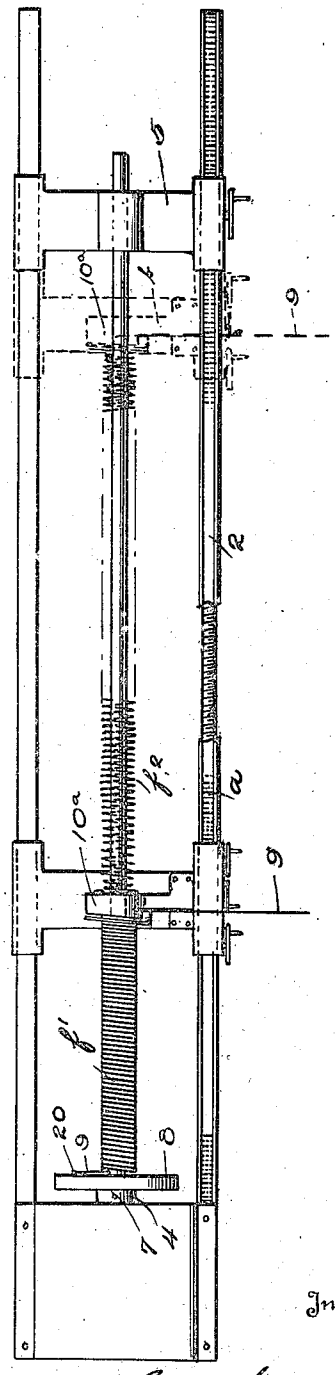


Fig. 2.

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Fig. 3.

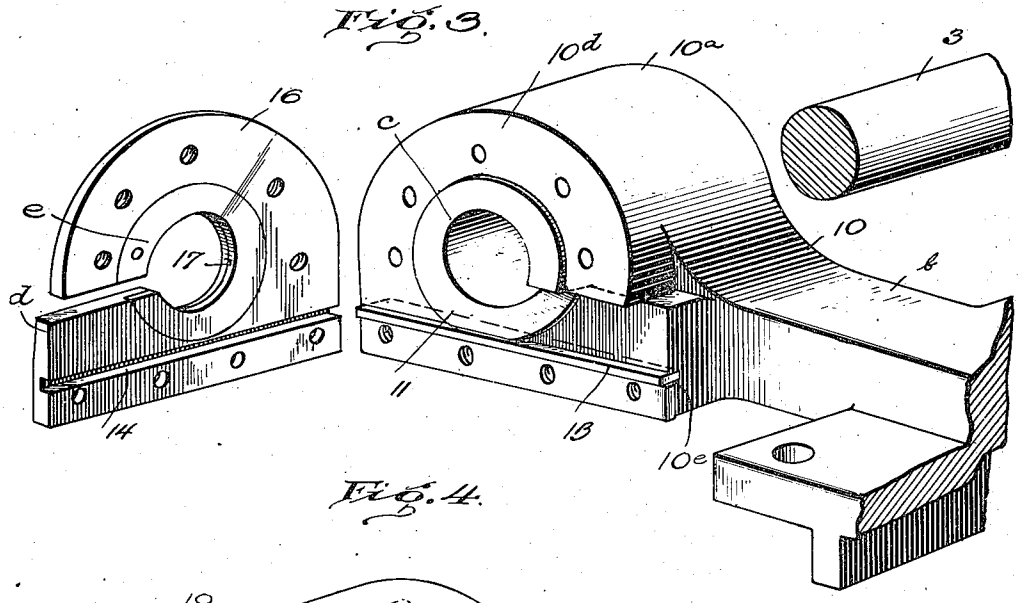


Fig. 4.

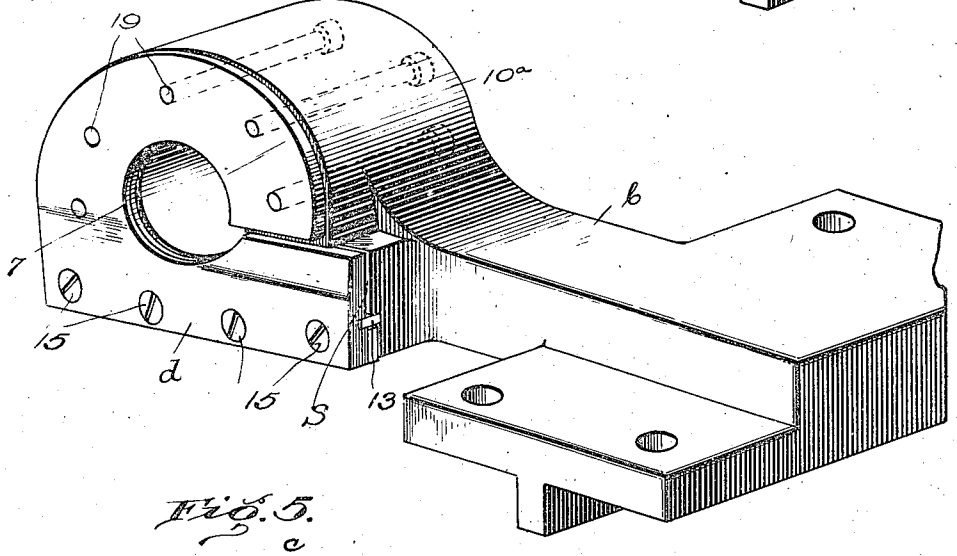
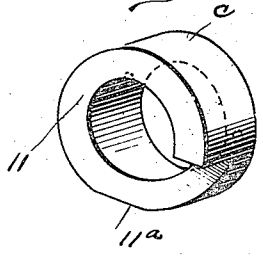


Fig. 5.



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Fig. 6.

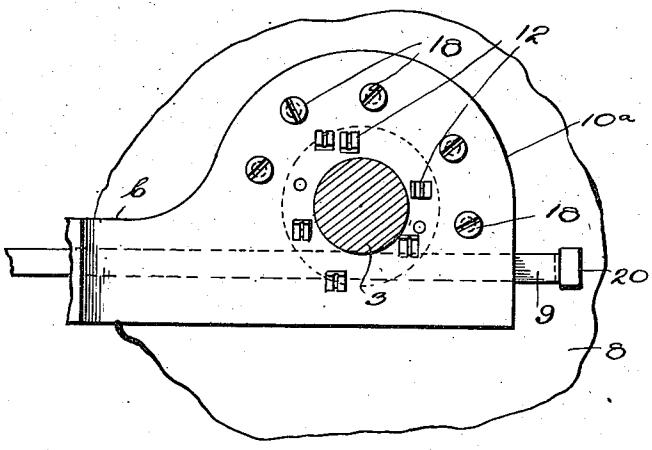


Fig. 8.

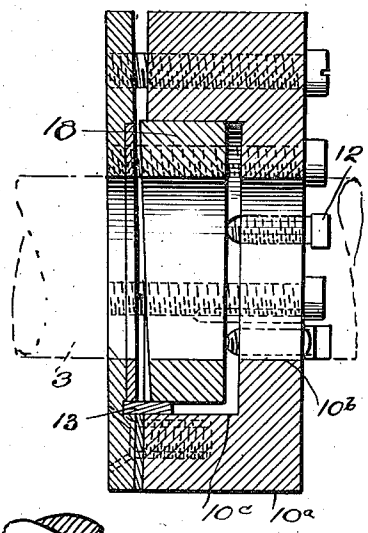
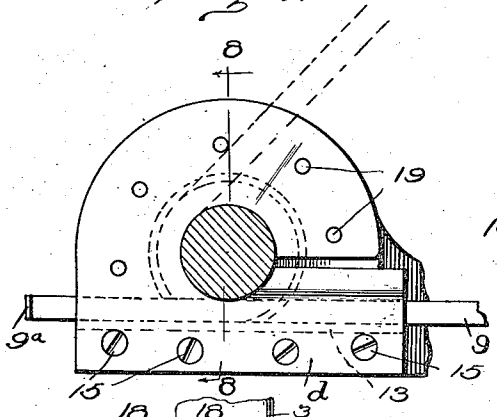


Fig. 7.



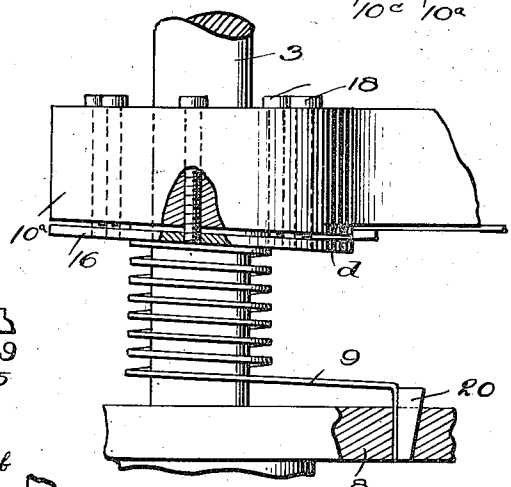


Fig. 10.

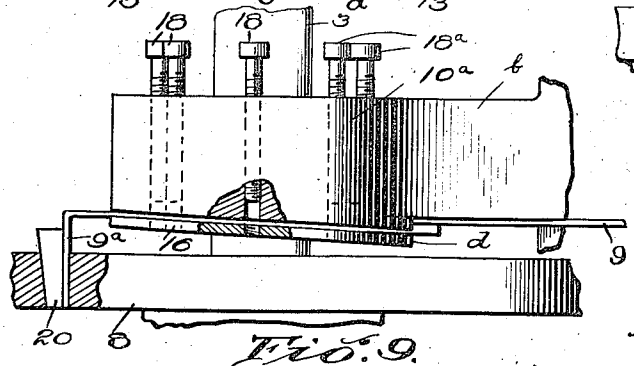


Fig. 9.

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR MAKING EDGE-WOUND COILS.

Application filed December 11, 1925. Serial No. 74,733.

This invention relates to a machine for and method of winding flat metal ribbons on edge. In carrying out the invention, I provide a machine, which may be an ordinary lathe, having a relatively long bed and having a slide-rest which is carried along the bed by the feed screw and which may be manually moved back and forth on the rails by the rack and pinion devices usually found on lathes. A relatively long core-bar is gripped in the chuck and is revolved by the machine, and upon the slide-rest is arranged a die supporting member carrying dies which co-operate with the bar to coil the ribbon on edge around the bar in evenly spaced convolutions. To start the operation of winding the coil, one end of the ribbon is passed through the die and is secured to the chuck, and certain adjustments are necessary in order that the die may coil the ribbon smoothly and accurately.

The invention is designed particularly for winding coils from ribbons of resistance metal, to be used in rheostats, which metal is usually of alloy and more or less resilient. Where the convolutions of the coil are spaced say one-quarter of an inch or more apart, a very limited length of the coiled ribbon would extend the length of the core-bar. In order to wind a greater length of ribbon on the core-bar, the machine is stopped after the slide-rest and dies have traveled approximately the full length of the bar and the core-bar is reversed sufficiently to slacken the grip of the coil on the bar. The slide-rest and die are then manually moved back toward the chuck, pressing the convolutions of the coil together. The machine is then started and the part of the coil which has been formed and compressed grips the bar and does not expand, and another length of coil with spaced convolutions is formed as the slide-rest and die move to the end of the bar. This latter length of coil is then compressed in the same manner as the first length, and another shorter length is wound upon the bar. These operations of winding and compressing the convolutions are repeated until the core-bar is practically covered with closely arranged convolutions, when the ribbon is severed and after the severed end has been drawn through the die, the motor is stopped and the die is moved beyond the end of the bar. This movement of the die permits the coiled and compressed ribbon to expand, and the coil by its own resiliency discharges itself from the bar, except for a part which may be readily pulled off of the bar. Thus, by the method described, a coil which may be several times the length of the core-bar may be made without going through the setting-up operation or cutting the ribbon more than once.

In the accompanying drawing,

Fig. 1 is a top plan view of the machine for winding the coils, showing the die in the position for starting the winding operation;

Fig. 2 is a similar view, the die being shown in position to commence a second operation;

Fig. 3 is a perspective view of the die supporting members and dies, separated;

Fig. 4 is a perspective view of the same, assembled;

Fig. 5 is a similar view of one of the dies;

Fig. 6 is a section on the line 6—6 of Fig. 1, showing the rear side of the die support and a portion of the face plate of the chuck in elevation;

Fig. 7 is a section on the line 7—7 of Fig. 1;

Fig. 8 is a section through the die holder and dies, taken on the line 8—8 of Fig. 7;

Fig. 9 is a top plan view of the die holder and of the face plate of the chuck, partly broken away, showing the metal ribbon attached to the face plate and with the tightening screws withdrawn from the horn of the die plate, the parts being shown in position to commence winding the coil; and,

Fig. 10 is a similar view, showing the coil partly wound and with the horn of the shoe clamped against the metal ribbon.

Referring to the drawing, *a* indicates a machine for winding the coils and which may be an ordinary lathe having a slide-rest 1, with the usual screw feed for moving the rest along the rails 2 and with the usual rack and pinion for returning the rest. The rails of the machine are relatively long, and a round bar 3, which forms a core on which to wind the coils, is secured at one end within a suitable chuck 4, and supported at its opposite end in a tail stock 5 which is adjustable along the rails. A motor is shown at 6 for turning the chuck, the gearing between the motor and the chuck being omitted because any desired arrangement of gearing may be provided. The chuck,

in this instance, is shown as a hub having a set screw 7 for securing the bar 3 within the hub, and upon the hub is a suitable face plate 8, to which one end of the ribbon 9, from which the coil is formed, is secured. Upon the slide-rest is suitably secured a die-holder *b*, carrying the dies for forming the coils.

The structure of the dies and die-holding members is shown in Figs. 3–10, inclusive. The die-holder comprises a supporting member 10, which is bolted to the slide-rest and has a hub or boss 10^a, provided with an opening 10^b through which the shaft or mandrel 3 extends. A socket 10^c is formed in the hub, concentric with the opening 10^b, and the face 10^d of the hub, surrounding the socket, is helically formed, as shown. Within the socket is arranged a cylindrical hardened steel die *c*, which surrounds the shaft or mandrel 3, and the exposed end 11 of said die is helically formed. Set screws 12, extending through the rear wall of the socket, bear against the die *c*, and by means of these screws the die may be adjusted to take up wear and to suit the thickness of the metal ribbon which is to be wound. The die *c* has a flattened portion 11^a on its lower side, and a hardened steel guide strip 13 is fitted into a groove 10^e in the support 10 and extends horizontally below the die *c*, and the flattened portion 11^a of the die rests upon this guide strip. The guide strip projects beyond the face of the support 10 and enters a groove 14 in a die plate *d*, which is secured to the hub by screws 15, below the guide strip 13. The lower part of the die plate *d* is substantially flat and rests against the lower flat portion of the hub 10^a, while the upper portion 16 of the plate is in the form of a helically arranged horn. The die plate has a central opening 17, through which the mandrel or core-bar extends, and arranged within a shallow socket surrounding this opening is a helical die *e*, which is opposed to the die *c* when the plate *d* is clamped to the hub. In addition to the screws 15, for securing the base of the plate to the base of the hub, a series of screws 18 is provided for adjusting the horn of the plate toward and from the helical face of the hub. As shown, these screws are spaced apart around the socket in the hub and extend through the hub into threaded openings 19 in the horn of the plate.

In starting the winding operation, the slide-rest 1 is moved to bring the die-holder close to the face plate 8 of the machine, as shown in Figs. 1 and 9. The adjusting screws 18 are turned backward so that they will be free from the plate *d*, as shown in Fig. 9, and will not obstruct the gap between the plate and the hub. One end of the flat ribbon 9, from which the coil is to be made, is inserted in the slot *s*, (Fig. 4) between the plate and the hub and above the guide strip 13, and this end portion of the ribbon is pushed through the slot. The end 9^a of the ribbon is then turned over at a right angle and inserted in an opening in the face plate 8 of the machine and secured in the opening by a wedge 20. The machine is then started and the face plate carries the end of the ribbon around, as indicated in dotted lines in Fig. 7, and when the end portion of the ribbon has been carried beyond the line of the last clamping screw 18^a in the series, the machine is stopped. In this operation, the face plate of the machine has made slightly more than a half revolution, to carry the end of the ribbon past the clamping screws for the horn of the die plate. The screws 18 are then tightened to hold the horn of the die plate firmly against the ribbon and the machine is then started, further adjustment of the screws 18 and 12 being made, if necessary, after the core-bar or mandrel has made a few revolutions. The winding of the metal ribbon causes the straight portion of the ribbon immediately below the core-bar to bear against the guide strip 13 and therefore this strip is made of hardened steel to resist wear. As the screw feed of the machine carries the slide-rest and the die carrier away from the face plate of the machine, the ribbon is coiled about the core-bar in evenly spaced convolutions, as shown in Fig. 10. When the slide-rest reaches the right hand end of the machine, as indicated in dotted lines in Fig. 1, the core bar will be filled with the spaced convolutions of the coil, as indicated at *f* in Fig. 1. The machine is then stopped and the motor is reversed sufficiently to cause the coil to release its grip on the core-bar. One or two revolutions of the bar is enough for this purpose. The slide rest is then moved toward the face plate until the spaced convolutions of the coil are all brought together, as shown at *f'* in Fig. 2. The motor is then started, and as it starts, the convolutions *f'* tighten on the core bar and remain in close contact with one another and another section of coil f^2 is formed on the bar, with its convolutions spaced apart. When the slide-rest reaches the right hand position shown in dotted lines in Fig. 2, the motor is again stopped and reversed sufficiently to loosen the grip of the coil on the bar and the slide-rest is again moved to the left to compress the spaced convolutions together. This action is repeated until the core bar is filled solidly with the convolutions of the coil. The part of the ribbon which is being fed to the machine is then severed close to the die, and when this end portion has been wound upon the core-bar the motor is stopped. The tail stock 5 is then moved to the right, beyond the core-bar, and the slide-rest is also moved to the right until the die

carrier is moved beyond the end of the bar. As soon as the die carrier has moved beyond the end of the bar, the greater part of the coil automatically discharges itself from the bar by its own expansive force, and the remainder of the coil can then be pulled off of the bar.

What I claim is:

1. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die-support and means for moving the same along the bar, a die carried by said support and closely surrounding the bar, said die having a helically formed end, a die-plate having a portion secured to said support and having a helically formed horn spaced from the support and extending around the bar parallel with the helical end of said die, and removable means for drawing said horn toward said support.

2. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die-support and means for moving the same along the bar, a die carried by said support and closely surrounding the bar, said die having a helically formed end, a die-plate having a portion secured to said support and having a helically formed horn spaced from the support and extending around the bar parallel with the helical end of said die, and means for adjusting said die toward said plate.

3. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die-support and means for moving the same along the bar, a die carried by said support and closely surrounding the bar, said die having a helically formed end, a die-plate having a portion secured to said support and having a helically formed horn spaced from the support and extending around the bar parallel with the helical end of said die, a helically formed die carried by said plate and opposed to the die in said support, and removable means for drawing said horn toward said support.

4. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die-support and means for moving the same along the bar, said support having a socket surrounding the bar, a die mounted within the socket and closely surrounding the bar, said die having a helically formed end, a die-plate having a portion secured to said support and having a helically formed horn spaced from the support and extending around the bar parallel with the helical end of said die, and removable means for drawing said horn toward said support.

5. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die support and means for moving the same along the bar, a die carried by said support and closely surrounding the bar, said die having a helically formed end, a die-plate secured to said support and having a helically formed horn extending around the bar parallel with the helical end of said die and spaced therefrom, and a series of adjusting screws spaced apart around the horn for drawing said horn toward the support, said screws being removable from the space between the horn and the support.

6. In a machine for winding flat metal ribbons on edge, a core-bar and means for rotating the same, a die support and means for moving the same along the bar, a die carried by said support and closely surrounding the bar, said die having a helically formed end, a die-plate secured to said support and having a helically formed horn extending around the bar parallel with the helical end of said die and spaced therefrom, a series of adjusting screws spaced apart around the horn for drawing said horn toward the support, said screws being removable from the space between the horn and the support, and a series of adjusting screws spaced apart around the die for adjusting the latter toward the plate.

7. In a machine for winding flat metal ribbons on edge, a core-bar and means for revolving the same, a die-holder movable along the bar, a die in said holder surrounding the bar and having a helical end, a plate secured to said holder and having a helical horn opposed to said die, and a hardened guide strip arranged between said holder and plate and arranged tangentially to the die.

8. In a machine for winding flat metal ribbons on edge, a core-bar and means for revolving the same, a die-holder movable along the bar, a die in said holder surrounding the bar and having a helical end, a plate secured to said holder and having a helical horn opposed to said die, and a hardened guide strip fitting within grooves in the holder and plate and extending tangentially to the die.

9. The method of coiling flat metal ribbons on edge which comprises extending one end of the ribbon through a coiling die and securing said end to a core-bar, rotating said bar and moving said die along the bar until the latter is substantially filled with spaced convolutions of the coil, stopping and reversing the motion of the core-bar sufficiently to release the grip of said convolutions on the bar, moving the die backward to compress the convolutions, rotating the bar and moving the die to wind further spaced convolutions on the bar, again stopping and reversing the core-bar and moving the die to compress the latter spaced convolutions together, and repeating these operations until the bar is substantially full of compressed convolutions, and then remov-

ing the die from the core-bar to permit the coil to expand and discharge from the bar.

10. The method of coiling flat metal ribbons on edge which comprises extending one end of the ribbon through a coiling die member and securing said end to a core bar having a driving member at one end, rotating said bar and moving said die member along the bar until the major part of the latter is filled with spaced convolutions of the coil, stopping the motion of the core bar and releasing the grip of the coil on the bar, moving the die member backward to compress the convolutions, rotating the bar and moving the die member to wind further spaced convolutions on the bar, again stopping the bar, releasing the grip of the coil on the bar and moving the die member to compress the latter spaced convolutions together, and repeating these operations until the major part of the bar is full of compressed convolutions, and then removing one of said members from the core bar to permit the coil to expand and discharge from the bar.

In testimony whereof I hereunto affix my signature.

GEORGE H. WHITTINGHAM.