Sept. 20, 1960 R. O. BIRCHLER ET AL 2,953,311

ARBOR FOR COIL WINDING APPARATUS

Original Filed April 9, 1951 2 Sheets-Sheet 1

FIG. 1

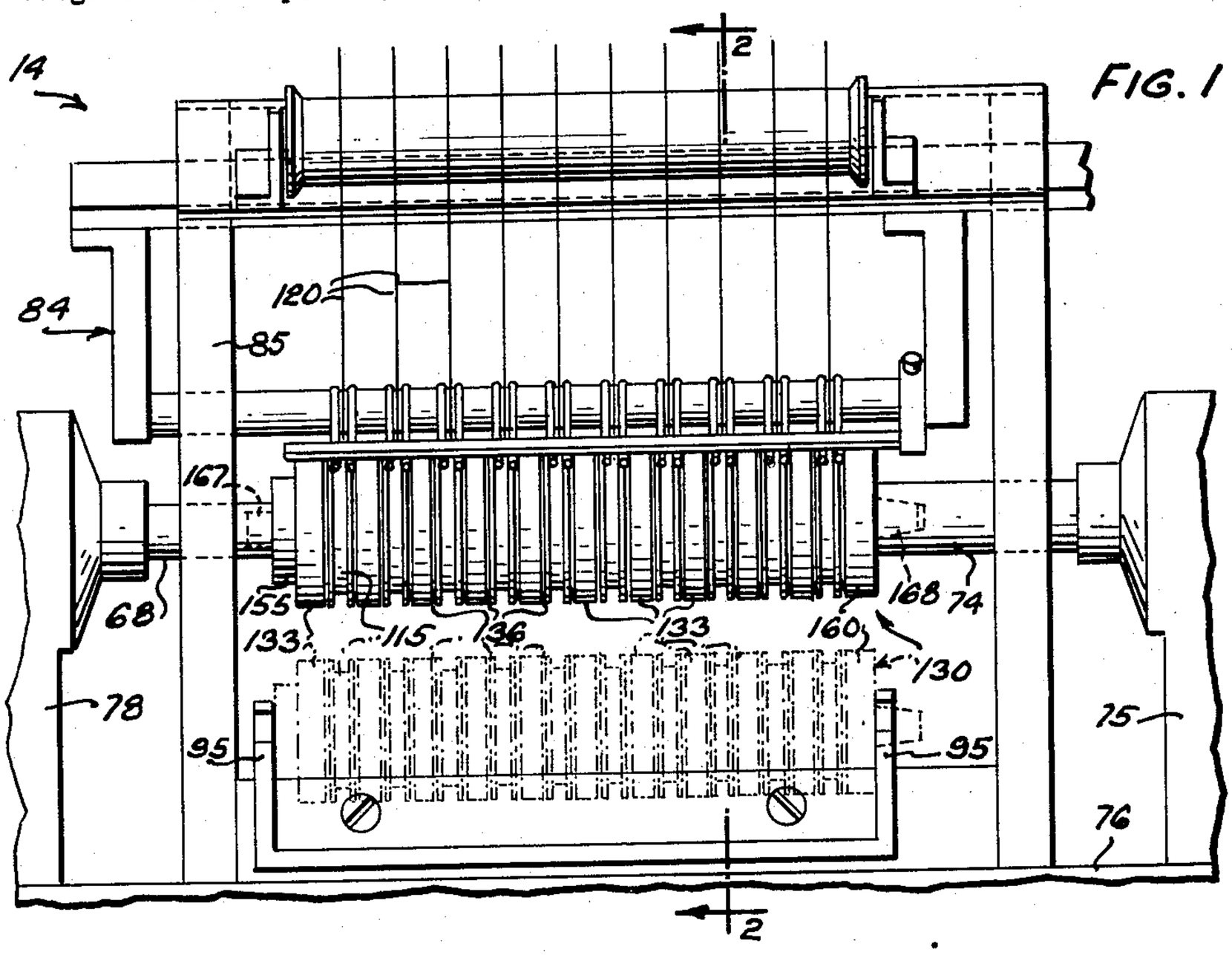


FIG. 2

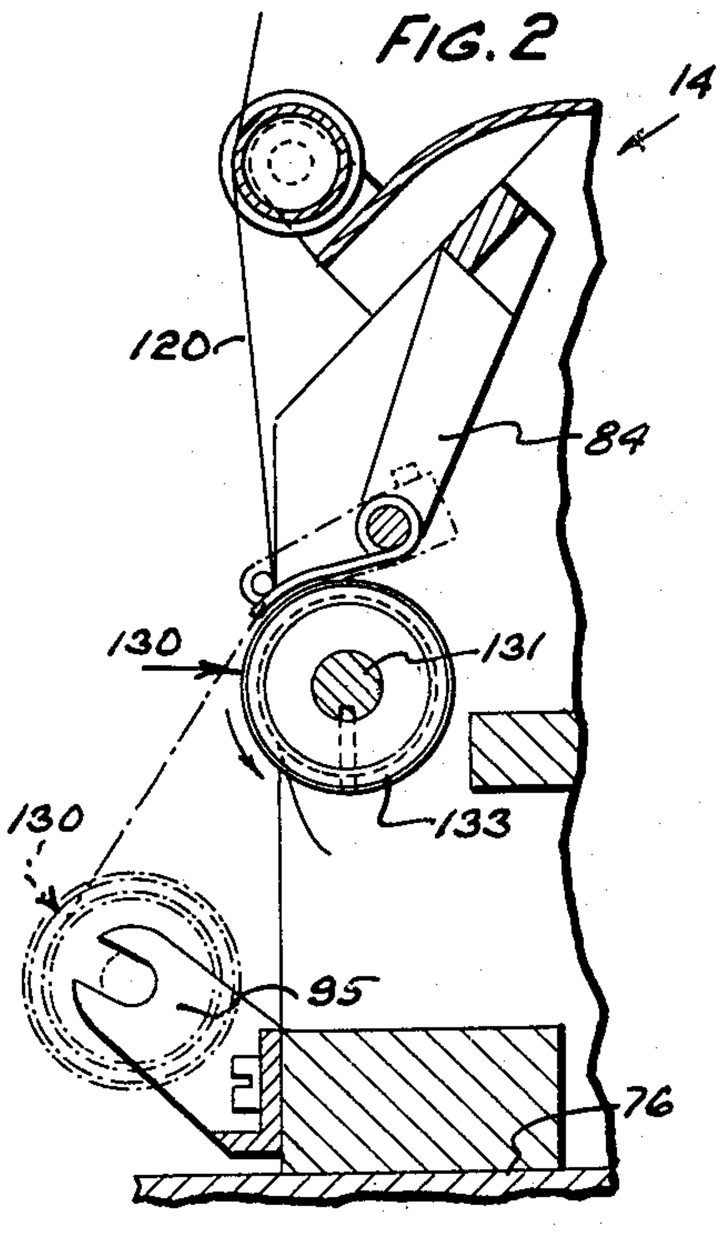


FIG. 3

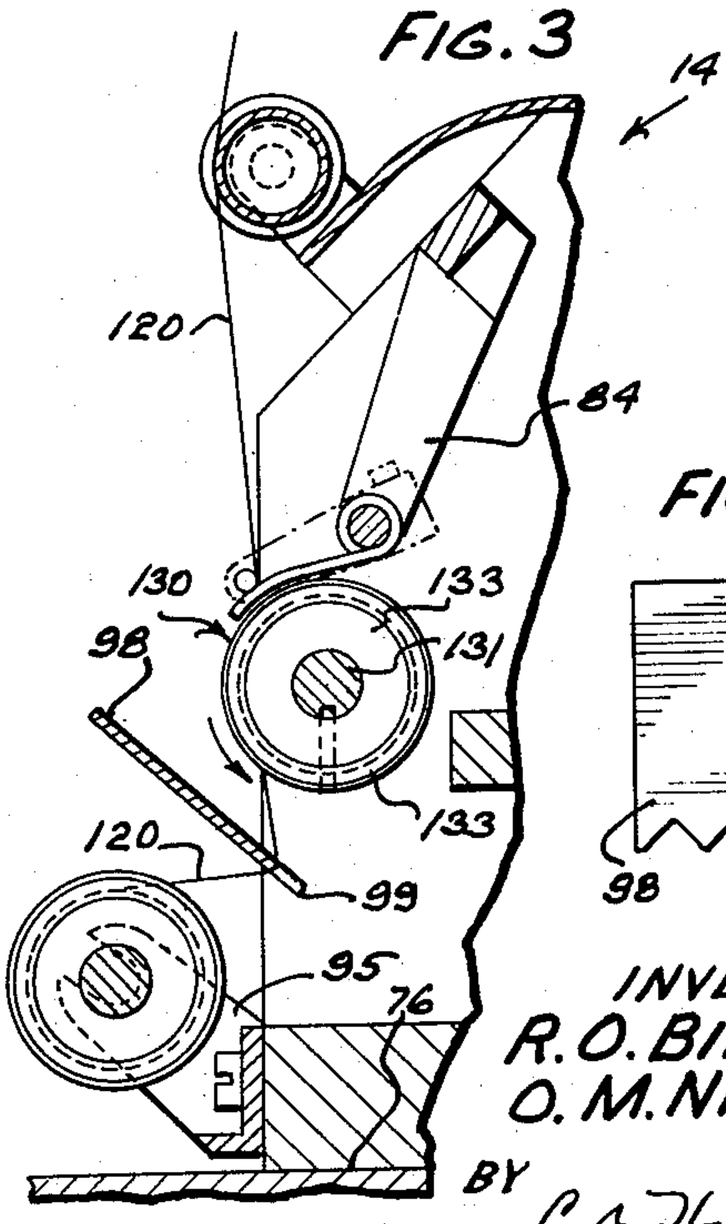
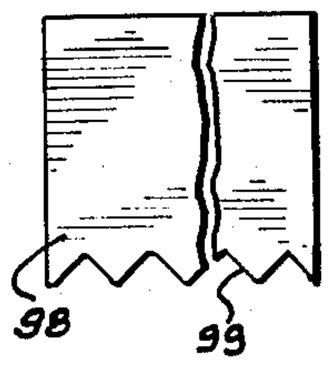


FIG. 4



INVENTORS
R. O. BIRCHLER
O. M. NIELSEN

BY C. B. Hamilton.
ATTORNEY

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FIG. 5

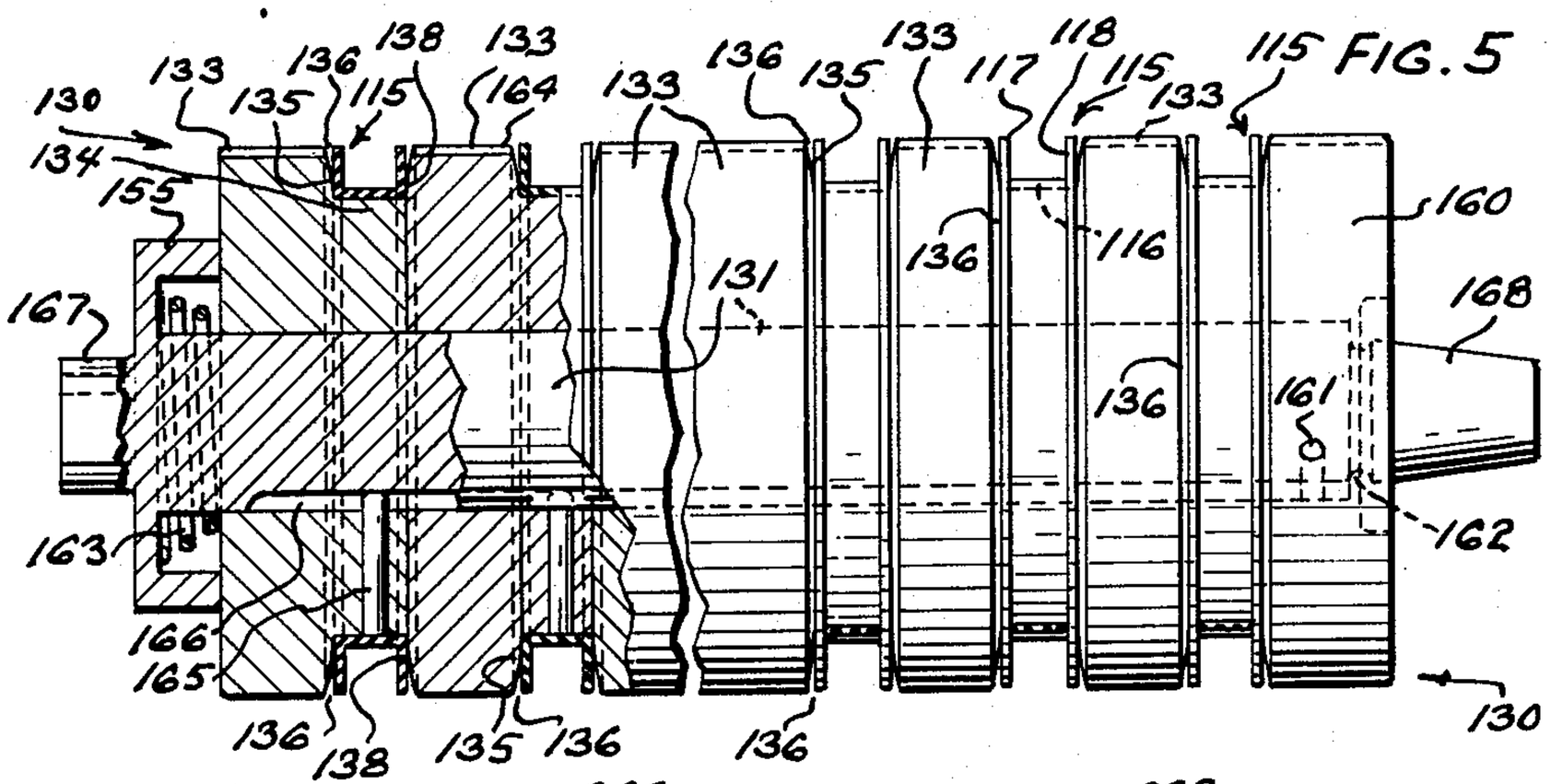


FIG. 6

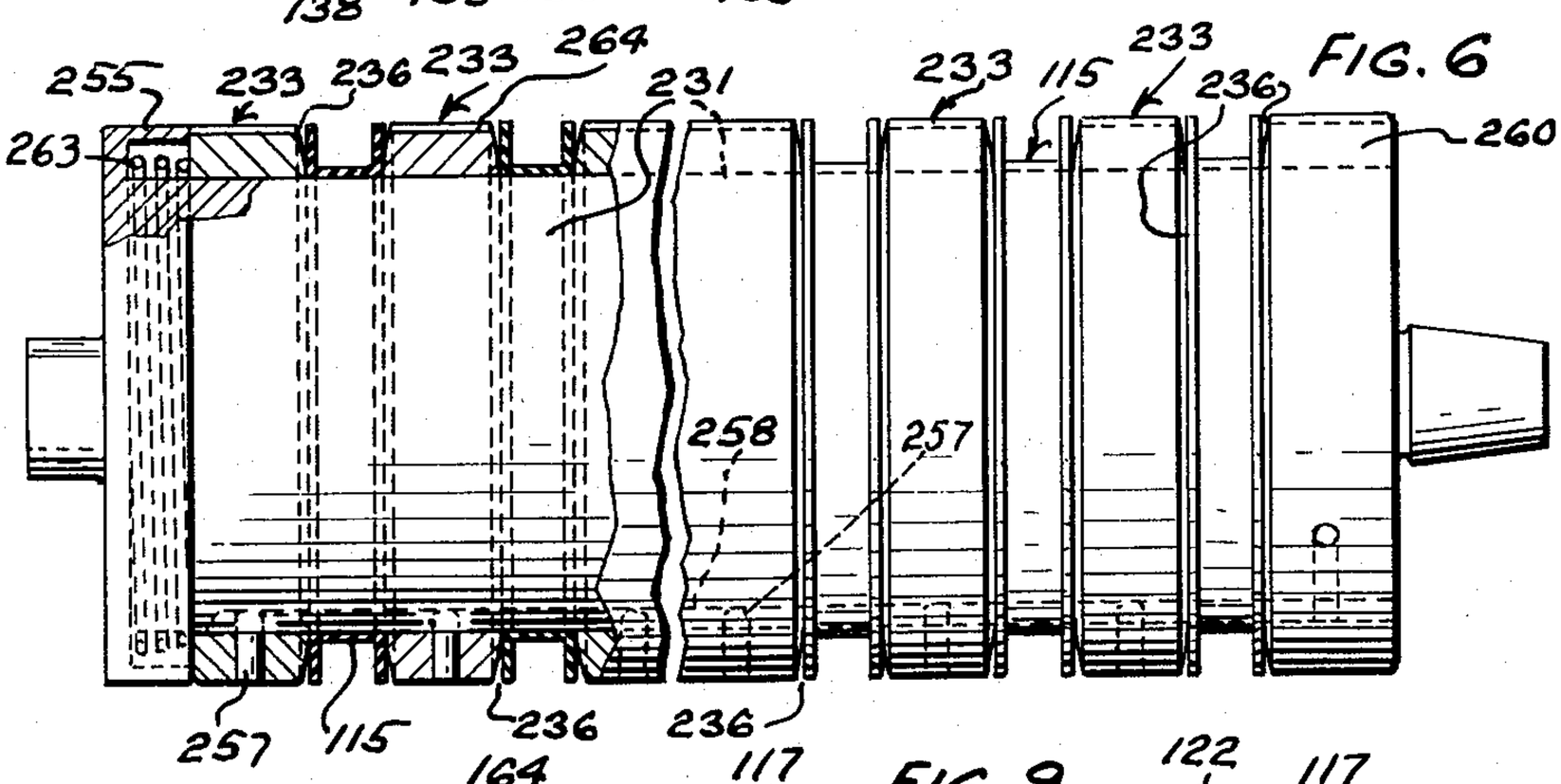


FIG. 7

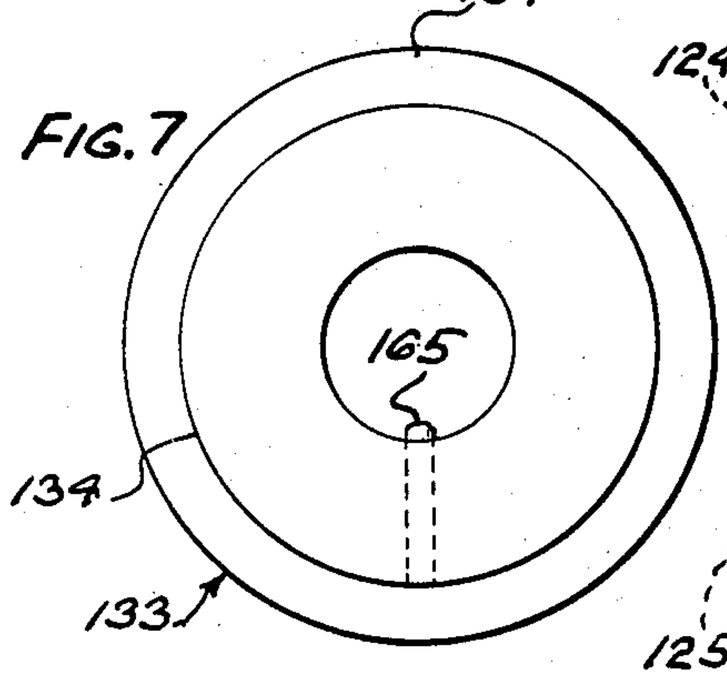


FIG. 9

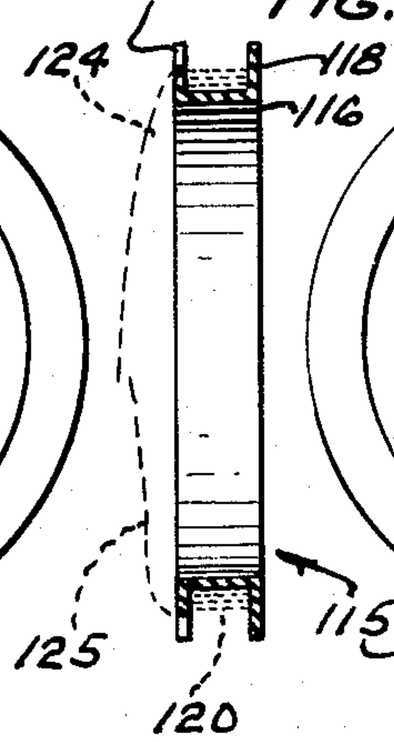
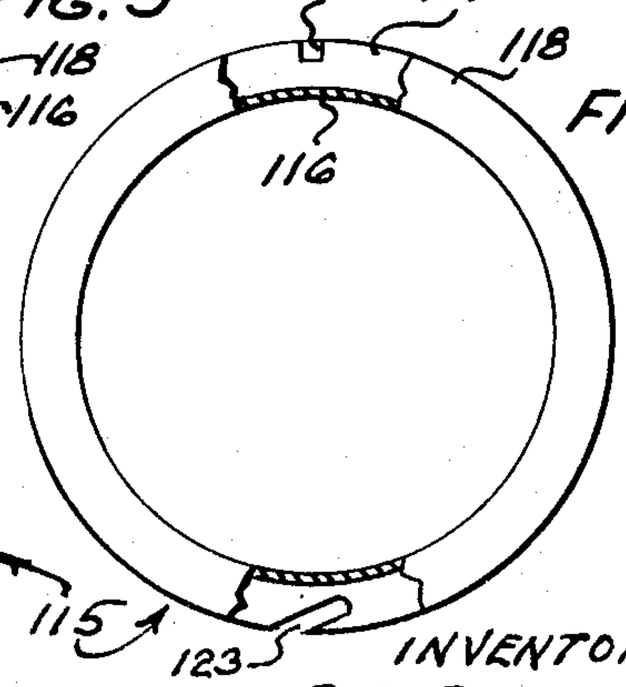


FIG. 8



INVENTORS
R. O. BIRCHLER
O. M. NIELSEN

BY C. B. Hamilton.
ATTORNEY

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ARBOR FOR COIL WINDING APPARATUS

Robert O. Birchler, Downers Grove, and Oliver M. Nielsen, Chicago, Ill., assignors to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

Original application Apr. 9, 1951, Ser. No. 219,948, now Patent No. 2,815,905, dated Dec. 10, 1957. Divided and this application Apr. 22, 1957, Ser. No. 654,147

5 Claims. (Cl. 242—46.2)

This invention relates to a composite arbor for a coil winding apparatus, and is a division of co-pending application Serial No. 219,948, filed April 9, 1951, now Patent No. 2,815,905, entitled Apparatus for Winding Coils on Spools.

In winding a plurality of coils on cylindrical cores, such as sheets of dielectric, which may also be interleaved between successive layers of the windings, various ways have been devised for holding the strands of wire during the beginning and the end of the winding operation so as to expedite the winding of the coils. However, in the winding of coils on spools having heads on the ends thereof, difficulty has been experienced in simultaneously and expeditiously winding a plurality of such coils because of the problem of securing the ends of the strands of wire to the arbor and winding the initial convolutions of strands onto the spools.

It is an object of the invention to provide an improved arbor for supporting a plurality of spools in a coil winding machine and for holding the ends of strands being wound thereon.

A device illustrating certain features of the invention may include an arbor for supporting a plurality of spools and spacing collars in abutting relation to each other in a coil winding machine, the collars having tapered end surfaces which cooperate with the spool heads to form wire gripping grooves therebetween for receiving and holding end portions of wires to be wound onto the spools.

Other objects and advantages of the invention will become apparent by reference to the following detailed description thereof and the accompanying drawings illustrating a preferred embodiment of the invention, in which

Fig. 1 is a fragmentary front elevational view of a winding machine with an arbor embodying the present invention;

Fig. 2 is a vertical sectional view of a portion of the machine taken on line 2—2 of Fig. 1 showing the arbor in full lines in operative position on the winding spindle and showing in dotted lines an arbor on which the coils have been completely wound supported in a holder in spaced relation to the winding spindle;

Fig. 3 is a view similar to Fig. 2 showing an arbor having a set of completely wound coils thereon in the holder and an arbor with a set of unwound spools thereon in operative position on the spindle and showing the strands being moved by a comb into gripping engagement with the arbor;

Fig. 4 is a fragmentary view of the comb;

Fig. 5 is an enlarged longitudinal elevational sectional view of one embodiment of the composite arbor in assembled relation;

Fig. 6 is an elevational sectional view of another embodiment of the composite arbor;

Fig. 7 is an end view of a spool supporting and spacing collar shown in Fig. 5; and

Figs. 8 and 9 are side elevational and sectional views, respectively, of the spool on which a coil is to be wound.

The present coil winding machine **14** is designed to wind strands of wire on spools **115** (Figs. 8 and 9) each of which comprises a cylindrical wall **116** and a pair of

spaced parallel heads **117** and **118** extending laterally outwardly therefrom to form an annular channel in which the strand **120** is wound to form the coil. The head **117** is provided with a notch **122** through which the strand passes during the initial portion of the winding operation. On completion of the winding of the coil, the strand is passed into an angular slot **123** also formed in the head **117** to retain the strand and prevent the unwinding of the coil. The ends **124** and **125** of the strand extending through the slots **122** and **123**, respectively, form leads for the coil wound on the spool.

A plurality of the spools **115** are adapted to be mounted in coaxial and spaced relation to each other on a composite arbor **130** (Figs. 1 and 5) which comprises an arbor shaft or shank **131** and a plurality of annular spool supporting and spacing elements or collars **133**. Each of the spacing collars **133** has an annular rabbet providing a cylindrical surface **134** engageable with the wall **116** of the spool **115** for supporting the spool in coaxial relation to the arbor, and an annular abutting surface **135** engageable with the head **117** of the spool. The surface **135** is tapered or convexly curved adjacent the periphery thereof and cooperates with the head of the spool to form an annular substantially V-shaped strand gripping groove **136** for receiving and frictionally holding a wire **120** pressed thereinto.

The axial length of the cylindrical shoulder formed by the surface **134** of the collars is slightly less than the distance between the outer faces of the heads of the spool **115** so that when the spools **115** and spacing collars **133** are assembled on the arbor shank **131** the spools are gripped between the surfaces **135** and **138** on the spacing collars **133**.

If desired, the end surface **138** of the spacing collars may have tapered or sloping marginal portions cooperable with the ends of the spools to form strand gripping grooves on the other side of the spools **133** from the grooves **136**.

With the spacing collars **133** and spools **115** assembled on the arbor shank **131** as shown in Fig. 5 the endmost collar **133** abuts a head or shoulder **155** on one end of the arbor shank, and the spools **115** and spacing collars **133** are retained on the arbor in tight engagement with each other and the head **155** by a locking collar **160** which has a pin **161** engageable in a bayonet slot **162** in the arbor shank. A spring **163** surrounding the arbor shank **131** and located in a groove in the head **155** aids in maintaining the spacing collars **133** and the spools **115** in engagement with each other.

Each of the spacing collars has an axially extending groove or line **164** on its periphery and a radially disposed aligning pin **165** in a predetermined angular relation to each other so that the spools **115** may be assembled on the collars **133** with the notches **122** in registration with the grooves **164**, and the collars **133** assembled on the arbor shank with the aligning pins **165** fitting in a keyway **166** to locate the notches **122** of the spools in alignment with each other and in a predetermined angular position on the arbor.

A flattened non-circular end **167** of the arbor projects beyond the head **155** and is receivable in a conforming socket in the end of a head stock spindle **68** of the winding machine **14**. The opposite end **168** of the arbor is tapered and is receivable in a tapered socket in a tail stock **74**.

The tail stock is rotatable in a support **75** mounted on a base **76** of the winding machine and is movable axially into and out of engagement with the arbor. The head stock spindle **68** is mounted for rotation in a support **78** mounted on the base **76** and is rotated by a suitable drive means (not shown). A distributor **84** mounted for reciprocation in a frame **85** is provided for distributing the wires **120** in the spools **115** during the coil winding operation.

In the operation of winding the coils the spools **115** are assembled on the spacing collars **133** with the notches **122** of the spools **115** in alignment with the grooves **164** thereof. The spacing collars **133** with the spools **115** thereon are then assembled on the arbor shank **131** and locked in position by the collar **160**. The assembled arbor with the empty spools **115** thereon is then applied to the spindle **68** and locked in position with the tail stock **74**, after which the free ends **124** of the wires **120** are moved laterally into the wire gripping grooves **136** to secure the ends of the wires to the arbor. At the beginning of the winding operation the notches **122** in the spools **115** are positioned a relatively small angular distance to the rear of the wires **120** as seen in Fig. 2, and the wires **120** are urged to the right as viewed in Fig. 1 by the distributor **84** so that upon rotation of the arbor the wires **120** will ride on the periphery of the spool heads **117** and into the notches **122** thereof and onto the walls **116** of the spools.

After predetermined lengths of the wires have been wound on the spools the winding spindle **68** is stopped in the same predetermined angular position shown in Fig. 2, after which the tail stock **74** is retracted and the arbor with the wound coils thereon is removed from the spindle **68** by the operator who then turns the arbor to position the slots **123** of the spools **115** into close proximity with the wires **120** and then imparts a lateral movement or twist to the arbor to cause the wires **120** to enter the slots **123** to prevent the uncoiling of the wires from the spools. The arbor with the wound coils thereon is then deposited in slotted arms **95** on the base **76** and is supported thereby in fixed and spaced relation to the axis of the winding spindle **68**. A portion of the wires **120** extend from the wound spools on the arbor to the distributor as shown in Fig. 2. Another composite arbor with empty spools thereon is inserted in operative position in the machine in driving engagement with the winding spindle **68** and supported by the tail stock spindle **73**.

A comb member **98** having a serrated edge **99** forming V-shaped grooves spaced apart distances equal to the spacing of the wires **120** and spools **115** is provided to move the wires **120** into engagement with the wire gripping grooves **136** of the arbor on the winding spindle and to sever the portions of the wire extending between the two arbors and leave the ends of the wires from the supply reels gripped in the grooves **136** of the arbor on the winding spindle. The arbor with the fully wound coils thereon is then removed from the holder **95**, after which the locking collar **160** is removed from the arbor to permit the spacing collars **133** and the spools **115** with the coils thereon to be slid off of the arbor shank and separated from one another.

In the construction shown in Fig. 6 the shank **231** of the arbor is engageable with the cylindrical walls **116** of the spools for slidably receiving and supporting the spools **115** thereon. A plurality of annular spacing collars **233** of substantially rectangular cross section are adapted to be assembled on the shank **231** of the arbor on opposite sides of the spools **115** to space the spools axially in predetermined positions on the arbor. The spools **115** and spacing collars **233** are held on the shank **231** against a head **255** on one end of the shank by a collar **260** having a pin engageable with a bayonet groove in the arbor shank **231**. A spring **263** disposed in a recess in the head **255** urges the spacing collars and spools against the locking collar **260** to maintain them in tight engagement with each other.

One or both of the end faces of the spacing collars **233** may be tapered slightly so that when the elements are assembled on the shank **231** of the arbor against the heads of the spools, they form in cooperation with the spool heads, narrow V-shaped grooves **236** for receiving and gripping the strands forced thereinto. Pins **257** extending inwardly from the spacing collars **233** are engageable in a keyway **258** in the shank **231** to align the

spacing collars **233** in a predetermined angular relationship so that the spools **115** may be angularly positioned on the shank of the arbor with the wire receiving notches **122** formed in the heads **117** thereof in alignment with grooves or other aligning marks **264** on the periphery of the collars **233** to align the notches in the spools in a predetermined angular position on the arbor.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a coil winding device, an arbor for removably supporting a headed spool, a member on the arbor independent of the spool and having a portion engageable with a head on the spool and an annular portion sloping from the head and cooperating therewith to form an annular groove with diverging strand-gripping surfaces for receiving and gripping a strand, and means on the arbor for holding the spool and the member in engagement with each other.

2. A coil winding device which comprises an arbor for removably supporting a headed spool, a collar independent of said spool positioned on the arbor and having a tapered end portion engageable with a head of the spool and cooperating therewith to form an annular groove of V-shaped cross section, and means on the arbor for pressing the spool and the collar toward one another, said tapered end portion of the collar permitting a strand to be wedged between it and the spool.

3. A coil winding device comprising an arbor for supporting a plurality of spools thereon, spacing elements independent of said spools removably supported on said arbor member for positioning the spools in a predetermined relation to each other, each of said spacing elements having an end surface cooperating with an end of a spool to form an annular groove having diverging strand-engaging surfaces for gripping a strand moved laterally into engagement therewith, and means for holding the spools and elements in engagement with one another on said member.

4. A coil winding device which comprises a plurality of spools on which strands are to be wound, an arbor for supporting the spools thereon, collars on the arbor independent of said spools for positioning the spools in a predetermined spaced relation to each other and having sloping end surfaces cooperating with the ends of the spools to form annular grooves having diverging strand-engaging surfaces for receiving and frictionally holding strands moved laterally into engagement therewith, and means for retaining the spools and the collars in engagement with each other on the arbor.

5. An arbor assemblage which comprises a plurality of headed spools on which strands are to be wound, members independent of said spools engageable with the heads of said spools for axially spacing the spools, means for removably supporting a plurality of the spacing members and the spools in alternate and assembled relation for rotation about an axis concentric with the spools, and annular wedging surfaces on the ends of said members sloping from the heads of the adjacent spools for wedging the strands against the spool heads.

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