July 18, 1939. F. WEISS 2,166,852

MANUFACTURING ELECTRICAL CONDENSERS

Filed June 6, 1936 4 Sheets-Sheet 1

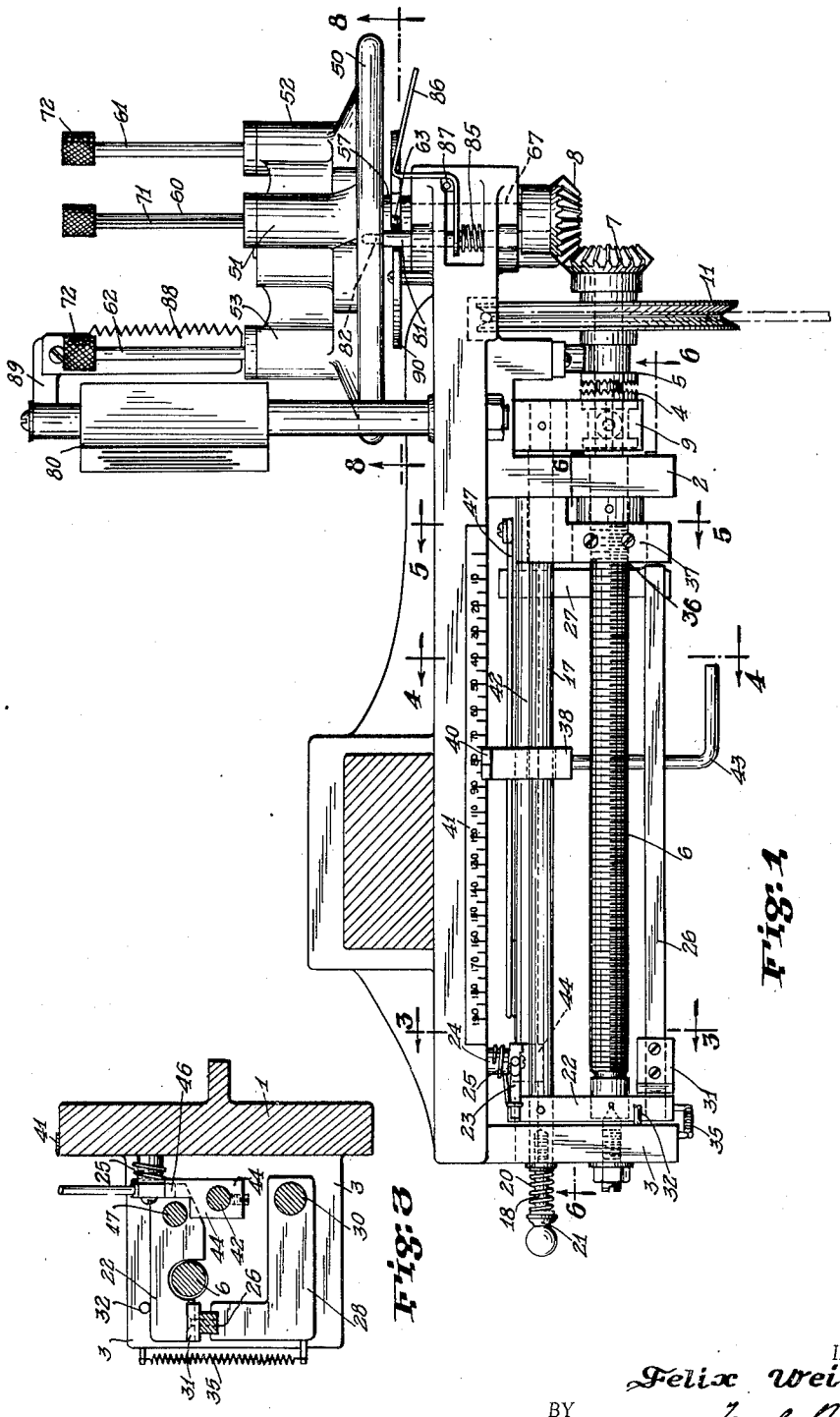


Fig: 1

Fig: 3

INVENTOR.
Felix Weiss
BY
Karl Nau
ATTORNEY.

July 18, 1939. F. WEISS 2,166,852

MANUFACTURING ELECTRICAL CONDENSERS

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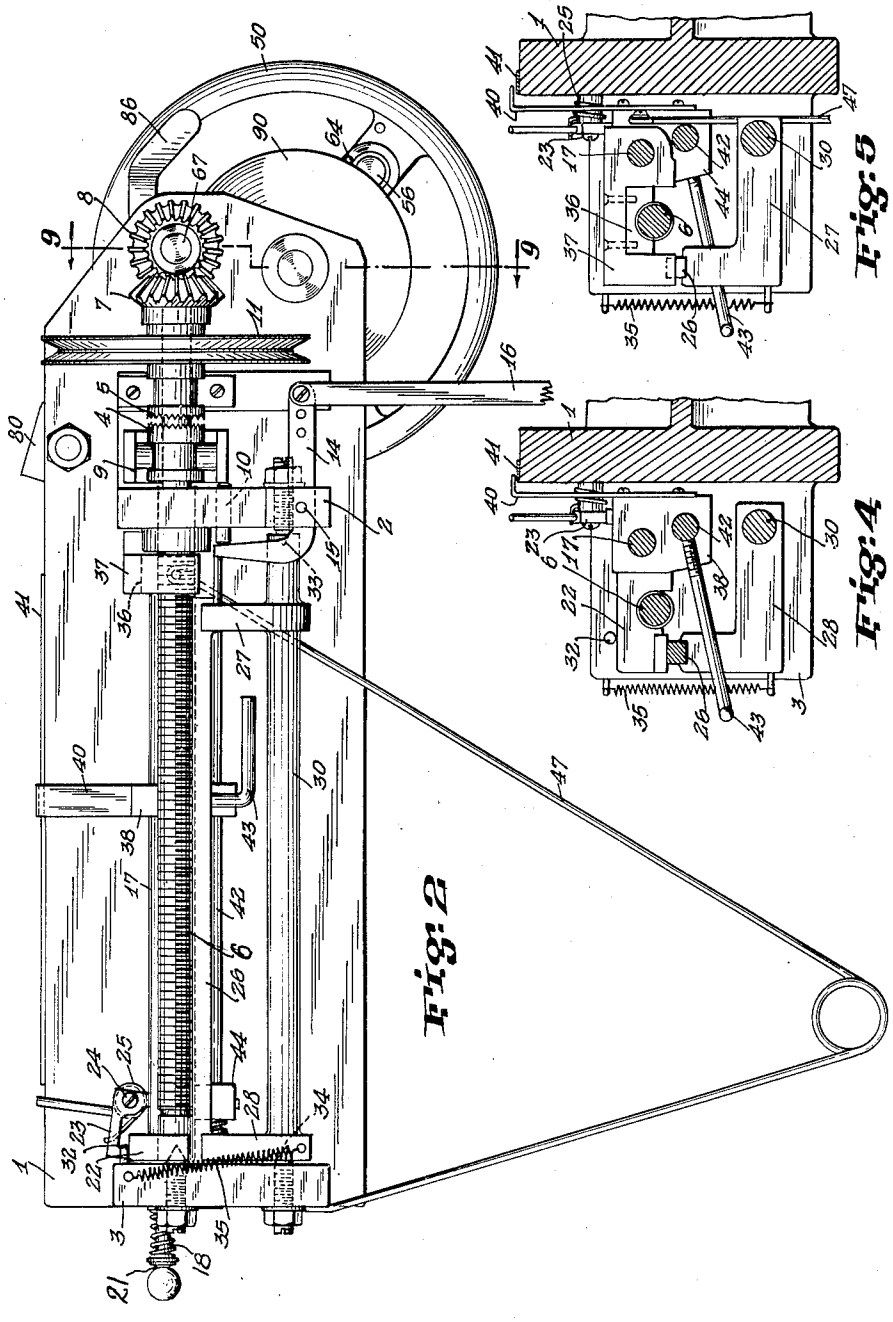


Fig: 2

Fig: 5

Fig: 4

INVENTOR.
Felix Weiss
BY
Karl Nau
ATTORNEY.

July 18, 1939. F. WEISS 2,166,852

MANUFACTURING ELECTRICAL CONDENSERS

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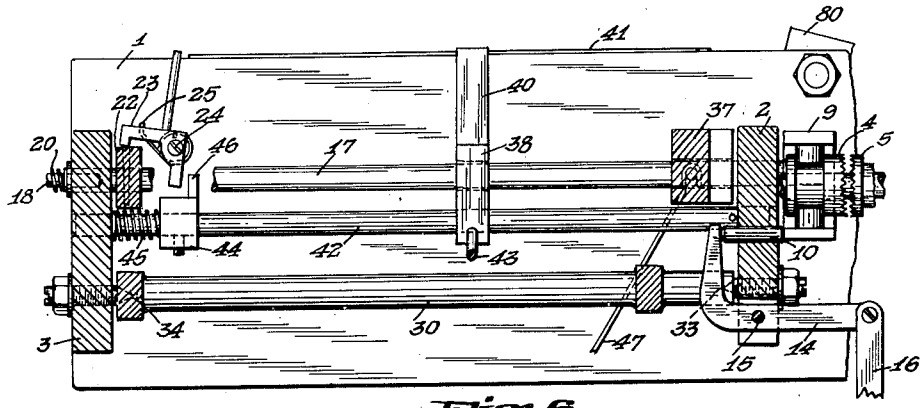


Fig: 6

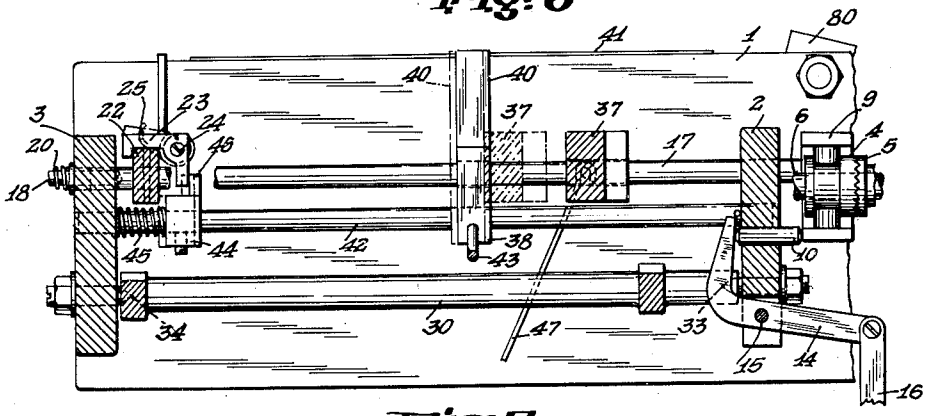


Fig: 7

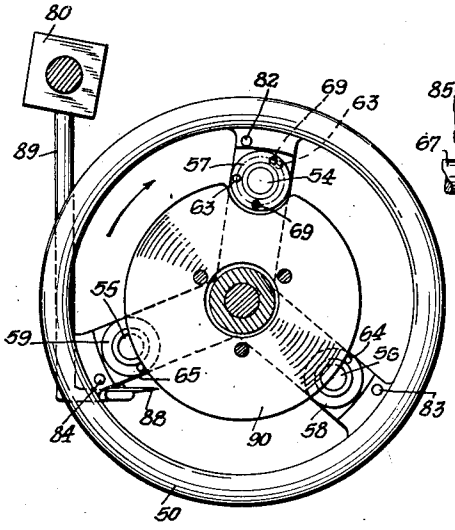


Fig: 8

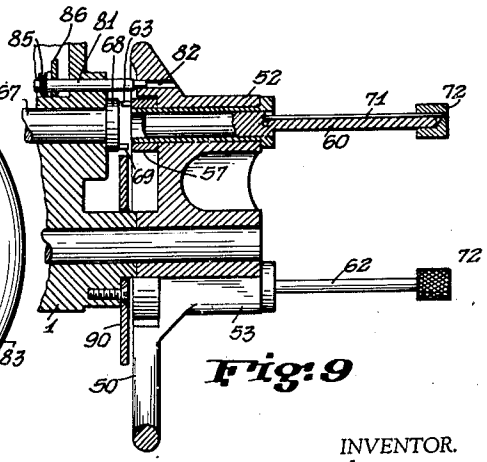


Fig: 9

INVENTOR.
Felix Weiss
BY
ATTORNEY.

July 18, 1939. F. WEISS 2,166,852

MANUFACTURING ELECTRICAL CONDENSERS

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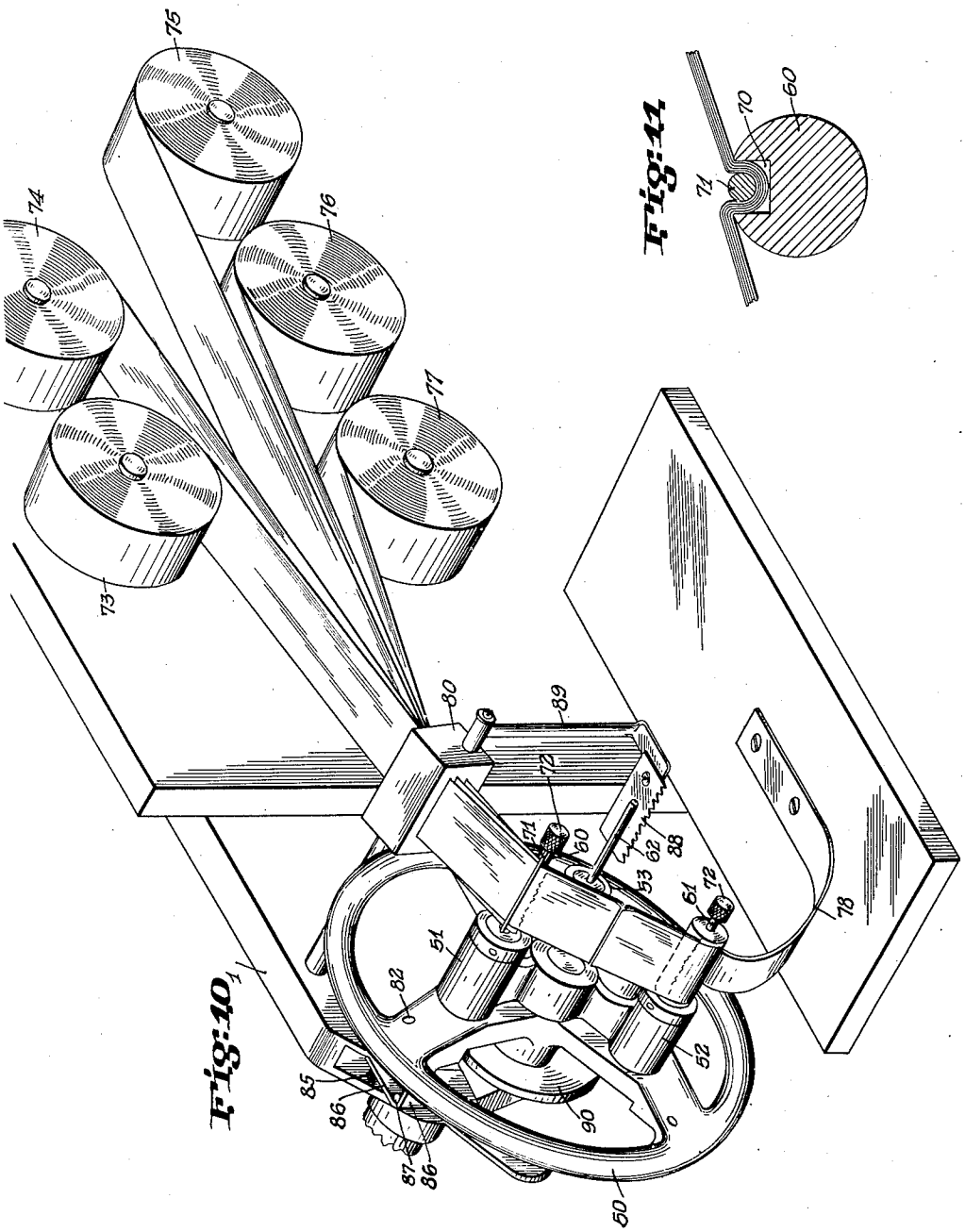


Fig:10

Fig:11

INVENTOR.
Felix Weiss

BY

ATTORNEY.

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2,166,852

MANUFACTURING ELECTRICAL CONDENSERS

Felix Weiss, New York, N. Y., assignor to Cornell-Dubilier Corporation, New York, N. Y., a corporation of New York

Application June 6, 1936, Serial No. 83,875

7 Claims. (Cl. 242—56)

The present invention relates to means for and a method of manufacturing electric condensers of the wound type, more particularly condenser units of small size and low capacity, economically and uniformly and with greatly increased efficiency compared with methods of manufacturing such condensers heretofore employed in the art.

In the present methods known for manufacturing electrical condensers of the above described general character comprising interleaved metal foil strips and strips of insulating material such as paper wound into a roll, especially those involving the winding of very thin metal foils and paper, great caution is required in the handling of these materials to prevent defects likely to impair the mechanical and electrical characteristics of the condenser or completely destroy the condenser unit. These cautions greatly slowed up the process resulting in increased cost of manufacture.

It is an object of the present invention to provide a winding machine for manufacturing rolled electric condensers with greatly increased efficiency at lower cost of the process of manufacture and insuring a more uniform product with a substantial reduction of faulty units and rejections. Another object of the invention is to eliminate some of the handling in an effort to further eliminate defective units and to increase the operating time of the machine by decreasing its idling during a given period.

Further objects and aspects of the invention will become more apparent from the following detailed description taken with reference to the accompanying drawings in which;

Figure 1 is a top view of one embodiment of a condenser winding machine according to the invention.

Figure 2 is a front elevational view of the machine according to Figure 1.

Figure 3 is a sectional side view taken on line 3—3 of Figure 1.

Figure 4 is a further sectional side view taken on line 4—4 of Figure 1.

Figure 5 is another sectional side view taken on line 5—5 of Figure 1.

Figure 6 is a partial sectional front view taken on line 6—6 of Figure 1 showing the coupling and release mechanism in disengaged condition.

Figure 7 is a similar view to Figure 6 showing the coupling and release mechanism in engaged position.

Figure 8 is a partial sectional view of the winding device taken on line 8—8 of Figure 1,

Figure 9 is a further section taken on line 9—9 of Figure 2.

Figure 10 is an isometric view showing the condenser winding mechanism.

Figure 11 is an enlarged partial view showing the winding mandrel and foil and paper locking device.

Like reference numerals identify the same parts throughout the different views of the drawings.

The condenser winding machine according to this invention comprises substantially two parts: (1) a clutch and automatic release mechanism for manually starting rotation of a winding mandrel to which the ends of a plurality of superposed metal foil and separator strips have been fastened previously and to stop the winding operation automatically after a predetermined number of winding turns adjusted in advance dependent on the size and electrical capacity of the condenser units to be wound.

(2) A winding mechanism comprising a plurality of winding mandrels adapted to be successively placed in coupling relation with a driving shaft connected to said clutch in such a manner as to allow the winding of one unit by a manual starting operation such as by pressing a foot pedal without necessitating any further attention on the part of the operator to the winding operation and completion of the winding process, whereby the operator is enabled to paste up and otherwise finish and remove the previously wound unit from the respective winding mandrel.

A detailed description of the winding machine will now be presented.

Clutch and automatic release mechanism

Referring to Figures 1 and 2, the several parts of the machine illustrated are mounted upon a support or frame comprising a vertical plate or wall 1 and a pair of mounting plates 2 and 3 connected at right angle thereto. The clutch or coupling device shown consists of two parts, a driven member 4 connected in axial sliding engagement with but restrained against rotatory movement relative to a shaft 6 rotatably mounted in the plates 2 and 3. The driving member 5 is connected to a pulley 11 driven continuously from a suitable prime mover, such as an electric motor (not shown), and both are mounted upon the right hand extension of shaft 6 in idling connection therewith. The shaft 6 has its part intervening between the mounting plates 2 and 3 screw threaded and carries at its right end a bevelled gear 7 cooperating with a bevelled gear 8 serving to drive the winding mandrels as will

be described in more detail hereafter. Part 4 of the clutch is mounted within a yoke or frame 9 adapted to be shifted in a direction parallel to shaft 6 by means of a pin 10 slidably mounted in the plate 2 and having one end engaging the frame 9 and operated by means of an angular lever 14 pivoted on plate 2 at 15 and having one arm engaging the other end of the pin 10. The lever 14 may be operated in any desired manner, such as by a foot pedal partly indicated at 16 and engaging the other arm of the lever 14.

When the frame 9 is shifted to the right by pressing down the pedal 16, the teeth of the clutch members 4 and 5 engage each other, thus starting rotation of shaft 6 and bevelled gear 8 and with it one of the winding mandrels to be described later. Rigidly connected or pinned to the frame 9 is a shaft or rod 17 passing through a perforation of plate 2 and having its other end slidably mounted in a boring of plate 3. The end of rod 17 has an extension 18, of lesser diameter and protruding beyond plate 3, and connected thereto in a suitable manner such as by a screw connection as shown. The extension 18 carries a compression spring 20 abutting with one end against plate 3 and with its other end against a knob 21 connected to the outer end extension 18. Fixedly connected or pinned to the rod 17 is a locking member or catch 22 (see Figure 3) adapted to engage an angular shaped trigger 23 when pulled towards the right together with rod 17 against the action of the spring 20. The trigger 23 is pivoted at 24 and its locking or trigger arm 22 is urged in a downward direction against member 22 by the action of a spring 25.

The member 22 has its other end resting upon the upper face of a square shaped guide rod 26 of a frame structure comprising a pair of angular elements 27 and 28 braced at their lower ends by a shaft 30 pivotally mounted in the plates 2 and 3 and braced at their upper ends by the rod 26. The end of the guide rod 26 of the frame structure 26, 27, 28, 30 adjacent to the member 22 has a bevelled or cam shaped section 31 screwed or otherwise secured thereto. The member 22 is restrained against upward movement by a stop pin 32 connected to the mounting plate 3.

Thus when the member 22 is pulled towards the right by the rod 17, its end rides over the bevelled section or cam 31 thus depressing the entire frame structure 26, 27, 28, 30 about its pivot points 33 and 34 against the action of tension spring 35 connected between part 28 of the frame at its one end and the mounting plate 3 at its other end.

Cooperating with the threaded portion of shaft 6 is a half nut 36 having an extension member 37 screwed or otherwise connected thereto. The extension member 37 is provided with a perforation at one end in slidable engagement with rod 17 serving as a guide, while the other end of member 37 has a guide groove and rests and slides by virtue of its own weight on the upper face of the rod 26. In the normal position, when the clutch is disengaged from the prime mover and accordingly the frame structure 26, 27, 28, 30 in its upper position, the nut 36 is slightly spaced or disengaged from the threaded shaft 6. When the clutch is engaged and the guide rod 26 moved or depressed slightly downward as described, the nut 36 descends by virtue of its own weight or that of member 37 thus engaging the threaded portion of shaft 6 and starting to travel along the shaft in a direction towards the left. As the nut travels along the shaft, it will strike the stop or winding setting member. The latter, as shown more clearly in Figures 4 and 5, is comprised of a member 38 having a perforation slidably engaging shaft 17 and a vertical member 40 connected thereto and having its end bent at right angle to serve as an index moving over a scale 41 and arranged upon the upper face of main support 1 and calibrated according to numbers of revolutions or winding turns. The member 38 is provided with a further perforation in sliding engagement with a further shaft or rod 42 to which it may be fixedly connected or locked by means of a setting lever or handle 43 having a threaded end portion engaging an internally threaded boring of the member 38 thus allowing the latter to be rigidly connected or locked to the shaft 42 by turning the setting lever 43 in the manner of a set screw, while the lever 43 at the same time serves of adjusting or setting the desired number of winding turns on the scale 41 by sliding member 38 to the proper position as indicated on scale 41 along shaft 42.

The shaft 42 has its ends slidably mounted within plates 2 and 3 and carries at its left end a releasing member 44 fixedly connected thereto such as by means of a set screw as shown (see Figures 6 and 7). A compression spring 45 surrounds the part of shaft 42 intervening between the member 44 and plate 3. The member 44 has an upward extension or lug 46 adapted to engage the lower arm of the angular shaped trigger 23 when the shaft 42 and with it the release member 44 are pushed in a direction towards the left by the travelling nut 36 or its extension 37 striking the adjusting member 38 against the action of the spring 20 together with the shaft 17 connected to the coupling frame 9 thus affecting the release of the clutch and stopping rotation of shaft 6 and accordingly the foil winding operation. At the same time, the other end of the locking member 22 recedes from the cam portion 31 of the guide rod 26 whereby the latter returns to its upper normal position by the action of the spring 35, thus lifting and disengaging the nut 36 from the threaded shaft 6. The nut is then returned to its initial position by the action of a bent spring 47 having one end connected to the plate 3 and having its other end reversely bent to form a slot guide slidably engaging a pin connected to the extension member 37 of the nut 34.

In this manner when operating the foot pedal 16, the clutch mechanism is engaged with the driving source and automatically disengaged and the original condition restored after a predetermined number of revolutions which may be adjusted and set as desired.

Condenser winding mechanism

The condenser winding mechanism is mounted on the opposite side of the supporting wall 1. The shaft 67 connected to bevel gear 8 shown in Fig. 1 is passed through the plate 1 acting as a bearing for same and carries a hub 68 at its end from which extends a pin 69 (see Figures 8 and 9). The winding mandrels in the example illustrated, three mandrels 60, 61, 62 are provided with cylindrical extensions 54, 55, 56 respectively to which are pinned or otherwise connected bearing sleeves 57, 58, 59 respectively rotatably mounted in the hubs 51, 52, 53 respectively of the hand wheel 50. Hubs 51, 52, 53 and accordingly the winding mandrels are spaced at equal angular distance in the example shown 120°. As is understood, any desired number of winding mandrels may be provided properly angularly spaced and that the ar-

rangement is not limited to three mandrels shown for illustration. Each of the inner ends of the bearing sleeves **57, 58, 59** carries an annular member to which are connected pins **63, 64, 65** respectively adapted to be engaged by the pin **69** of the driving shaft **67** in the form of a lost motion connection to establish driving connection between the prime mover and any of the winding mandrels moved into coupling position as will be described hereafter.

In order to move and lock the winding mandrels **60,61,62** individually in proper coupling position with the driving shaft **67**, I have shown locking holes **82,83,84** arranged in the hand wheel **50** spaced at 120° or at different angles if less or more mandrels are provided and adapted to engage a locking pin **81** slidably mounted in plate **1** and normally urged in the direction towards the hand wheel **50** by the action of the spring **85**. The latter at one end abuts against the plate **1** and at its other end against an unlocking lever **86** rigidly connected to the pin **81** and pivoted at **87** (see Figure 1). Normally, the spring **85** urges the pin **81** into one of the locking holes **82, 83** or **84** thus locking the hand wheel and holding the corresponding winding mandrel in proper coupling relation with the driving shaft **67**. When the next following mandrel is to be moved into coupling position the handwheel is temporarily unlocked by pressing the lever **86** and the hand wheel turned manually until the pin **81** snaps into the next locking hole, in the example illustrated hole **84**, by the action of spring **85** thus placing the next following mandrel, in the example shown mandrel **62**, in coupling position.

In the example shown in the drawings I have chosen for illustration the winding of small condenser units comprising a pair of metal foil strips such as strips of tin foil separated by strips of paper with each of the foil strips projecting at opposite sides of the paper strips in a manner well known in the manufacture of small wound electrical condensers. The strips are continuously supplied from rolls **73,74,75,76,77** as shown in Figure 10, of which in the example illustrated **73,75,77** are of paper and **74** and **76** of metal foil. As is understood, any desired number of paper and separator strips may be provided and the separators may consist either of single strips or double paper strips as may be desired in each case. In order to superpose and guide the strips in proper relative relation upon the winding mandrel, I have shown a guide member **80** having a plurality of superimposed and suitably laterally displaced slots through which the individual strips are passed and thus interleaved and superimposed in proper relation as seen more clearly in Figure 1 in the example described and chosen for illustration.

In order to fasten the ends of the superimposed strips upon the winding mandrel, I have provided a locking pin **71** (see Figure 11) adapted to be placed in a groove **70** on the upper side of the winding mandrel in such a manner as to clamp and hold the strip ends firmly in place upon the mandrel.

The locking pin is connected to a knurled knob **72** having a boring adapted to slide over the mandrel, thus firmly locking the pin and strip ends.

In order to ensure that each of the winding mandrels **60, 61, 62** when moved into a coupling position has its groove always in the same relative, preferably upper, position to facilitate the fastening of the strip ends by the operator by means of the locking pin, I have provided a cam-like member or disc **90** rigidly connected to the support **1** having a radius equal to the distance between the axes of the shaft **54** of the handwheel **50** and of the driving shaft **67** or winding mandrel coupled therewith. This disc member **90** has a semi-circular recess allowing free rotation of the coupling pins **69** and **63, 64, 65**, respectively. In this manner when the handwheel is turned manually to move another mandrel into coupling position, the pull of the paper unwinds the mandrel being removed from the coupling position until its coupling pin **63** strikes cam **90**. This cam holds the mandrel in the proper position and in such a manner that when the mandrels come up to their uppermost or operating position, the coupling pin and accordingly the winding grooves will always assume the same relative position to the operator.

Operation

The operation of the winding machine described is as follows: After the separate metal foil and paper strips have been passed through the respective guide slots of member **80** (see Fig. 10), the metal foil between the end portions of the paper strips is removed and the strips locked in superimposed position on the winding mandrel by means of a locking pin as described. The operator then presses the foot pedal, thus starting the winding operation. After a predetermined number of winding turns, dependent on the desired capacity of the electrical condenser unit as set on the scale **41**, the winding is automatically stopped in the manner described. The operator after shortly pressing the release lever **86** turns the handwheel **50** manually, thus placing the next winding mandrel in coupling position with the driving shaft. This position is shown in Figure 10 with a condenser section previously wound on the mandrel **61** and the metal foil and paper strips passing over the next following mandrel **60**. In this position the operator locks the strips upon the mandrel **60** by a second locking pin and then separates or cuts the strips between the mandrels **60** and **61** by the upward movement of a cutting or separating lever **89** carrying a saw-toothed shaped cutting knife **88**. After this is done, he removes the metal foil portions between the ends of the paper strips and presses the foot pedal whereby a new winding operation is started. Without the necessity of paying any further regard to the winding, the operator is then allowed to remove and paste up or otherwise finish the section on mandrel **61** while the next unit is being wound on the mandrel **60** and the same cycle of operations repeated. In order to prevent unwinding of the wound condenser section from mandrel **61**, I have provided a flat spring **78** firmly pressing against the condenser roll.

From the above it will be evident that while I have described the invention with specific reference to the construction and details of a winding machine disclosed and presented herein for illustration, numerous variations and modifications may be made in the arrangements of parts and details of construction in accordance with the broad scope and spirit of the invention as defined in the appended claims.

I claim:

1. A winding machine comprising a driving shaft, a rotary support, a plurality of winding mandrels journaled in said support and arranged to be consecutively coupled with said shaft by ro-

tation of said support, means for locking said support in the coupling positions of said mandrels with said shaft, a driving member and releasable coupling means therebetween and said shaft, means for manually engaging said coupling means to start rotation of said shaft, a locking member connected with said coupling means having a catch adapted to engage a trigger and hold said coupling means in engaged position against the action of a spring, a threaded extension of said driving shaft, a semi-cylindrical nut cooperating with said extension and arranged to move along the same during rotation, an adjustable stop member having an index, fixed calibrating scale means adjacent to said stop member, said stop member adapted to release said catch when engaged by said nut to disengage said coupling means, and further means including a resilient mounting for said nut controlled by said locking member whereby said nut is normally disengaged from said extension and engaged therewith upon rotation of said shaft and whereby said nut is again disengaged from said extension and returned to its initial starting position upon release of said coupling means.

2. A winding machine comprising a driving shaft, a rotary support, a plurality of angularly spaced winding mandrels journaled in said support and arranged to be consecutively coupled with said shaft by rotation of said support, means for locking and unlocking said support in the coupling positions of said mandrels with said shaft, a driving member and releasable coupling means therebetween and said driving shaft, means for manually engaging said coupling means to start rotation of said shaft, a locking member connected to said coupling means having a catch adapted to engage a trigger to hold said coupling means in engaged position against the action of a spring, a threaded extension of said driving shaft, a nut cooperating with said extension and arranged to move along the same during rotation, an adjustable stop member having an index, fixed calibrated scale means adjacent to said stop member, said stop member adapted to engage said trigger and release said catch when engaged by said nut to disengage said coupling means, a guiding element for said nut, a cam operatively associated with said locking member adapted to engage and displace said guiding element whereby said nut is engaged with and disengaged from said threaded shaft upon the engagement and disengagement of said coupling means, respectively.

3. In a winding machine as claimed in claim 2, means for returning said nut to its starting position upon disengagement of said coupling means.

4. In a winding machine as claimed in claim 2, spring means connected to and adapted to return said nut to its starting position upon release of said coupling means.

5. In a winding machine as claimed in claim 2 in which the coupling between said mandrels and driving shaft consists of a pair of pins each extending axially of the driving shaft and the respective mandrels and adapted to engage each other in driving connection.

6. In a winding machine as claimed in claim 2 in which said winding mandrels are provided with grooves adapted to receive locking pins for fastening the ends of the foil strips to be wound.

7. In a winding machine as claimed in claim 2 in which said winding mandrels are provided with grooves adapted to receive locking pins for fastening the ends of the foil strips to be wound, and means for restoring the same relative position of the grooves in said winding mandrels and said support when placed in coupling position with said driving shaft.

FELIX WEISS.