Feb. 24, 1959 A. S. WALLIN 2,874,916

COIL HOLDER

Filed May 5, 1954 5 Sheets-Sheet 1

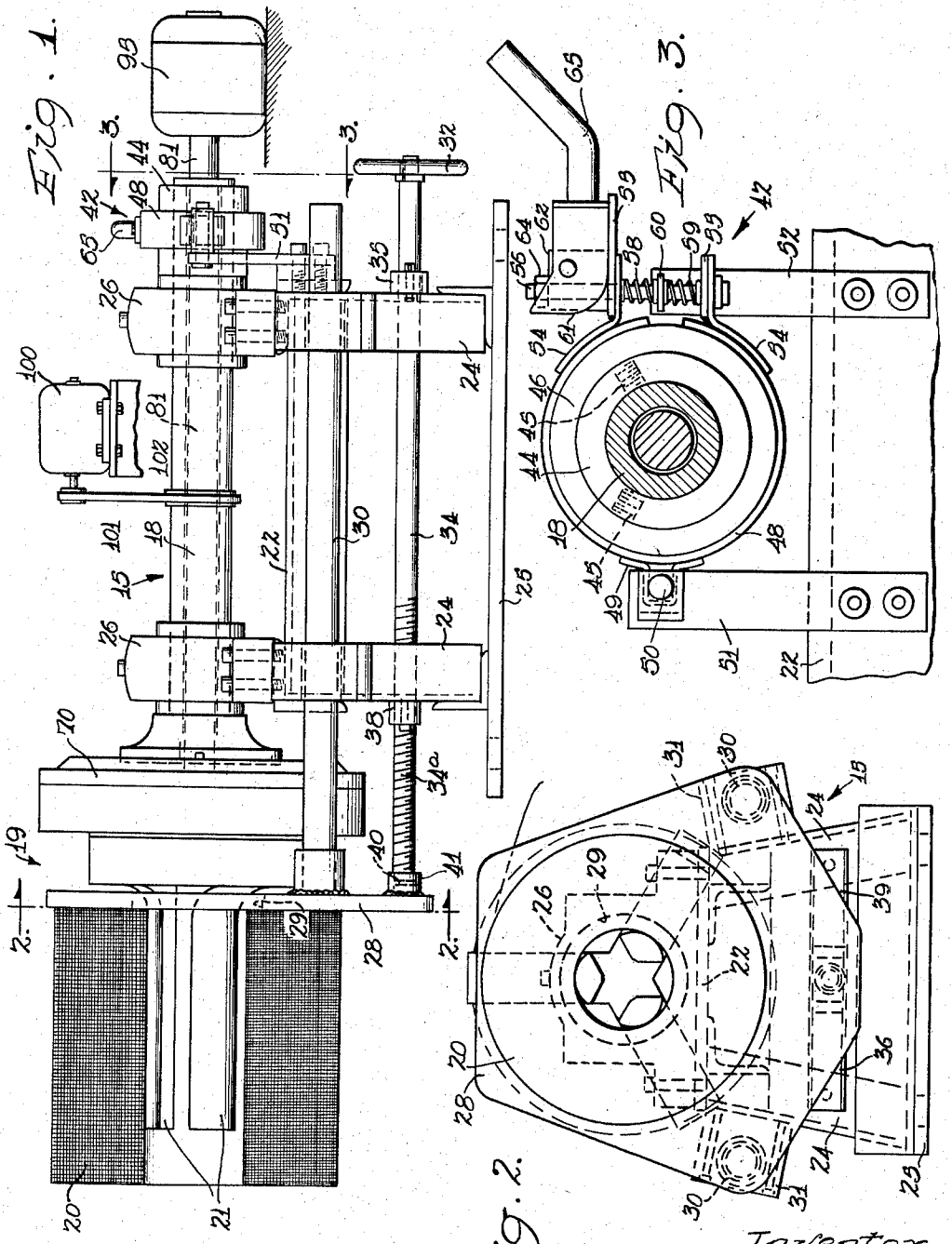


Fig. 1.



Fig. 3.



Fig. 2.

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COIL HOLDER

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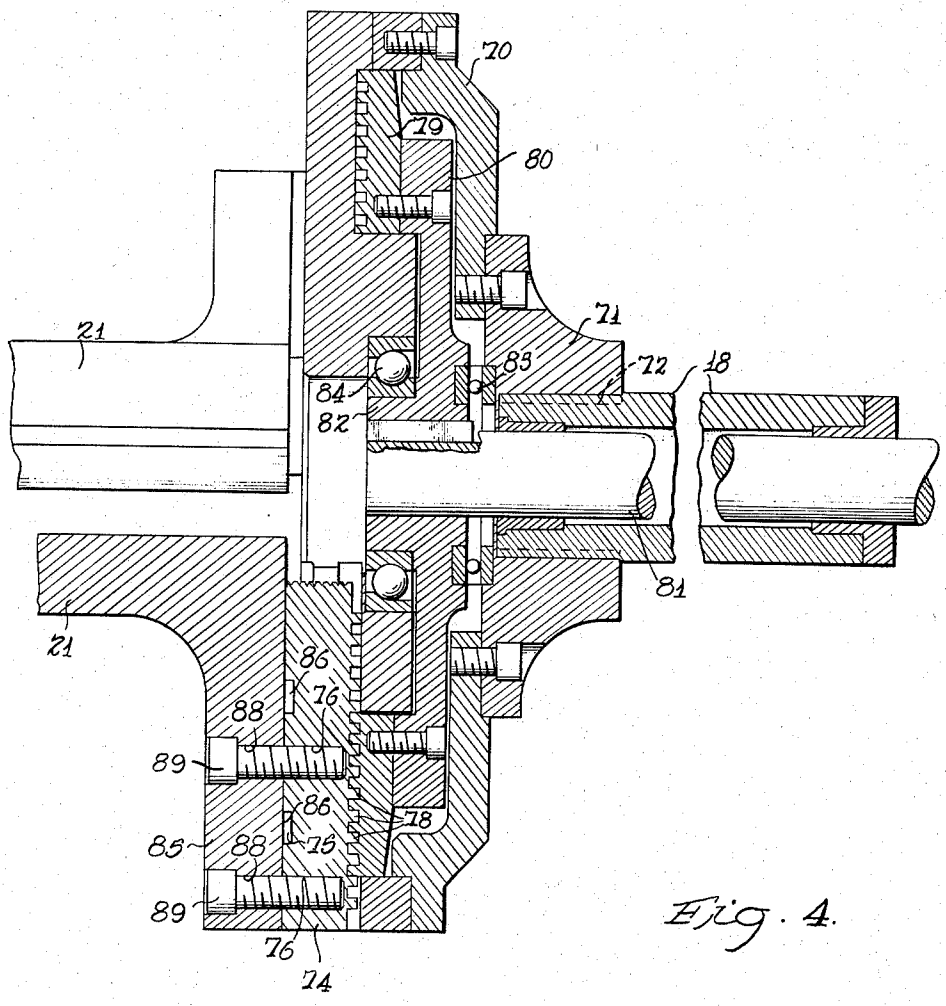



Fig. 4.

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COIL HOLDER

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Fig. 11.

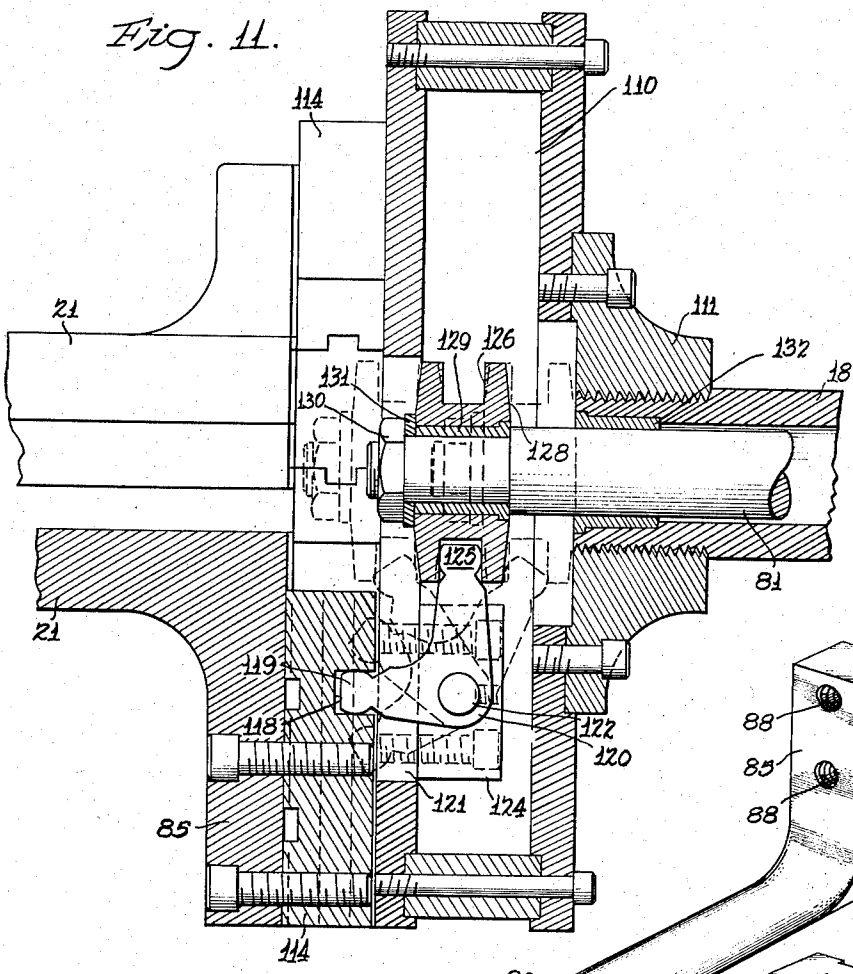






Fig. 5.

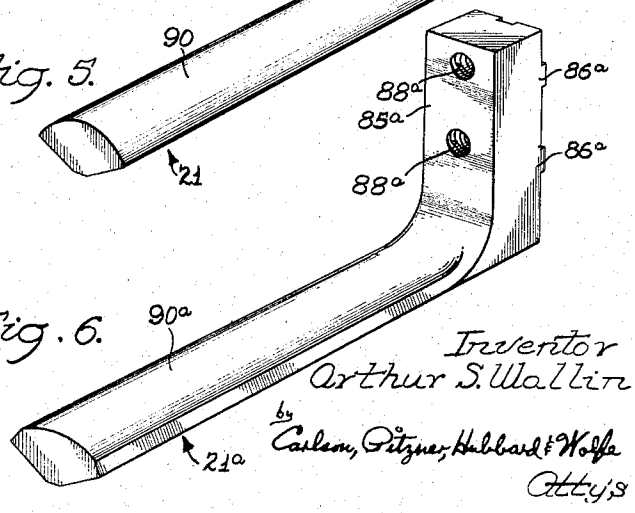



Fig. 6.

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COIL HOLDER

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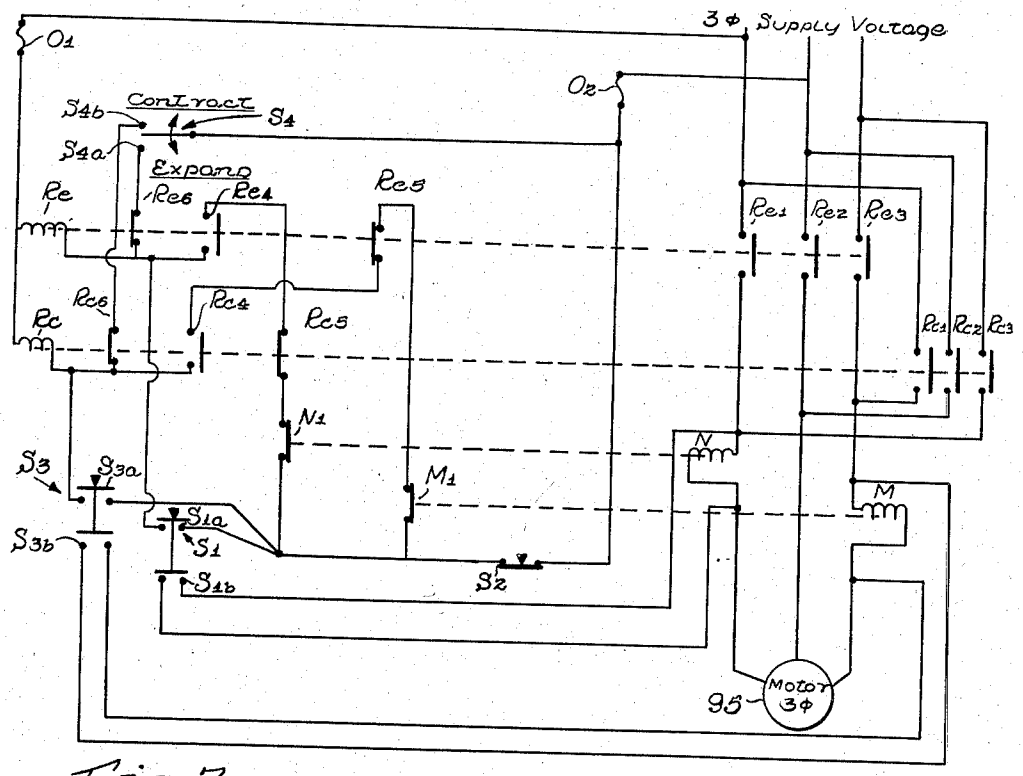



Fig. 7.

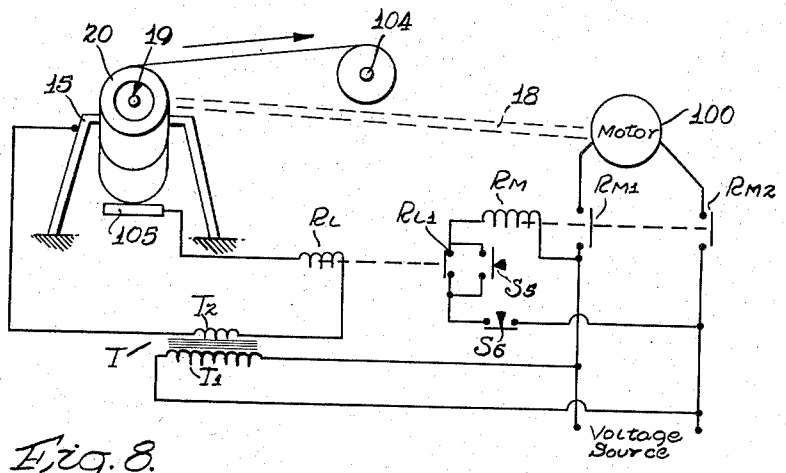



Fig. 8.

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COIL HOLDER

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Fig. 9.

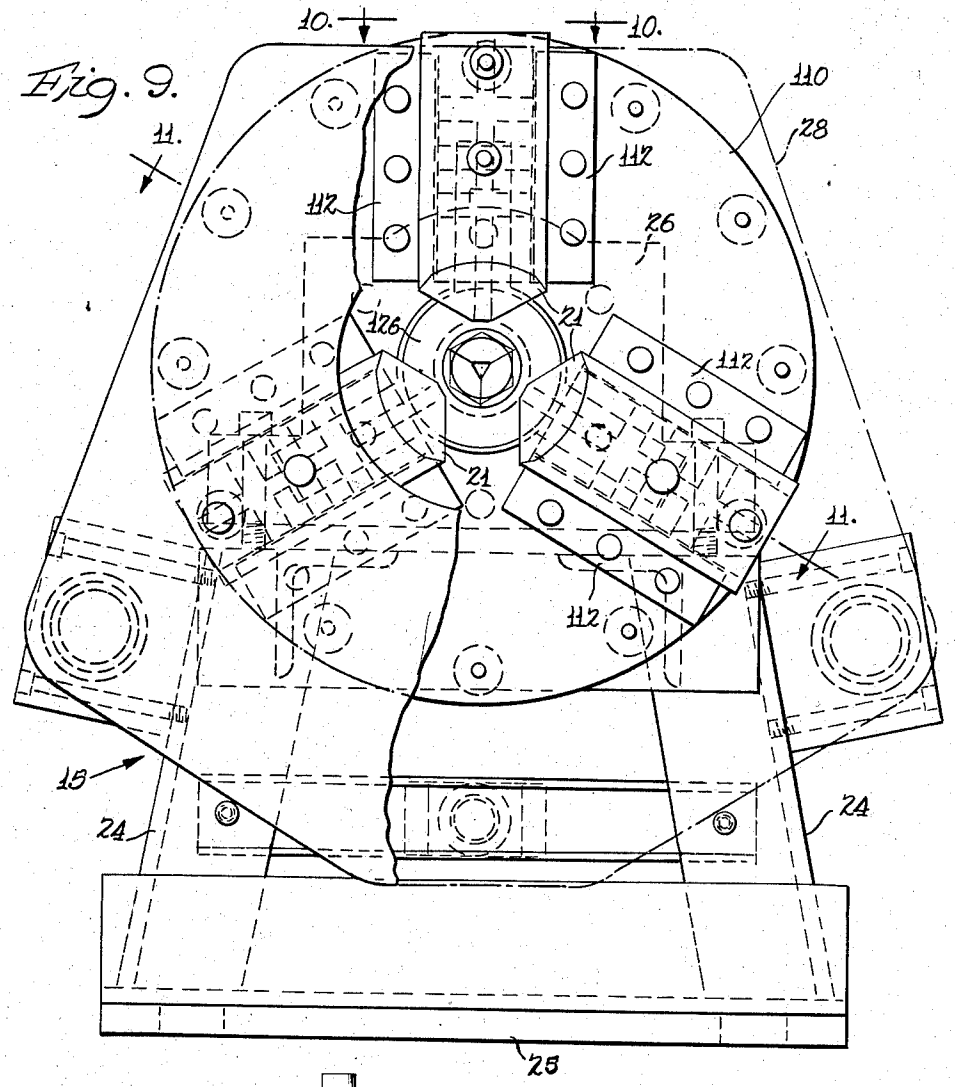
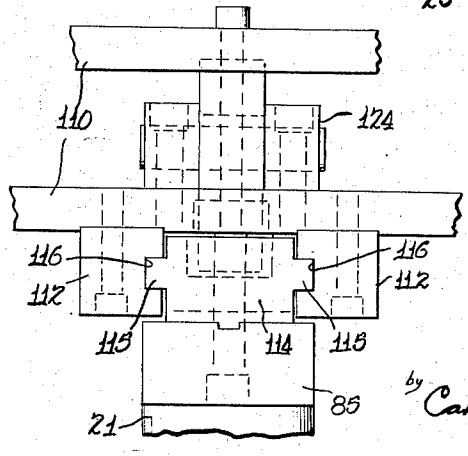



Fig. 10.




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United States Patent Office 2,874,916
Patented Feb. 24, 1959



2,874,916

# COIL HOLDER

Arthur S. Wallin, Chicago, Ill., assignor to Hydrometals, Inc., Chicago, Ill., a corporation of Illinois

Application May 5, 1954, Serial No. 427,714

10 Claims. (Cl. 242—75.51)

The present invention relates in general to apparatus for supporting or holding coils of sheet material during winding or unwinding. More particularly, the invention relates to power-actuated expanding mandrels and to the control of such mandrels both as to the radial adjustments thereof and rotational drive therefor.

It is the general aim of the invention to provide improved automatic controls both for adjusting the coil holder to different sizes of coils and for rotatably driving the coils.

A further object is the provision of control means for radially expanding and retracting the arms of such a mandrel, the movement of the arms being automatically terminated when they have been expanded into contact of a predetermined pressure with the internal surface of a coil or when they have been retracted into mutual engagement.

It is still another object of the invention to provide means for unwinding a coil of sheet material so as to maintain automatically looseness of the outermost layers of the coil, thereby permitting the sheet material to shift laterally as required for alinement with the take-up or utilizing device.

Additional objects and advantages will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a front elevation of a coil holder constructed in accordance with a preferred embodiment of the invention;

Fig. 2 is a left side elevation of the coil holder shown in Fig. 1;

Fig. 3 is an enlarged fragmentary elevation, partially in section taken along the line 3—3 in Fig. 1, illustrating details of a friction brake;

Fig. 4 is a fragmentary cross-sectional view of the expanding mandrel shown in Fig. 1;

Figs. 5 and 6 are perspective views of two respective types of arms for the expanding mandrel;

Fig. 7 is a schematic circuit diagram of a novel electrical control for the power expansion and contraction for the mandrel shown in Fig. 1;

Fig. 8 is a schematic representation, partially in electric circuit diagram form, of a novel control for rotating the holder to unwind a coil thereon;

Fig. 9 is an end elevation of a coil holder having a modified embodiment of the expanding mandrel of the present invention;

Fig. 10 is a fragmentary plan view taken substantially along the line 10—10 in Fig. 9; and

Fig. 11 is a fragmentary cross section taken substantially along the line 11—11 in Fig. 9 illustrating further details of the mandrel shown therein.

Although the invention has been shown and is described in some detail with reference to particular embodiments, there is no intention to thereby limit it to such detail. On the contrary, the intention here is to cover all alterations, modifications, and equivalents falling within the spirit and scope of the invention as defined by the appended claims.



The problem is posed in the coiling and uncoiling of sheet material, for example soft sheet metal, of providing a single coil holder which may effectively accommodate a wide variety of coils having different weights, widths, and internal diameters, as well as materials of different thicknesses and degrees of stiffness. In the coiling of non-ferrous sheet metals or light gauge sheet steel, merely slipping a coil over an under-size supporting shaft is unsatisfactory. The lack of rigidity and the weight of the material soon results in the coil becoming egg-shaped in cross section, making it extremely difficult to wind or unwind. To prevent such distortion in shape, coils of such non-rigid sheet material must be formed to have relatively small inside diameters. Yet, the inside diameters must be capable of variation to meet consumer specifications.

On the other hand, coils of heavier gauge, stiffer material must have larger internal diameters to prevent a bending or "setting" of the innermost layers. The size and weight of such coils sometimes are radically greater than coils of softer, lighter gauge non-ferrous sheet metals.

The present coil holding arrangement is intended to satisfy the extreme requirements for the versatile handling of such different coils and to accommodate easily large, heavy coils through the provision of power means automatically controlled in a novel manner.

Referring now to the drawings, an exemplary coil holder embodying the features of the invention is shown in Fig. 1. Briefly, the coil holder includes a support or frame **15** suitably journaling a shaft **18** which carries on one end an expanding mandrel **19** of unique and advantageous construction. For supporting a coil **20** of sheet material, the mandrel has a plurality of elongated axially extending arms **21** which are radially expandable and contractable in a manner to be more fully described.

The support **15** make take a variety of forms. It is here shown as having a bed **22** on four legs **24**, the latter adapted by a base plate **25** to be bolted to the floor. The shaft **18** is preferably hollow and elevated above the bed, journaled in spaced pedestal bearings **26**. A guide plate **28** abuts the inner edge of the coil mounted on the mandrel arms and thus serves to keep the edge of the coil smooth during winding. The mandrel arms **21** extend through a large central opening **29** in the guide plate, rotating freely in any of their radial positions. For adapting the guide plate **29** to abut coils of various widths, to thus position the coils axially along the arms, and for permitting retraction of the plate free of the supported coil, it is mounted on the ends of a pair of rods **30** which are axially slidable in sleeves **31** bolted to the support legs **24**. Axial positioning of the guide plate **28** is accomplished by turning a hand wheel **32** on the right end of a threaded shaft **34**. This shaft is journaled for rotation and axial sliding in a bushing **35** carried by a strap **36** between the right legs (Fig. 1); and its threaded portion **34***a* is engaged with a tapped sleeve **38** on a strap **39** between the left legs. The left end of the shaft **34** has a collar **40** axially captive and rotatably disposed in a bushing **41** rigid on the lower edge of the guide plate **28**.

For imposing a variable drag on the shaft **18** when operation of the coil holder requires, as hereinafter explained, a brake assembly **42** is provided which comprises a sleeve **44** fixed on the shaft **18** by set screws **45** and having a narrower, larger diameter portion **46** serving as a brake drum. A brake band **48** substantially surrounds the drum, being supported at the front by a U-shaped bracket **49** carried by a pin **50** in a standard **51** bolted to the bed **22**. At the rear, a tension device is attached to the opposite ends of the band. As here shown, this

device is supported on a second standard 52 and includes a pair of straps 54 fastened to the band 48 and extending for welded attachment to a pair of plates 55 slidable on an upright bolt 56 and urged apart by compression springs 58, 59 bearing against a flange 60 mounting the bolt 56. Tension is applied to the band 48 by pulling the plates 55 toward one another by means of a camming plate 61 pinned in a bracket 62 held captive on the upper end of the bolt by an adjustment nut 64. By moving a handle 65 on the camming plate 61 counterclockwise (Fig. 3) to push the top plate 55 downwardly, the brake is applied, whereas it is released in the position shown. Initial and final braking torques may be set by adjusting the nut 56.

As here shown, the expanding mandrel 19 is constructed in a manner to permit extensive radial adjustment of the arms 21, thereby accommodating a wide variety of coils having different internal diameters, weights, and widths. In accomplishing this objective, a universal machine type tool chuck, readily available commercially, is employed, the usual jaws of such chuck being removed and the special arms 21 mounted in lieu of such jaws. The chuck includes therein a mechanism for radially expanding and contracting the arms in unison, such mechanism being susceptible of power actuation.

As best shown in Figs. 1, 2, and 4, the preferred form of chuck comprises a hollow housing 70 having a collar 71 keyed as at 72 on the left end of the shaft 18. The outer wall of the housing 70 has a plurality of radially extending slots receiving radially slidable pads 74, there being three such pads in the present instance. For mounting the mandrel arms, the pads 74 are formed with a plurality of transverse keyways 75 and a pair of spaced, tapped openings 76. In order that the pads 74 may be adjusted radially in unison, the inner face of each is provided with spiral buttress threads 78 which are engaged with mating threads on a scroll ring 79. The latter is bolted to a circular plate 80 fast on the end of an actuator rod 81 which extends through and is rotatable relative to the hollow shaft 18. Support for the rod and plate is effected by a collar 82 journaled in the left half of the housing 70 (Fig. 4) by a ball bearing 84, and a thrust ball bearing 85 interposed between the opposite side of the plate 80 and the housing.

During winding or unwinding of a coil 20 on the mandrel arms 21, the shaft 18 and actuator rod 81 rotate together. But for quickly adjusting the radial positions of the arms 21, the shaft 18 may be restrained, for example, by the brake assembly 42, and the rod 81 and plate 80 turned with respect to the housing 70 in the bearings 84 and 85. This turns the scroll ring 79 and effects a threaded movement of the pads 74 radially inward or outward. Such adjustment may be accomplished to place the mandrel arms 21 in any of a wide range of radial positions, and it may be carried out in an instant.

For mounting the three arms 21, their end bases 85 have a set of projecting keys 86 insertable into the keyways 75 of the pads 74, and openings 88 for receiving securing bolts 89 inserted therethrough for threaded engagement with the tapped holes 76.

The arms 21 extend at right angles from the radially innermost sides of their bases 85, being of considerable length to accommodate coils of relatively great width. It is to be noted that since the arms are not fettered by an adjusting mechanism interposed between them, they may be radially retracted to lie in a circle of very small diameter. They are thus easily inserted into coils having relatively small internal diameters.

The arms are curved on their outer sides for engagement with the circular surface of the coil opening. Manifestly, a given curvature of arm surfaces will not smoothly match all the internal surfaces of coils having a wide range of internal diameters. However, such perfect matching is not necessary to the secure support of the coils, and with three such arms extending at 120 degree intervals, the desired support is obtained by a slight radial stretching or bearing pressure. In the form shown in Fig. 5, the arms 21 have a relatively sharply curved surface 90 to form a small composite cylinder when retracted into mutual abutment. This is ideal for a range of smaller coil internal diameters. In the second form illustrated by Fig. 6, the arms 21*a* have outer surfaces 90*a* of less curvature, i. e., a greater radius of curvature, matching to a greater degree the inner surfaces of larger coil openings. Otherwise, the two forms are the same and may be used interchangeably for coils of different size groups. Either form, however, will serve satisfactorily for coils having central openings varying between the limits of adjustment accorded by the chuck.

In accordance with an important feature of the invention, power means are provided for driving the adjusting mechanism of the mandrel 19, such power means being controlled in a manner so as to be automatically deenergized whenever the radial movement of the mandrel arms 21 is resisted by a predetermined force. Thus, whenever the pads 74 reach their inner or outer limits of travel relative to the threads on the scroll ring 79, or whenever the arms 21 are expanded into firm engagement with the inner surface of a coil, thereby setting up a resistance to further radial movement of the arms, the movement is automatically terminated. The operator need not worry about stopping radial movement of the arms before destructive stresses are created; yet he may be sure that each coil will be securely engaged by the arms.

The exemplary power means here shown for driving the mandrel adjusting mechanism, include a reversible motor 95 suitably connected with the actuator rod 81. As shown in Fig. 1, the motor 95 is mounted at the right end of the support 15, its shaft being connected with the right end of the rod 81 which projects from within the hollow shaft 18. With the braking device 42 set to hold the shaft 18 stationary, energization of the motor 95 so that it rotates in one direction or the other thus correspondingly rotates the scroll ring 79 to adjust the pads 74 and the mandrel arms 21 radially inward or outward.

For the automatic deenergization of the motor 95, a control circuit exemplified by that illustrated in Fig. 7 is employed. As there shown, the motor 95 is of the three-phase induction type and is reversibly energized from a three-phase voltage source through contacts $R_{e1-3}$ and $R_{c1-3}$ of relays having respective coils $R_e$ and $R_c$. Closing of the contacts $R_{e1-3}$ energizes the motor 95 in a direction to expand the mandrel arms, while closure of the contacts $R_{c1-3}$ causes the motor to rotate in the opposite direction to contract the mandrel arms. Energization of the controlling coils $R_e$ and $R_c$ is effected through a circuit fed from two of the voltage supply lines through suitable protective or overload devices $O_1$ and $O_2$.

To initiate expanding movement of the mandrel arms, a double-contact push button switch $S_1$ is momentarily closed, completing a circuit through the overload device $O_1$, the coil $R_e$, contacts $S_{1a}$ of the push button switch, a normally closed push button "stop" switch $S_2$, and the second overload device $O_2$. This closes the contacts $R_{e1-3}$ and energizes the motor 95. At the same time, however, normally open contacts $R_{e4}$, controlled by the coil $R_e$, are closed to complete a seal-in circuit through normally closed contacts $R_{c5}$ (controlled by the coil $R_c$), normally closed contacts $N_1$ of a current responsive relay having a coil N, and the normally closed push button switch $S_2$. Thus, the relay coil $R_e$ remains energized and the motor continues to run in a direction to expand the mandrel arms.

It will be observed that the relay coil N is connected directly in series with one of the supply lines for the motor 95. The coil N is so designed as to be responsive only to current of a predetermined minimum value, so that as long as the motor 95 does not encounter a heavy load the contacts $N_1$ remain closed. Whenever the

mandrel arms reach their outer limit of travel or when they firmly engage the inner surface of a coil placed around the arms, a relatively heavy load will be imposed on the motor **95** and it will draw increased current. This increase in current is sufficient to energize the coil N and thus to open the contacts $N_1$. Accordingly, the coil $R_e$ is deenergized and the contacts $R_{e1-3}$ opened to automatically deenergize the motor **95**. The normally closed contacts $R_{c5}$ in series with the seal-in circuit for the relay coil $R_e$ insure that the latter coil may not remain energized when the $R_c$ coil is subsequently energized. Additionally, the coil N is prevented from opening its normally closed contacts $N_1$ as a result of the relatively great surge of starting current drawn by the motor **95** when the switch $S_1$ is initially depressed by the provision of a second set of normally open contacts $S_{1b}$ for the latter switch which are connected directly in parallel with the coil N. Thus, during the short interval that the motor **95** is being started, the coil N is shorted out by the contacts $S_{1b}$ and the normally closed contacts $N_1$ remain closed so that the seal-in circuit becomes complete upon energization of the relay coil $R_e$.

By the same token, contracting movement of the mandrel arms is initiated by depressing another push button switch $S_3$ thereby completing a circuit through the coil $R_c$, the contacts $S_{3a}$ of the push button switch, and the normally closed contacts of the switch $S_2$. This energizes the coil $R_c$ which closes the contacts $R_{c1-3}$ to energize the motor **95** for rotation in the opposite direction. At the same time, normally open contacts $R_{c4}$, controlled by the coil $R_c$ close to complete a seal-in circuit through the latter coil, through the contacts $R_{c4}$, through normally closed contacts $R_{e5}$, through normally closed contacts $M_1$ of a second current responsive relay having a coil M, and through the normally closed push button switch $S_2$. Accordingly, once contracting movement of the mandrel arms has been initiated by depressing the switch $S_3$, the relay coil $R_c$ is sealed-in and the motor **95** continues to run. The relay coil M is connected directly in series with one of the supply lines for the motor **95** and, as in the case of the relay coil N, is so designed as to be responsive only to current above a predetermined minimum value drawn when the motor **95** is heavily loaded. Thus, when the mandrel arms **21** have been contracted into mutual abutting engagement and the motor **95** is consequently loaded to draw a heavier current, the coil M is energized to open the contacts $M_1$. This deenergizes the coil $R_c$ and permits opening of the contacts $R_{c1-3}$, so that the motor **95** is automatically deenergized. It will be observed that the switch $S_3$ includes a second set of normally open contacts $S_{3b}$ which are connected directly in parallel with the relay coil M. Thus, when the switch $S_3$ is temporarily depressed as the motor **95** is started in a contracting direction, the coil M is shorted out and will not be energized by the heavy starting current of the motor. The contacts $M_1$, therefore, remained closed so that the seal-in circuit for the coil $R_c$ may be completed as described.

It will be evident from the foregoing that an operator may deenergize the motor at any time simply by depressing the push button switch $S_2$. Further, provision is made for quickly reversing the direction of motor rotation, that is for "plugging" the motor to move the mandrel arms in the opposite direction from that in which they may be moving at any given time. For this purpose, a plugging switch $S_4$ of the single pole, double-throw type has one of its contacts $S_{4a}$ connected through normally closed contacts $R_{e6}$ of the relay coil $R_e$ to the common connection between the coil $R_e$ and the switch $S_1$. The second contact $S_{4b}$ of the switch $S_4$ is similarly connected through a normally closed contact $R_{c6}$ to the common connection between the coil $R_c$ and the switch $S_3$. The common movable contact of the switch $S_4$ is connected directly to the voltage supply through the overload device $O_2$. The operation of the plugging switch may therefore be described as follows. If the motor is initially energized by the relay coil $R_c$ so as to be driving the mandrel arms in a contracting direction, closure of the switch $S_4$ through the contact $S_{4a}$ energizes the coil $R_e$. This causes closure of the contacts $R_{e1-3}$ and opening of the normally closed contacts $R_{e5}$. The latter thus breaks the seal-in circuit of the relay $R_c$, deenergizing the same and opening the contacts $R_{c1-3}$. Simultaneously, however, the seal-in circuit for the relay coil $R_e$ is completed so that the motor begins and continues to run in the opposite direction to expand the mandrel arms. It will be noted that closure of the switch $S_4$ to the contact $S_{4b}$ at the time when the relay coil $R_c$ is energized produces no effect whatever since such coil is already energized through its seal-in circuit.

On the other hand, when the motor is initially running in a direction to expand the mandrel arms by virtue of the relay $R_e$ being sealed in, closure of the switch $S_4$ to the contact $S_{4b}$ energizes the coil $R_c$. This closes the contacts $R_{c1-3}$ and opens the normally closed contacts $R_{c5}$ to deenergize the relay coil $R_e$. At the same time, the normally open contacts $R_{c4}$ are closed to complete the seal-in circuit for the coil $R_c$ so that the motor is quickly reversed and continues to run in a direction to contract the mandrel arms. In either case, when a predetermined resistance or load is placed on the motor as a result of the mandrel arms reaching one limit of their travel or contacting the inner surface of a coil, either the relay M or the relay N operates to deenergize the sealed-in coil $R_e$ or $R_c$ to thereby automatically deenergize the motor **95**.

In order to rotate a coil held on the mandrel **19** either for winding or unwinding the same, a power drive for the hollow shaft **18** is provided. As seen in Fig. 1, such drive may comprise a second motor **100** suitably mounted and connected, as by a V belt **101** running over a pulley **102** fast on the shaft. In the case of unwinding a coil, a particular problem arises in connection with the need for the sheet material to have freedom to shift laterally so that it may be alined with the utilization machine being fed from the coil. For example, if the utilization machine, such as a slitter and recoiler, is allowed simply to pull or "strip" the material from the coil with the shaft **18** turning freely in its bearings, an excessive tension may be developed in the web of material causing prohibitive stretching. Further, the tightness of the coil tends to increase by virtue of such tension. This tightening of the coil prevents sidewise movement of the outer layer which may be necessary for smooth feeding into the utilization machine especially if the coil was originally wound unevenly. Still further, if the speed of the motor **100** is constant during the unwinding of the complete coil, the lineal speed of the material being unwound will decrease as the coil diameter decreases. This is particularly objectionable where the utilization device is intended to accept the unwound material at a uniform speed. It will be understood that the utilization device is power driven to take up material unwound from a coil; it is desirable, however, that the utilization device be free of the requirement of pulling or stripping the material from the coil.

In the fulfillment of one object of the invention, the above described difficulty is eliminated by choosing the speed of the motor **100** to be such that even when the coil on the mandrel has a small diameter, the material is unwound faster than it is taken up by the utilization machine. In addition, control apparatus is provided which is operative to deenergize and energize the motor in response respectively to the presence or absence of a loose outer loop of material depending a predetermined distance below the coil. Thus, the coil is speeded up when the motor is energized so that a loose loop develops, the motor then being deenergized until take-up by the utilization device starts to consume the loop.

Such an automatic control arrangement for maintain-

ing a loose loop of material on a coil being unwound is schematically exemplified in Fig. 8. As there shown, a coil **20** of sheet material is carried on the mandrel **19** of a coil holder such as that illustrated in Fig. 1. The coil is being unwound from the mandrel and rewound on a power driven shaft **104** of a utilization device. The speed of the motor **100**, when running, is sufficient to rotate the mandrel **19** fast enough to unwind the coil at a greater rate than material is taken up by rotation of the shaft **104**. For controlling the motor **100**, it is energized through contacts $R_{M1}$ and $R_{M2}$ of a motor controlling relay having a coil $R_M$, the $R_{M1,2}$ contacts being in series with a suitable voltage source. The coil $R_M$ is controlled in a manner such that the contacts $R_{M1,2}$ are closed whenever a loose loop of material does not depend a predetermined distance below the coil **20**, while they are automatically opened in response to the presence of such a loose loop.

This operation is achieved by connecting the coil $R_M$ across the voltage source in series with normally closed contacts $R_{L1}$ of a relay having a low voltage actuating coil $R_L$. The latter coil is connected in series circuit with the low voltage secondary winding $T_2$ of a transformer T having its primary winding $T_1$ energized from the voltage source as indicated. Serially connected with the coil $R_L$ and secondary winding $T_2$ are the coil holder support **15** and a conductive element or plate **105** disposed beneath the mandrel **19**. It will be apparent that by employing the step down transformer T a very low voltage (in the order of 12 volts) is employed in the secondary circuit thereby eliminating the possibility of electrical shock or injury to workmen who might touch the support **15** and the plate **105**.

Whenever a loose loop of the sheet metal material of the coil **20** depends into contact with the conductive plate **105**, the secondary circuit is completed and the relay coil $R_L$ is energized. This, in turn, opens the contacts $R_{L1}$, deenergizing the coil $R_M$ and opening the contacts $R_{M1,2}$ to thereby deenergize the motor **100**. The take-up of the shaft **104** thus begins to consume the depending loop of the coil **20**, and when such loop is lifted free of the plate **105**, the coil $R_L$ is deenergized, the contacts $R_{L1}$ closed, the coil $R_M$ energized, and the contacts $R_{M1,2}$ closed to again energize the motor **100**. The motor **100** thus runs until the depending loop again contacts the plate **105**, whereupon the cycle of operation is repeated. It will be apparent, from the foregoing, that this cycle of operation takes place relatively fast so that a depending loop of approximately uniform length is continuously maintained, thereby permitting the shaft **104** to take up the material being unwound from the coil **20** as it may require.

Also illustrated in Fig. 8 is a normally open push button switch $S_5$ connected in parallel with the contacts $R_{L1}$ for permitting manual initiation of energization for the motor **100**. For stoppage, a normally closed push button switch $S_6$ is connected in circuit with the relay coil $R_M$ in order that an operator may deenergize the motor **100** at any time during the operation described above.

Turning now to Figs. 9, 10 and 11, a modified embodiment of the invention is there illustrated, more particularly a modified construction of the expanding mandrel which is susceptible of convenient power actuation by hydraulic means. By the provision of pressure regulating means for the hydraulic source, movement of the mandrel arms is terminated whenever resistance to such movement balances the force exerted by the hydraulic actuator.

As here illustrated, the modified form of expanding mandrel comprises a universal machine tool chuck of the "crank" type, having its jaws replaced with the special arms **21** previously described with reference to Figs. 1, 5 and 6. The chuck includes a hollow housing **110** having a collar **111** threaded on the end of the shaft **18**. The outer face of the housing has bolted to it three circularly spaced pairs of way members **112** slotted to receive radially slidable pads **114**. For retention against circumferential movement with freedom for radial movement, the pads **114** have integral keys **115** riding in cooperatively spaced guide slots **116** (Fig. 10) of the way members. The faces of the pads **114** are shaped to receive the butt ends of the special mandrel arms **21**, as described above in connection with Fig. 4.

For adjusting the radial positions of the pads **114** in unison, they are provided with recesses **118** (Fig. 11) receiving balled ends **119** of crank members **120** extending through radial slots **121** in the outer face of the housing. The crank members **120** are generally right-angled in form and pivoted on pins **122** carried by brackets **124** bolted within the housing. The opposite balled ends **125** of the crank members extend into a circumferential groove **126** of a crank collar **128** which is mounted for free rotation of the end of the axially movable actuator rod **81** by a bronze bearing **129** and retained by a lock nut **130** and washer **131**. The actuator rod **81** extends through the hollow shaft **18** as previously described in connection with Fig. 1 and is mounted for rotation relative to the latter by a pair of bearing sleeves **132**. That is, the shaft **18**, chuck housing **110**, and crank collar **128** may all rotate freely as a unit while the actuator rod **81** remains stationary, the latter being axially movable to effect pivoting of the crank members **120** and to thereby radially position the pads **114**.

For shifting the actuator rod **81** axially to effect such radial adjustment of the pads **114** and arms **21**, its right end may be connected (in lieu of the motor **95** in Fig. 1) to the ram of a double-acting pneumatic or hydraulic cylinder (not shown). Since the crank collar **128** is journaled on the left end of the actuator rod **81**, the latter need not turn with the shaft **18** as it rotates. A rotary pneumatic or hydraulic joint is, therefore, unnecessary and the rod **81** need be only mechanically coupled to the ram. By positioning the ram of the cylinder, therefore, to adjust the actuator rod **81** axially, the mandrel arms **21** may be expanded or retracted radially to engage or disengage the central opening of the coil. Such power adjustment may be accomplished in an instant with little or no effort. The maximum force exerted by the arms on one another when retracted, or on the inner surface of a coil when expanded, may be controlled by means of a suitable pressure regulator (not shown) for the hydraulic cylinder.

I claim as my invention:

1. A coil holder for strip metal comprising, in combination, a support, a shaft journaled in said support, an expanding mandrel on said shaft and having a plurality of circularly spaced, axially extending arms, power means for radially expanding and retracting said arms, control means responsive to a predetermined resistance to radial movement of said arms for automatically deenergizing said power means, driving means for rotating said shaft to unwind a coil on said mandrel arms faster than the strip metal is stripped from the coil, and means controlled by current conduction through a slack loop of the strip metal for deenergizing said driving means in response to the presence of a slack loop depending a predetermined distance from the coil.

2. A coil holder for sheet metal comprising, in combination, a support, a shaft journaled on said support, a mandrel on said shaft having a plurality of circularly spaced, axially extending arms adapted for insertion into the central opening of a coil of sheet metal, electric power means for radially expanding and contracting said arms in unison, control means operative upon manual initiation to energize said power means and automatically operative upon a predetermined resistance to radial movement of said arms to deenergize said power means, electric driv-

ing means for rotating said shaft to unwind the coil faster than sheet metal is stripped from the coil, and a control circuit including as a part thereof a slack loop of the sheet metal depending from the coil for automatically energizing and deenergizing said driving means in response respectively to the absence or presence of a slack loop depending a predetermined distance beneath the coil to thereby maintain looseness in the outer layers of the coil affording freedom for lateral shifting of the same.

3. A coil holder comprising, in combination, a support, a shaft journaled on said support, an expanding mandrel on said shaft having a plurality of circularly spaced, axially extending arms adapted for insertion into the central opening of a coil of sheet metal to support the same, a mechanism for radially expanding and retracting said arms, a reversible electric motor for driving said mechanism, a control circuit for said motor including a current responsive relay in series with said motor and operative to deenergize the same in response to a current of predetermined magnitude drawn by said motor when said arms engage the inside of the coil or one another, a second motor for driving said shaft to unwind the coil faster than material is stripped therefrom, and a control circuit for said second motor including a conductive element disposed beneath said arms and a control relay connected in series between said frame and said element, said control relay being operative to deenergize said second motor when a slack loop from the coil contacts said element to complete the control relay circuit.

4. A coil holder comprising, in combination, a support; a hollow shaft journaled on said support; an expanding mandrel fixed on said shaft and including a universal machine tool chuck with the jaws thereof removed, a plurality of circularly spaced, elongated, axially extending arms fixed to said chuck in lieu of the jaws, and a mechanism in said chuck for radially expanding and contracting said arms in unison; an actuator shaft disposed within said hollow shaft and connected to operate said chuck mechanism, a first electric motor drivingly connected with said actuator shaft to radially adjust said arms; a current responsive relay in series with said first motor and operative in response to current of a predetermined minimum value indicative of predetermined resistance to movement of said arms to automatically deenergize said first motor; a second motor for driving said hollow shaft to unwind a coil of conductive sheet material on said mandrel arms faster than material stripped from the coil; a conductive element beneath said mandrel arms; and a control circuit including said element, said support, and a control relay which is completed when a slack loop of the coil material engages said conductive element, and means including said control relay for automatically energizing and deenergizing said second motor in response respectively to the interruption and completion of said control circuit.

5. In a coil holder, the combination with a mandrel having radially expandible and retractable arms, of power means for radially moving said arms, and control means operative upon said power means for automatically deenergizing the latter in response to predetermined resistance to the movement of said arms, occasioned by the latter reaching the limits of their travel or engaging the inner surface of a coil.



6. In a coil holder, the combination with an expanding mandrel having a plurality of arms and a mechanism for relatively expanding and contracting said arms, of an electric motor for driving said mechanism, and a control circuit for said motor including means responsive to a predetermined resistance to the movement of said arms for automatically deenergizing said motor.

7. In a coil holder, the combination with an expanding mandrel having a plurality of arms and a mechanism for radially expanding and contracting said arms in unison, of a reversible electric motor for driving said mechanism, and an electric control circuit for said motor including means for manually initiating energization of said motor to expand and contract said arms, and a relay in circuit with said motor and responsive to current flow above a predetermined value for automatically deenergizing said motor.

8. In a coil holder, the combination of means for rotatably supporting a coil of sheet metal, with power means for rotationally driving said supporting means to unwind the coil, and means controlled by current conduction through and responsive to the length of a slack loop in the outer layer of the coil for automatically deenergizing and energizing said power means to thereby maintain such outer layer loose with freedom to shift laterally.

9. In a coil holder, the combination of means for rotatably supporting a coil of sheet metal, with an electric motor for rotationally driving the coil to unwind the same faster than material is stripped from it, and an electric control circuit for automatically energizing and deenergizing said motor in response to the absence or presence of a slack loop of metal depending a predetermined distance from the coil, said circuit including as a current conducting portion thereof the slack loop when the latter depends said predetermined distance, whereby the outer layer of said coil is maintained loose with freedom to shift laterally.

10. In a holder for rotatably supporting a coil of conductive sheet material, the combination of a journaled shaft, a mandrel on said shaft for supporting the coil, a motor for driving said shaft to unwind the coil, and a circuit for maintaining loose loops of the sheet material in order that it may be laterally shifted as it is unwound from the coil, said circuit including a conductive plate disposed beneath the coil, and means electrically connected between said shaft and said plate for deenergizing said motor when a loose loop from the coil contacts said plate.


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