June 12, 1962 R. F. HERR 3,038,681

COIL UNWINDER

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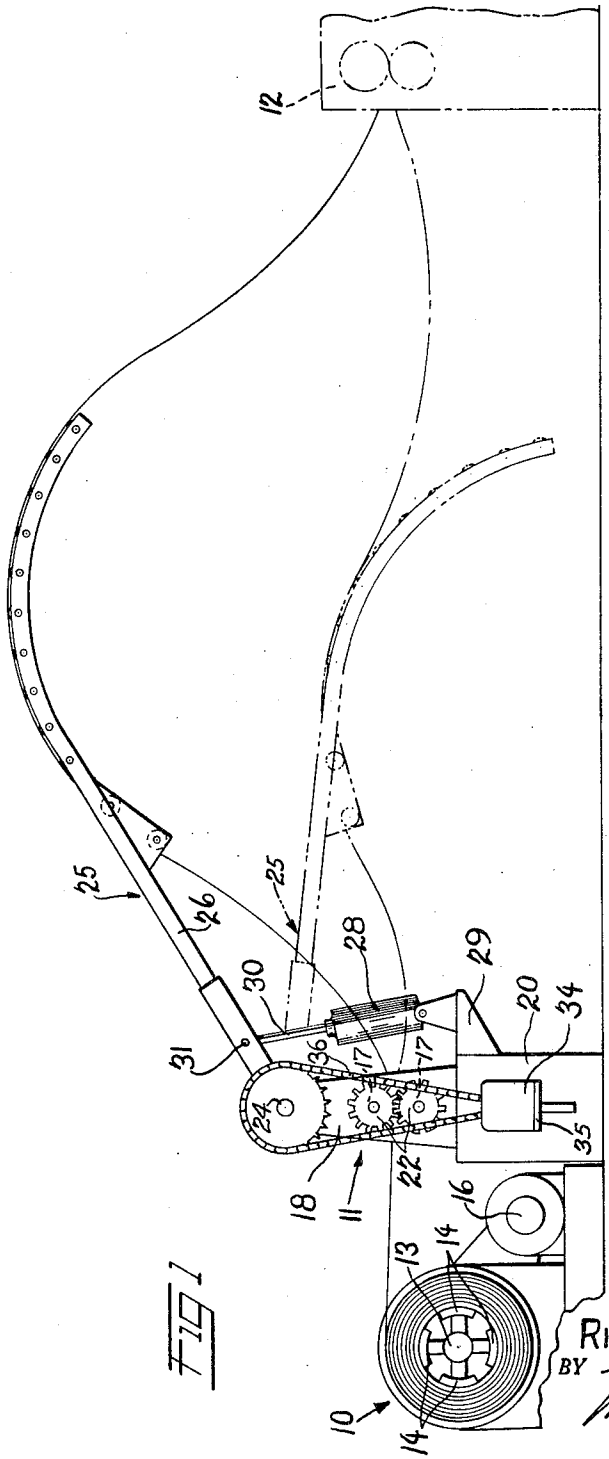


FIG 1

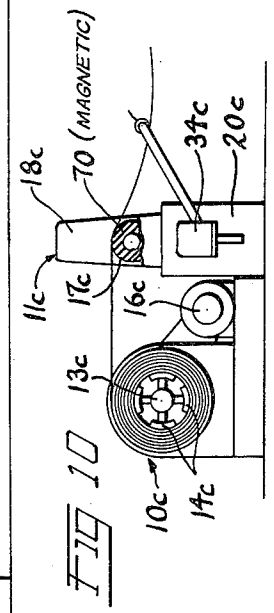


FIG 10

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COIL UNWINDER

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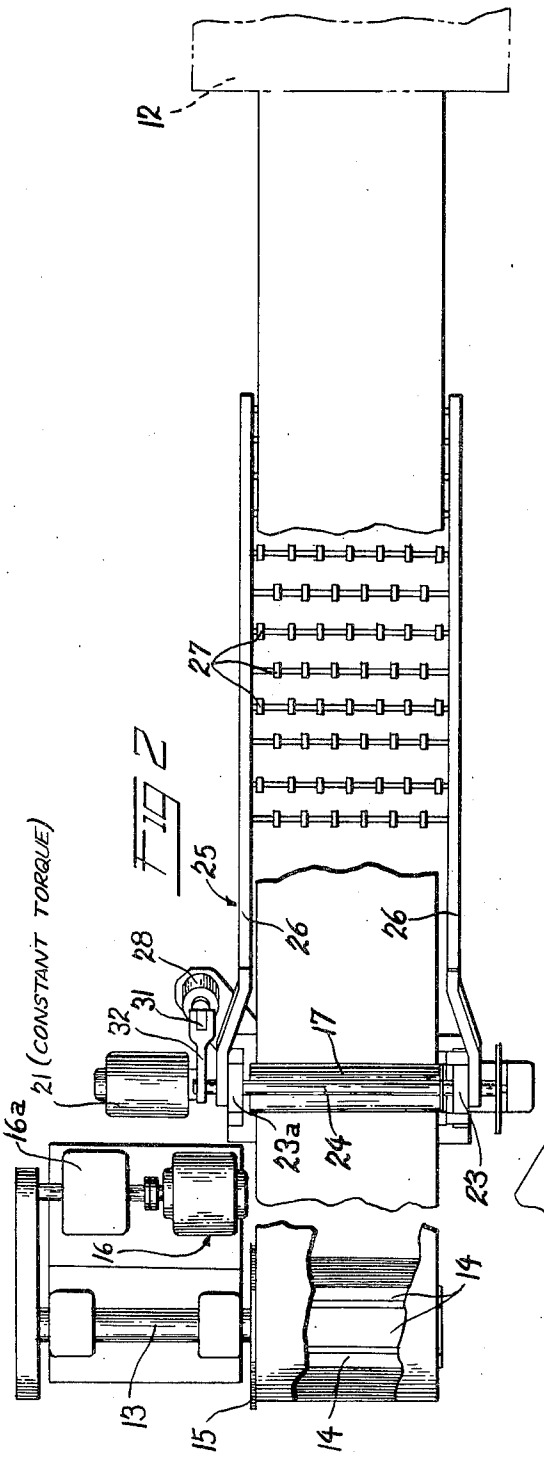


FIG 2

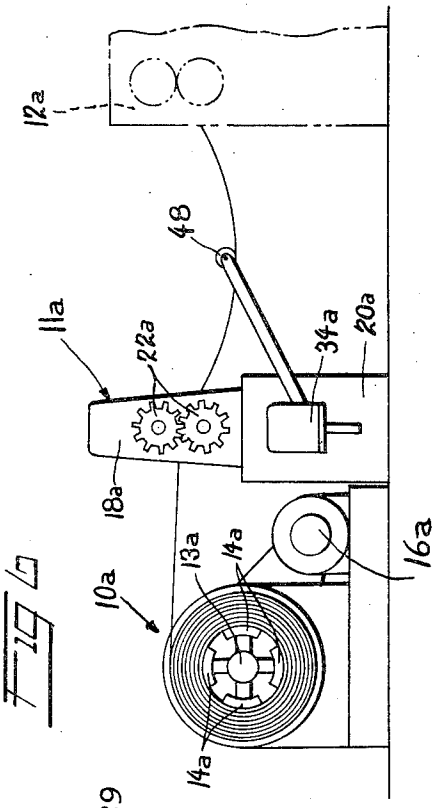


FIG 3

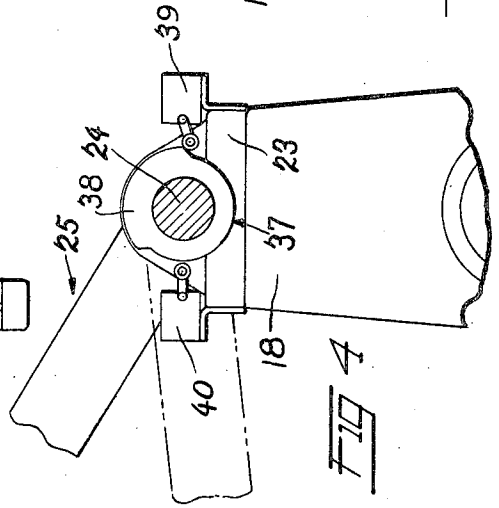


FIG 4

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COIL UNWINDER

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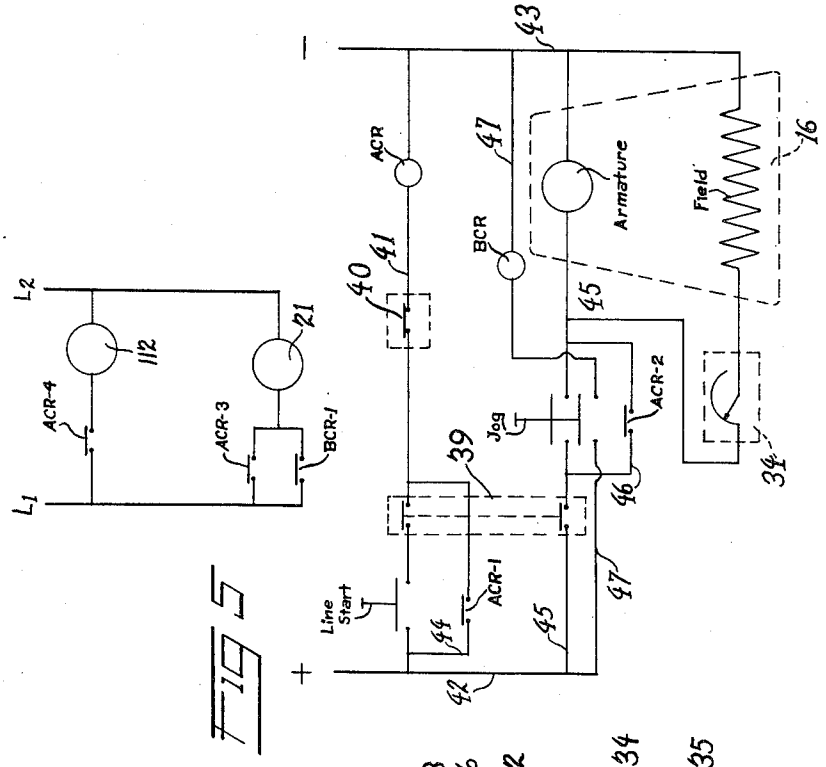


FIG 5

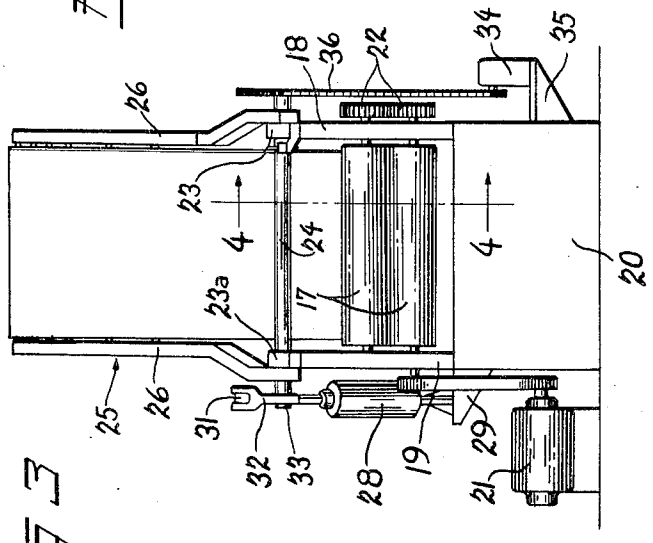


FIG 3

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COIL UNWINDER

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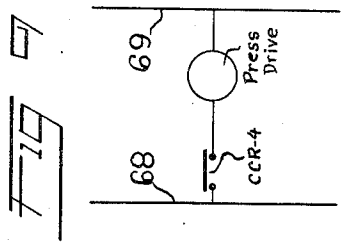


FIG 6

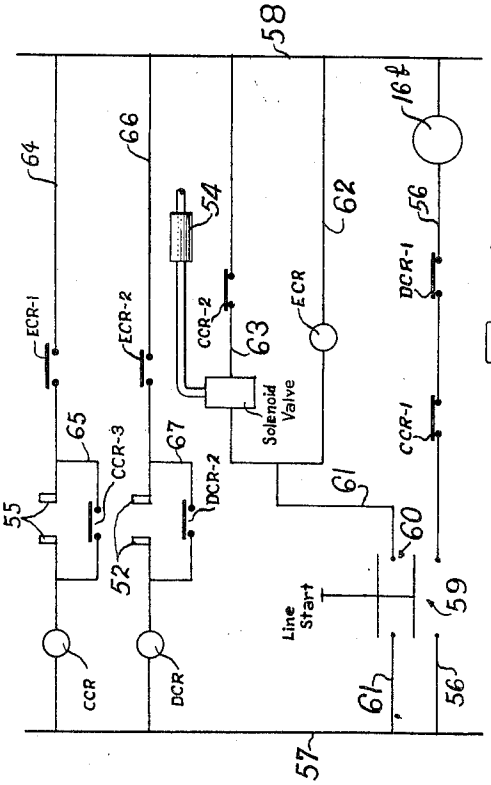


FIG 8

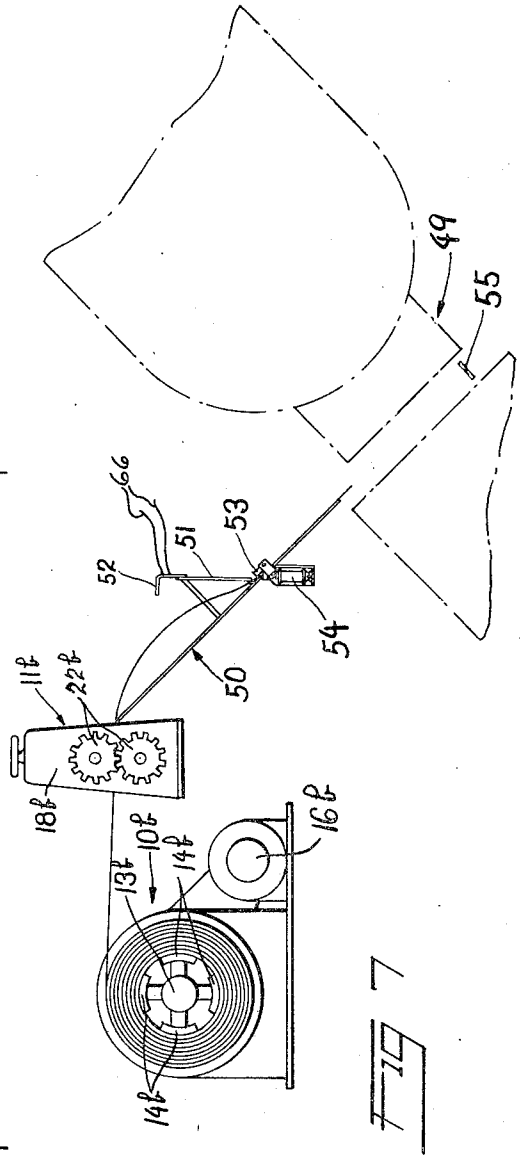


FIG 7

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United States Patent Office 3,038,681
Patented June 12, 1962

3,038,681

COIL UNWINDER

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Filed July 26, 1960, Ser. No. 45,406
16 Claims. (Cl. 242—78.6)

The present invention relates to apparatus for handling tenuous material and the principal object of my invention is to provide new and improved apparatus of such character. This application is a continuation-in-part of my co-pending application of the same title, Serial Number 425,675, filed April 26, 1954, and now abandoned.

In the past, considerable difficulty has arisen in handling tenuous material, particularly when such material must be unwound from a coil intermittently and/or at various speeds. Under these conditions, there has been a tendency for the outer layers of the coil to unravel during acceleration and/or deceleration and this often results in kinked or otherwise damaged material. Moreover, the problem is considerably aggravated when the tenuous material must be unwound from a coil and fed to receiving apparatus which will not operate properly unless the material fed thereto is maintained under a predetermined, uniform, minimum tension.

The present invention solves the problems inherent in prior art apparatus and these and other advantages will become apparent from a study of the following description and from the drawings appended hereto.

In the drawings accompanying this specification and forming a part of this application there are shown, for purpose of illustration, embodiments which my invention may assume, and in these drawings:

FIGURE 1 is a side elevational view of a preferred embodiment of my invention,

FIGURE 2 is a top plan view of the embodiment illustrated in FIGURE 1,

FIGURE 3 is an end elevation with certain parts removed in the interest of clarity,

FIGURE 4 is a fragmentary enlarged sectional view generally corresponding to the line 4—4 of FIGURE 3,

FIGURE 5 is a schematic wiring diagram of certain electrical circuits employed in controlling operation of the invention shown in FIGURES 1 through 4,

FIGURE 6 is a side elevational view of another embodiment of my invention.

FIGURE 7 is a side elevational view of still another embodiment of my invention,

FIGURE 8 is a schematic wiring diagram of certain electrical circuits employed in controlling operation of the apparatus shown in FIGURE 7,

FIGURE 9 is a diagram of an electrical circuit which may operate in conjunction with the circuits shown in FIGURE 8, and

FIGURE 10 is a reduced size view similar to FIGURE 6 but of still another embodiment of the invention.

The present invention is particularly adapted to handle metal strip of the type employed in making electrical transformer laminations and the like; however, it will be appreciated that my invention may be advantageously employed to handle other tenuous material. In handling metal strip of the type heretofore mentioned, special problems arise since this material will not tolerate rough handling. Bending the material or otherwise stressing it can damage its electrical characteristics even though the strip is not permanently deformed. Accordingly, the present invention is particularly adapted for use with tenuous material which requires exceptionally gentle handling; however, the invention obviously is not limited to such use.

As best shown in FIGURES 1 and 2, the embodiment

of the invention therein illustrated comprises two basic components: a pay-off or unicoiler mechanism **10** and a translating mechanism **11** which receives the tenuous material dispensed or unwound by the mechanism **10**. Also shown fragmentarily and in phantom in FIGURE 1 is receiving apparatus **12** which receives the material from the mechanism **11** and performs certain operations thereon. By way of illustration, but by no means as a limitation, apparatus **12** may comprise a press for blanking transformer laminations from the material. However, it will be appreciated that apparatus **12** is herein disclosed for purpose of illustration only.

The uncoiler mechanism **10** may be of any suitable design, preferably of the type which is adapted to grip the center of a coil, and such mechanism is herein disclosed to be of the general type shown in Letters Patent 2,762,577. For a clear understanding of the present invention, it should be sufficient to disclose that the mechanism **10** comprises a rotatably supported arbor **13** to which a plurality of reel segments **14** are secured. The reel segments **14** are movable radially toward and away from the axis of the arbor **13** to expand and contract the mandrel thus provided for a purpose to be disclosed. A face plate **15** may be carried by the arbor **13** and, in the present embodiment, a suitable variable speed D.C. motor **16** is provided to effect rotation of the arbor **13** at various speeds for reasons later to become clear. As shown in FIGURE 2, the motor **16** drives the arbor **13** through a gear reduction unit or the like **16***a* in the conventional manner and for the usual reasons.

From the description thus far, it will be understood that a coil of tenuous material having a hollow center is adapted to be positioned on the mandrel provided by the uncoiler mechanism **10** and the reel segments **14** moved away from the arbor **13**, by any suitable means, to gripping engagement with the interior of the coil.

Referring now to the mechanism **11**, and as best shown in FIGURES 1, 2 and 3, it will be seen that in this embodiment a pair of pinch rolls **17** are rotatably supported between a pair of spaced-apart housings **18**, **19** which are secured to and extend upwardly from a base **20**. Any suitable construction may be employed for rotatably supporting the rolls **17** and, if desired, one or both of the rolls may be movable vertically (in the relation of parts shown in FIGURES 1 and 3) and in a well-known manner to provide for adjustment of the spacing between the rolls.

The rolls **17** are adapted to be rotated by means of a torque drive device **21** (see FIGURE 3), unitary rotation of the rolls being effected by respective interengageable gears **22**, each of which is structurally integral with its related roll **17**.

The drive device **21** may be of any well-known design, it being understood that its purpose is to maintain a generally constant torque on the rolls **17** regardless of roll rotation for a reason later to become clear.

Secured to respective housings **18**, **19** by any suitable means are journal boxes **23**, **23***a* in which is journaled a rocker shaft **24**. A generally arcuate arm **25**, formed of a pair of spaced-apart side members **26**, **26**, has one end secured to the rocker shaft **24** as shown by any suitable means. For a purpose to be disclosed, a plurality of rollers **27** are positioned between the side members **26**, **26** of the arm **25** (see especially FIGURE 2).

Means are provided for resiliently biasing the arm **25** to the full line position shown in FIGURE 1 for reasons later to be described. At the present time, such means comprises a fluid cylinder **28** which has its blank end pivotally secured to a portion **29** of the base **20** and its piston rod **30** pivoted at **31** to a lever **32**. The lever **32** is structurally integral with a portion **33** of the rocker

shaft 24 which extends beyond the journal box 23a (see especially FIGURES 2 and 3).

In the embodiment herein disclosed, a rheostat or the like 34 is supported by a shelf 35 which is secured to the base 20. The rotor of the rheostat 34 is connected for rotation with rocker shaft 24 by means of a chain 36 and suitable sprockets respectively carried by the shaft and the rotor.

Referring particularly to FIGURE 4, a cam 37 having a lobe 38 is secured to the rocker shaft 24 for unitary rotation therewith. Switches 39 and 40 are supported by suitable brackets, as shown, on opposite sides of the shaft 24 and each switch has an actuating member engageable with the lobe 38 of the cam. In the position of parts shown, that is, with arm 25 in the full line position, the actuating member of switch 39 has been moved by engagement with the lobe 38 of cam 37. It will be understood that when arm 25 is moved to its dot-dash position, lobe 38 will engage the actuating member of switch 40.

As shown schematically in FIGURE 5, the electrical circuit for the herein disclosed apparatus preferably comprises a D.C. control circuit together with a power circuit for the uncoiler drive motor 16 and an A.C. power circuit for the torque drive device 21 of the rolls 17 and for the receiving apparatus 12.

At the present time, D.C. control circuit 41 comprises a solenoid ACR connected between the power lines 42 and 43 through a normally open, spring-biased push button labeled "line start." Interposed in this circuit, as shown, is limit switch 40 and also one of two pair of contacts of limit switch 39. A shunt circuit 44 is provided around the "line start" button, current flow through this shunt circuit being controlled by means of normally open contacts ACR–1 which are adapted to be closed upon energization of the solenoid ACR.

A power circuit 45 between the power lines 42 and 43 for the armature of the uncoiler motor 16 passes through the other pair of contacts of limit switch 39 and also through one of two pair of contacts of a normally open, spring-biased push button labeled "jog." A shunt circuit 46 is provided about the pair of contacts of the "jog" switch which control the circuit 45, current flow through shunt circuit 46 being controlled by means of normally open contacts ACR–2 which are adapted to be closed upon energization of the solenoid ACR.

The field of the uncoiler motor 16 is wired in shunt with the armature thereof and the rheostat 34 is interposed in this field circuit for a purpose to be disclosed.

As previously mentioned, one of the pairs of contacts of the "jog" push button is in the power circuit 45. The other pair of contacts control current flow through a circuit 47 which passes through a solenoid BCR as shown.

The pinch roll torque drive unit 21 is connected across the alternating current power lines L1 and L2 and current flow through the drive unit 21 is controlled by either one of two normally open contacts ACR–3 and BCR–1. Contacts ACR–3 are adapted to be closed when solenoid ACR is energized and contacts BCR–1 are adapted to be closed when solenoid BCR is energized.

The receiving apparatus 12 may be driven by a drive unit, such as a motor 112 illustrated in FIGURE 5, and such motor is connected across the alternating current power lines L1 and L2 and current flow through the drive unit 112 is controlled by normally open contacts ACR–4 which are adapted to be closed when solenoid ACR is energized.

Operation of the embodiment thus far described is as follows: As shown in full lines in FIGURE 1, a coil of strip material is supported in position upon the uncoiler 10 and has a portion extending through the pass provided by the rolls 17. From the rolls 17, the strip extends over the rollers 27 of the arm 25 which is supported in the full line position by the fluid cylinder 28, and from the arm 25 the strip extends to the receiving apparatus 12. In this position of parts, the apparatus is ready to operate as soon as the "line start" button is pressed.

Referring now to FIGURE 5, it will be noted that the normally open pair of contacts of limit switch 39 which are in the control circuit 41 will be closed and the normally closed pair of contacts of this switch which are in the power circuit 45 will be open since arm 25 is in the full line position wherein limit switch 39 has been actuated by the lobe 38 of the cam 37. Additionally the normally closed contacts of limit switch 40 remain closed since the actuator of this switch is out of engagement with the lobe of the cam.

If the operator now momentarily presses the "line start" button, solenoid ACR will be energized and this will close contacts ACR–1, 2, 3 and 4. Circuit 41 will remain energized through solenoid ACR even after the "line start" button is released since the shunt circuit 44 around this button will be completed.

Closing of contacts ACR–2 in the shunt circuit 46 will not, at this instant, energize the power circuit 45 through the uncoiler motor 16 since the one pair of contacts of limit switch 39 which are in this circuit are held open.

Closing of contacts ACR–3 in the A.C. circuit will energize the torque drive unit 21 and the rolls 17 will thereupon exert a torque upon the portion of the strip between the rolls and the coil; however, since the uncoiler drive motor is not rotating as yet, the relatively light torque exerted by the drive unit 16 is insufficient to rotate the coil and pull material therefrom.

When the receiving apparatus starts operating as a result of the closing of contacts ACR–4 and begins to remove strip material from the loop in which the material is supported by the arm 25, the arm will move downwardly (in the position of parts shown in FIGURE 1) against the yieldable force exerted by the cylinder 28. It will be understood that arm 25 will preferably be biased by cylinder 28 toward the full line position with just sufficient force to slightly overbalance the weight of the arm and the weight of the loop of strip material supported thereby.

As the receiving apparatus 12 removes material from the loop supported by the arm 25, the arm will move downwardly from its full line position shown. Movement of the arm from this position will disengage cam lobe 38 from the actuator of limit switch 39 and this will open the contacts in the control circuit 41 and close the contacts in the power circuit 45.

Opening the contacts of switch 39 in control circuit 41 will not affect current flow in this circuit since shunt circuit 44 remains unbroken. However, the closing of the contacts of switch 39 in power circuit 45 will energize the uncoiler drive motor 16 through the shunt circuit 46 and thus effect rotation of the drive motor 16 to uncoil material.

Rotational speed of the drive motor 16 will be regulated by controlling flow of current through the field of this motor by means of the rheostat 34 which is connected for movement with arm 25 in the manner heretofore disclosed. The farther arm 25 is pulled down from its full line position, the more rheostat 34 will be rotated from the position shown in the diagram and the more resistance will be placed in circuit with the motor 16 and therefore the faster motor 16 will be rotated to uncoil material and thus prevent complete collapse of the loop.

It will be apparent that at any given normal operational speed of the receiving apparatus, the arm will seek a position wherein the material will be unwound from the coil at the same rate at which it is being drawn into the receiving apparatus. However, since the coil progressively decreases in diameter, the arm will gradually drop so as to gradually increase the rotational speed of the coil to maintain the given material removal rate.

During uncoiling of material from the coil, it is to be understood that the rolls 17, under the relatively constant

torque exerted by the drive unit **21**, will continually pull the material from the coil as fast as it is unwound therefrom and transfer it to the arm **25**.

When the receiving apparatus slows down, the arm **25** will immediately be biased (by the cylinder **28**) toward the full line position and this will rotate rheostat **34** to place less resistance in circuit with the motor **16** to reduce the speed of the motor and thus reduce the speed at which the material is being unwound from the coil. In the event the receiving apparatus stops, the arm will rise (under the urging of the cylinder **28**) until the arm reaches its full line position. At such time, lobe **38** of cam **37** will engage the actuator of switch **39** and this will open the contacts thereof in the power circuit **45** and thus interrupt this circuit and stop the uncoiler drive motor **16**. As soon as the receiving apparatus once again begins to remove material from the loop, the power circuit to the uncoiler motor will again be completed and the speed of the motor regulated by the rheostat as before.

In the event the receiving apparatus removes material from the loop at a speed faster than it can be replenished by the uncoiler, the arm **25** will be pulled to the dot-dash position against the urging of cylinder **28**. At this time, lobe **38** of cam **37** will engage the actuator of switch **40** and open the normally closed contacts in the control circuit **41**. This will de-energize solenoid ACR and thus open all of the circuits including the circuit which controls operation of the torque drive unit **21** and the circuit which controls operation of the receiving apparatus.

Starting the line once again after it has been stopped by the arm **25** being pulled to its dot-dash line position as described above or when threading material through the apparatus after a coil has been positioned on the uncoiler, requires that the arm be positioned once again in the full line position. This is accomplished by pressing the "jog" button.

When the "jog" button is pressed, uncoiler motor **16** will be energized through power circuit **45** since the contacts of limit switch **39** in this circuit are closed because the arm is not in its full line position. Additionally, the "jog" button will complete control circuit **47** and energize solenoid BCR. Energization of solenoid BCR will close contacts BCR–**1** in the A.C. circuit of the torque drive unit **21**. Accordingly, pressing the "jog" button will effect operation of the uncoiler and the torque unit so as to feed material to the arm **25**. As material is fed to the arm, cylinder **28** will raise the arm to the full line position until cam **37** once again engages the actuator of switch **39** to break power circuit **45** and thus stop the uncoiler motor. At this time, the apparatus is ready for operation as hereinbefore described as soon as the "line start" button is pressed.

In the embodiment of the invention shown in FIGURE 6, the arm **25** has been eliminated and the material fed directly to receiving apparatus **12***a* from the translating apparatus **11***a*. It will be understood that the uncoiler **10***a*, including related elements **13***a*, **14***a* and **16***a*, and the translating apparatus **11***a* including related elements **18***a*, **20***a* and **22***a* are similar to that disclosed heretofore and that the rolls of the translating apparatus are driven by a torque unit which is similar in all respects to that disclosed in the embodiment shown in FIGURES 1, 2 and 3.

In this embodiment, the material may be permitted to sag somewhat and form a loop intermediate the translating apparatus **11***a* and the receiving apparatus **12***a*. A dancer roll **48** or the like rides in the loop of material and this dancer roll may be connected to a rheostat **34***a* as shown.

The circuit diagram for this embodiment of the invention has not been shown since it is believed that a description of the operation of this embodiment will be sufficient to enable one skilled in the art and familiar with the embodiment shown and described hereinbefore to construct a suitable circuit.

With the parts in the position shown in FIGURE 6, operation of the receiving apparatus **12***a* will draw material from the loop and thus cause the dancer roll to rise. When the dancer roll rises, the uncoiler **10***a* will rotate and the torque drive unit **11***a* will feed material to the loop. Clearly, the higher dancer roll **48** is raised, the more the rheostat will be rotated and the faster the uncoiler will be driven in order to maintain the loop in the material. When the receiving apparatus **12***a* stops, the size of the loop in the material will increase, thus lowering the dancer roll until it reaches a position wherein it will stop rotation of the uncoiler in a manner which will readily be apparent.

The embodiment of the invention disclosed in FIGURE 7 is particularly, although not necessarily, adapted for use with an inclined press **49** wherein material may be fed to the press by gravity. In this embodiment, an uncoiler **10***b*, including related elements **13***b*, **14***b* and **16***b*, and translating apparatus **11***b*, including related elements **18***b* and **22***b*, each of which is similar to that disclosed in FIGURES 1, 2 and 3, is positioned above the press **49** for a purpose to be shown. However, translating apparatus **11***b* differs from apparatus **11** and is similar to **11***a* in that it does not utilize an arm to support the material in loop form.

As illustrated in FIGURE 7, the strip material issues from between the rolls of the translating apparatus **11***b* and slides downwardly into the press **49** along a guide table **50**. Secured to guide table **50** in any suitable manner is an angularly positioned wall **51** for a purpose to be shown, it being understood that the portion of wall **51** adjoining guide table **50** is spaced apart from the table a sufficient distance so as to provide for passage of the strip material therebetween.

In the position of parts shown and for a purpose which will later be described in detail, the upper portion of wall **51** supports a pair of spaced-apart contact members **52** which are electrically insulated from each other and which extend toward the guide table **50**.

Means are provided for selectively clamping the strip material against the guide table **50** adjacent the juxtaposed portions of the table and the wall **51** as shown. In the present embodiment, an elongated bar **53** extends transversely of the table and is pivotally mounted for movement toward and away from the table so as to selectively clamp the strip material therebetween. At the present time, a fluid cylinder **54** is employed to effect pivotal movement of the bar **53**.

Secured within the die (not shown) of the press **49** or located along the bed plate of the press is abutment means which locates the leading edge of the material relative to the die. At the present time, such abutment means comprises a pair of spaced-apart stop members **55** which are electrically insulated from each other for a purpose to be disclosed and which are adapted to be engaged with the leading edge of the material.

Referring now to FIGURE 8 wherein a schematic wiring diagram for the embodiment of the invention disclosed in FIGURE 7 is shown, a power circuit **56** connects the drive motor **16***b* of the uncoiler **10***b* across power lines **57** and **58**. Normally closed contacts CCR–**1** and DCR–**1** are interposed in the circuit **56**, as is a set of contact members **59** of a switch labelled "line start." In addition to the contact members **59**, the "line start" switch is provided with a set of contact members **60** which are interposed in a circuit **61** which branches out to provide parallel control circuits **62** and **63**.

As will be understood, "line start" switch is adapted to be manually operated (either by hand or by foot) and is constructed so that initial movement of the switch closes contact members **60** and further movement of the switch closes contact members **59**.

Referring once again to control circuits **62** and **63**, it will be seen that a solenoid ECR is in circuit **62** and that a solenoid valve is in control circuit **63**. The solenoid valve is of any conventional type, it being clear that ener-

gization and de-energization of the coil therein effects shifting of the valve to control flow of fluid to the clamping cylinder **54**. Also interposed in circuit **63** are normally closed contacts CCR–**2**.

Connected across the power lines **57** and **58** is a control circuit **64** which contains a solenoid CCR, stop members **55**, and normally open contacts ECR–**1**. A shunt circuit **65** is provided across the members **55** and normally open contacts CCR–**3** are interposed in this circuit. It is to be understood that energization of solenoid CCR effects operation of contacts CCR–**1**, **2** and **3** and that operation of contacts ECR–**1** is effected by energization of solenoid ECR.

Connected across the power lines **57** and **58** is control circuit **66** which contains a solenoid DCR, contact members **52**, and normally open contacts ECR–**2**. A shunt circuit **67** is provided across the contact members **52** and normally open contacts DCR–**3** are interposed in this circuit. Energization of solenoid DCR effects operation of contacts DCR–**1** and **2** and operation of contacts ECR–**2** is effected by energization of solenoid ECR.

After a coil of strip material has been position on the uncoiler **10***b* and secured thereto in the manner disclosed with respect to the uncoiler disclosed in FIGURES 1 and 2, the leading edge of the material will be fed between the rolls of the translating apparatus **11***b*. The torque drive of the apparatus **11***b* will then be energized to place the portion of the material between the uncoiler and the translating apparatus under tension. At this time, the line is ready to start as soon as the operator presses the "line start" button.

When the operator presses the "line start" button, contacts **60** will first be closed. This will cause current to flow through circuits **61** and **62** and also through circuit **63** since contacts CCR–**2** are closed. Current flow through circuit **63** will energize the solenoid valve and cause the fluid cylinder **54** to shift the bar **53** away from the table **50**. Current flow through circuit **62** will energize solenoid ECR and close contacts ECR–**1** in circuit **64** and contacts ECR–**2** in circuit **66**. However, no current will flow through circuits **64** and **66** since they still remain open.

Further movement of the "line start" button will close contacts **59** while still holding contacts **60** closed. Closing of contacts **59** will effect current flow through power circuit **56** since the contacts CCR–**1** and DCR–**1** are closed. This will energize the drive motor **16***b* of the uncoiler **10***b* and effect rotation of the coil and the unwinding of strip material therefrom.

As the material is unwound from the coil and fed to the guide table **50**, it will slide down along the table, beneath the clamping bar **53**, and into the die (not shown) of the press **49**. When the leading edge of the material engages the spaced-apart stop members **55**, the circuit **64** will be completed. Completion of circuit **64** will energize solenoid CCR and close contacts CCR–**3** in shunt circuit **65**, and open contacts CCR–**2** in circuit **63** and contacts CCR–**1** in power circuit **56**.

It will be clear that interruption of circuit **63** will de-energize the solenoid valve and cause the cylinder **54** to shift the bar **53** so as to clamp the material against the guide table **50**. Moreover, interruption of power circuit **56** will stop operation of the uncoiler **10***b*. It will be noted that shunt circuit **65** will hold solenoid CCR energized even though the leading edge of the strip material establishes only a momentary contact between the stop members **55**.

Even though uncoiler motor **16***b* has been de-energized and even though a break may be employed, it will be understood that the uncoiler may rotate a slight amount until it comes to rest. Accordingly, any material which is unwound from the coil after the bar **53** has clamped the material against the guide table **50** will be accumulated in a loop adjacent the wall **51**.

With the material in the die of the press **49**, a single stroke operation of the press may be initiated. Operation of the press may be initiated by the operator in any conventional manner such as by a suitable switch (not shown).

However, if desired and as shown in FIGURE 9, press operation may be initiated automatically by connecting the drive apparatus of the press across power lines **68** and **69** through normally open contacts CCR–**4** which are adapted to be closed when solenoid CCR is energized. Accordingly, if the circuit shown in FIGURE 9 is employed, the press will operate as soon as the leading edge of the strip material engages the stop members **55** and completes circuit **64**.

After the press **49** has completed a single stroke and has been stopped by any of the usual means employed for this purpose, the operator will release the "line start" button if he has not already done so. If the operator fails to release the button, solenoid ECR will remain energized and this will keep contacts ECR–**1** and ECR–**2** closed so that solenoid CCR will remain energized and this will result in contacts CCR–**2** holding circuit **63** open and contacts CCR–**1** holding circuit **56** open so that the clamp bar **53** will not release and uncoiler motor **16***b* will not be energized.

When the operator releases the "line start" button, solenoid ECR will be de-energized and contacts ECR–**1** and ECR–**2** will return to their normally open positions. This will de-energize solenoid CCR and open contacts CCR–**1**, **2**, **3** and **4**. If the operator now presses once again on the "line start" button, the circuit will once again be completed through the contacts **60** to effect movement of the bar **53** and unclamping of the material.

When the material is unclamped, any material stored in the loop adjacent the wall **51** will slide down the guide table and into the die of the press. In the event sufficient material has been stored to enable the leading edge of the material to engage the stop pins **55**, another cycle of the press may be initiated without pressing the "line start" button sufficiently to energize the uncoiler motor. However, if sufficient material has not been stored in the loop to enable the leading edge to engage the stop pins **55**, it will be necessary for the operator to further press the "line start" button to close contacts **59** and thus initiate operation of the uncoiler in the manner heretofore described.

The operation of circuit **66** and its associated parts have not been described in detail; however, this circuit is in parallel with circuit **64** and operates in a similar manner but only under certain unusual conditions. If for some reason circuit **64** fails to operate properly to shut off the uncoiler motor **16***b*, a sufficiently large loop of material will accumulate adjacent the wall **51** to complete a circuit through the contacts **52**. This would energize solenoid DCR, close contacts DCR–**2** in holding circuit **67** and open contacts DCR–**1** in respective circuit **56**. Clearly, this would stop the uncoiler **10***b* in the manner heretofore described with respect to circuit **64**.

With reference now to the embodiment of the invention seen in FIGURE 10 wherein corresponding parts are identified with the same reference characters as before but with the suffix "*c*" added, it is to be understood that whenever tenuous material must be fed through a roll pass, the introduction of the leading end of each length of material through such pass is somewhat time-consuming and potentially dangerous. By eliminating the necessity of threading the material through the translating apparatus **11***c*, the embodiment seen in FIGURE 10 is much safer to operate and saves considerable down-time whenever a new coil of material is mounted upon the arbor **13***c* for unwinding purposes.

In this embodiment, but a single roll **17***c* is employed in the translating apparatus **11***c* rather than the pair of rolls heretofore disclosed. Such roll will, of course, be rotated by a torque drive device similar to that disclosed in the previously described embodiments. In addition to the

advantage of eliminating the roll pass, the use of a single roll results in less inertia of the moving parts of the translating device thus making it much more responsive to variations in the rate of material discharge from the coil.

While at first glance it would appear that a single roll would have insufficient frictional engagement with the material to effect movement thereof, it has been found that if roll **17***c* is magnetic, and also if the roll periphery provides a high-friction surface, sufficient frictional engagement between the roll and the material will be obtained to maintain the strip portion between the roll and the coil under tension and to transfer the material to the loop formation as the coil is rotated. Obviously, the embodiment seen in FIGURE 10 can only be used when the material being unwound is magnetically permeable; however, the invention contemplates other arrangements whereby the material is urged to frictional engagement with a single roll. For example, a continuous air blast might well be employed for this purpose.

Although any suitable magnetic roll can be employed in the embodiment seen in FIGURE 10, it is preferable at the present time to employ a roll covered with magnetic, rubber-like material **70**. This construction provides a roll whose magnetic attraction for the material is constant from end to end of the roll's material engaging force and further provides a high-friction, material-engaging roll periphery which minimizes slippage between the roll and the material.

A detailed description of operation of the embodiment seen in FIGURE 10 is believed to be unnecessary since this embodiment functions in the same manner as that disclosed in FIGURE 6. It will be noted, however, that when the leading end of a new coil of material is to be fed to the receiving apparatus, it is only necessary to lay such leading end upon the single roll **17***c* rather than feed it through a roll pass as was heretofore necessary.

In view of the foregoing it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that my invention is not limited thereto.

I claim:

1. Apparatus for unwinding tenuous material from a coil and for transferring the unwound material to receiving apparatus, comprising a rotatably mounted arbor insertable within the coil of material to be unwound for rotatably supporting the latter, drive means selectively operable to effect rotation of said arbor and consequently the material coil in a direction to unwind material therefrom, a rotatably mounted roll spaced from said arbor and frictionally engaged with a portion of material unwound from the coil, means operable when said arbor is rotating and also when said arbor is stationary to exert a predetermined torque tending to rotate said roll in a direction to tension the material portion extending between the coil and said roll, rotation of said roll effecting movement of the unwound material from said roll to a looped configuration adjacent the receiving apparatus, and means responsive to the size of the loop in the material for controlling operation of said drive means in accordance therewith.

2. The construction of claim 1 and further comprising means for urging the unwound material to frictional engagement with said roll.

3. The construction of claim 1 wherein the tenuous material is magnetically permeable and wherein magnetic means urges the unwound material to frictional engagement with said roll.

4. The construction of claim 1 wherein the tenuous material is magnetically permeable and wherein said roll is covered with magnetic rubber to urge the unwound material to frictional engagement with said roll and to provide a high-friction, material-engaging periphery on said roll which minimizes slippage between the latter and said material.

5. Apparatus for unwinding tenuous, magnetically permeable material from a coil and for transferring the unwound material to receiving apparatus, comprising a rotatably mounted arbor insertable within the coil of material to be unwound for rotatably supporting the latter, drive means selectively operable to effect rotation of said arbor and consequently the material coil in a direction to unwind material therefrom, a rotatably mounted, magnetic roll spaced from said arbor and frictionally engaged with a portion of material unwound from the coil, means operable when said arbor is rotating and also when said arbor is stationary to exert a predetermined torque tending to rotate said roll in a direction to tension the material portion extending between the coil and said roll, rotation of said roll effecting movement of the unwound material from said roll to a looped configuration adjacent the receiving apparatus, and means responsive to the size of the loop in the material for controlling operation of said drive means in accordance therewith.

6. The construction of claim 5 wherein the material-engaging periphery of said roll provides a high-friction surface to minimize slippage between said roll and said material.

7. Apparatus for unwinding tenuous material from a coil and for transferring the unwound material to receiving apparatus, comprising a rotatably mounted arbor insertable within the coil of material to be unwound for rotatably supporting the latter, drive means selectively operable to effect rotation of said arbor and consequently the material coil in a direction to unwind material therefrom, a pair of juxtaposed, rotatably mounted rolls providing a pass for the material unwound from the coil, means operable when said arbor is rotating and also when said arbor is stationary to exert a predetermined torque tending to rotate one of the rolls of said pair in a direction to tension the material portion extending between the coil and said pass, rotation of said rolls effecting movement of the material from said pass to a looped configuration adjacent the receiving apparatus, and means responsive to the size of the loop in the material for controlling operation of said drive means in accordance therewith.

8. The construction of claim 7 wherein said drive means is selectively operable to rotate the coil at various speeds and wherein said means responsive to the size of the loop in the material affects operation of said drive means and consequent rotation of the coil at relatively high speed when the material loop is relatively small, at relatively low speed when the material loop is relatively large, and at an intermediate speed when the material loop is of intermediate size.

9. The construction of claim 7 wherein the loop in the material extends upwardly and wherein means underlies and supports the loop with substantially only that amount of force necessary to overcome the weight of the material in the loop.

10. The construction of claim 9 wherein the means underlying and supporting the loop comprises a plurality of rollers spaced longitudinally of the material and arranged in an arcuate path.

11. Apparatus for unwinding tenuous material from a coil and for transferring the unwound material to receiving apparatus, comprising a rotatably mounted arbor insertable within the coil of material to be unwound for rotatably supporting the latter, drive means selectively operable to effect rotation of said arbor and consequently the material coil in a direction to unwind material therefrom, a rotatably mounted roll spaced from said arbor and frictionally engaged with a portion of material unwound from the coil, means operable when said arbor

is rotating and also when said arbor is stationary to exert a predetermined torque tending to rotate said roll in a direction to tension the material portion extending between the coil and said roll, rotation of said roll effecting movement of unwound material from said roll to the receiving apparatus, and means intermediate said roll and the receiving apparatus for selectively clamping the material against movement toward the latter.

12. The construction of claim 11 and further comprising means responsive to the position of the material relative to the receiving apparatus for controlling operation of said clamping means and said drive means.

13. The construction of claim 11 and further comprising means responsive to the length of material intermediate said roll and said clamping means for controlling operation of said drive means in accordance therewith.

14. Apparatus for unwinding tenuous material from a coil and for transferring the unwound material to receiving apparatus, comprising a rotatably mounted arbor insertable within the coil of material to be unwound for rotatably supporting the latter, drive means selectively operable to effect rotation of said arbor and consequently the material coil in a direction to unwind material therefrom, a rotatably mounted roll spaced from said arbor and frictionally engaged with a portion of material unwound from the coil, said roll being spaced above the receiving apparatus to provide for gravitation of material therefrom to the receiving apparatus, means operable when said arbor is rotating and also when said arbor is stationary to exert a predetermined torque tending to rotate said roll in a direction to tension the material portion extending between the coil and said roll, and means intermediate said roll and the receiving apparatus for selectively clamping the material against gravitation toward the latter.

15. The construction of claim 14 wherein said clamping means is spaced from said roll to provide for storing therebetween a quantity of unwound material for release to the receiving apparatus.

16. The construction of claim 15 and further comprising means responsive to the quantity of stored material for controlling operation of said drive means in accordance therewith.

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