United States Patent [19]

Raasch

BEST AVAILABLE COPY

[11] **3,913,853**

[45] **Oct. 21, 1975**

[54] **AUTOMATIC WINDING MACHINE**

[75] Inventor: **Hans Raasch,** Rheydt, Germany

[73] Assignee: **W. Schlafhorst & Co., Maschinenfabrik,** Monchen-Gladbach, Germany

[22] Filed: **June 25, 1973**

[21] Appl. No.: **373,081**

[30] **Foreign Application Priority Data**

June 23, 1972 Germany 2230801

[52] **U.S. Cl.** ..... **242/35.5 R;** 242/35.5 A

[51] **Int. Cl.²** **B65H 54/20;** B65H 54/22; B65H 67/02

[58] **Field of Search** ..... 242/35.5 R, 35.5 A, 35.6 R

[56] **References Cited**

UNITED STATES PATENTS

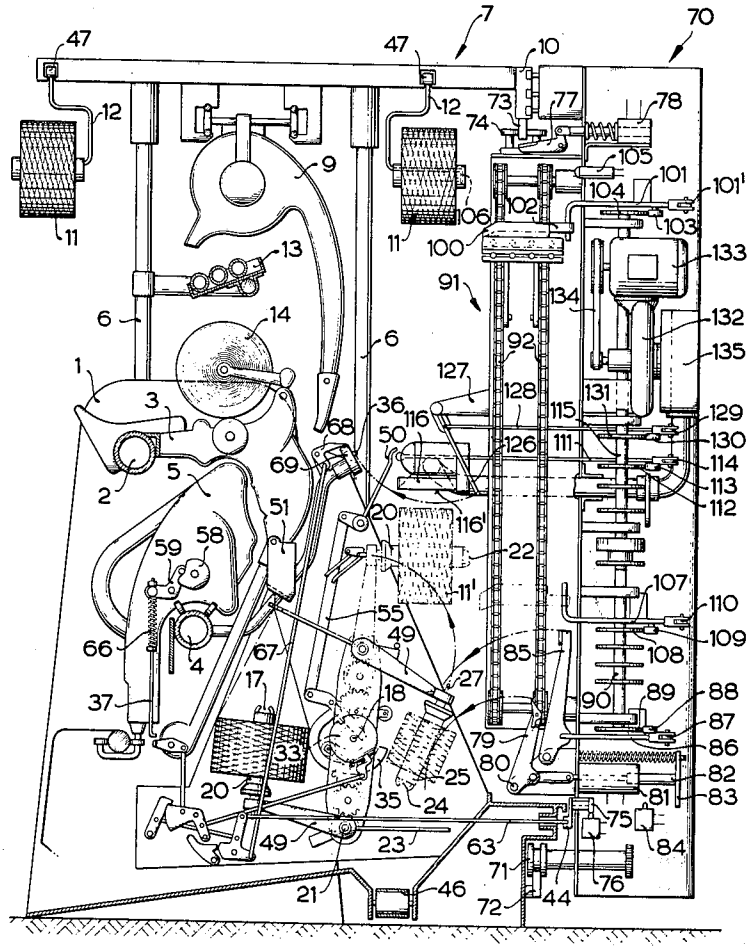
3,279,710	10/1966	Raasch	242/35.5 R
3,358,940	12/1967	Beckwith, Jr. et al.	242/35.5 R
3,368,766	2/1968	Livingston	242/35.5 R
3,421,705	1/1969	Benedict	242/35.5 R
3,480,128	11/1969	Brouwer et al.	242/35.5 R X
3,774,859	11/1973	Brouwer et al.	242/35.5 R

Primary Examiner—Stanley N. Gilreath
Attorney, Agent, or Firm—Herbert L. Lerner

[57] **ABSTRACT**

Automatic winding machine for large-volume supply coils that are delivered by a transporting device to respective winding stations of the machine whereat respective means for unwinding the supply coils are located includes a coil loading carriage drivable past the winding stations. The coil loading carriage has both conveyor means for transferring supply coils from the transporting device to the coil unwinding means of the respective winding stations, as well as make-ready means for readying incompletely unwound supply coils to immediately continue the unwinding operation.

9 Claims, 5 Drawing Figures



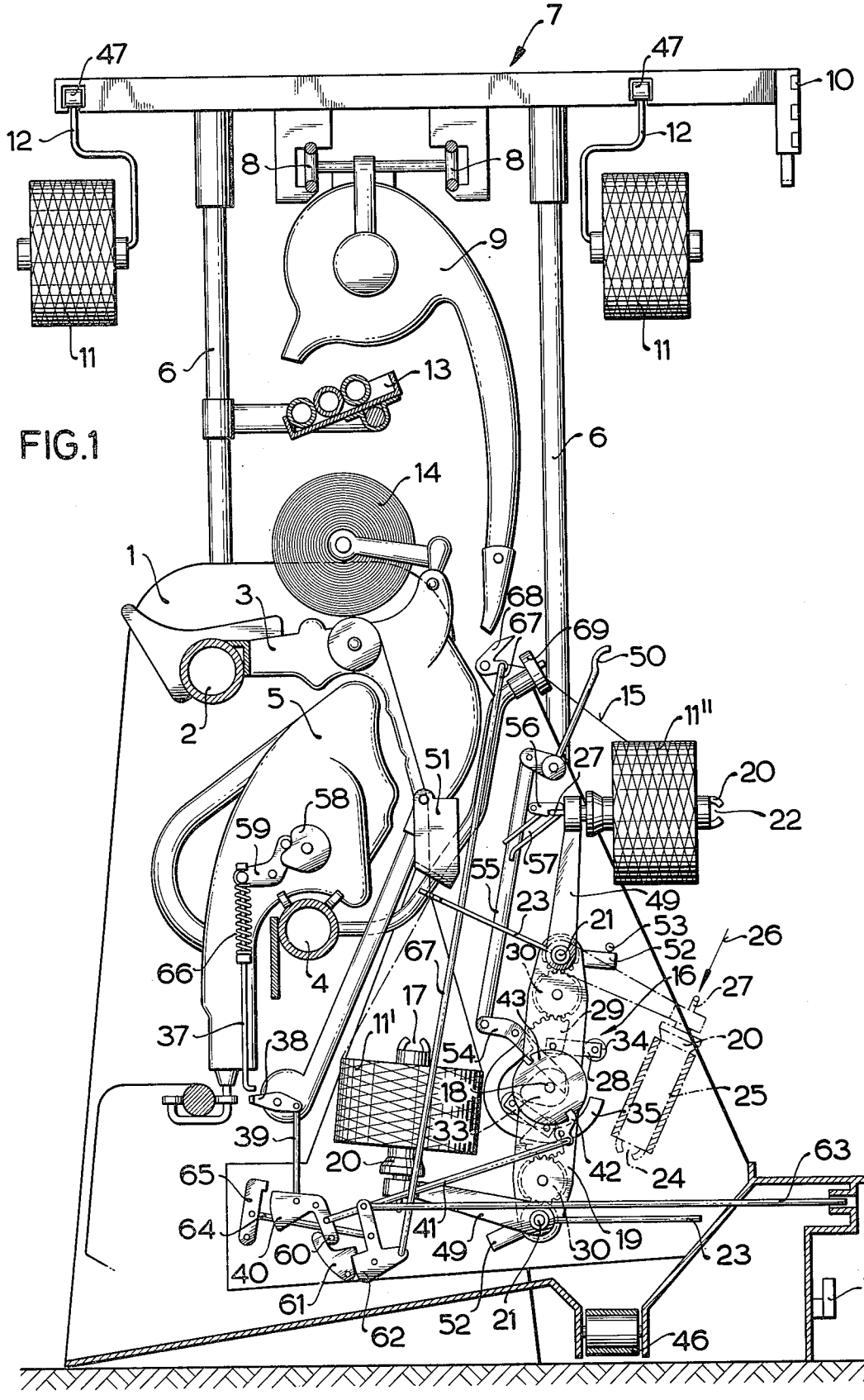

7
47
47
10
12
12
8
8
9
11
11
6
13
6
14
1
3
68
67
69
50
15
11''
56
27
20
22
5
2
51
58
59
55
57
49
23
21
53
52
26
66
4
67
30
16
27
17
43
29
37
38
11'
54
34
20
18
28
25
33
35
39
20
42
24
63
65
64
60
41
49
30
19
23
40
61
62
52
21
46
72

FIG.1

FIG. 2

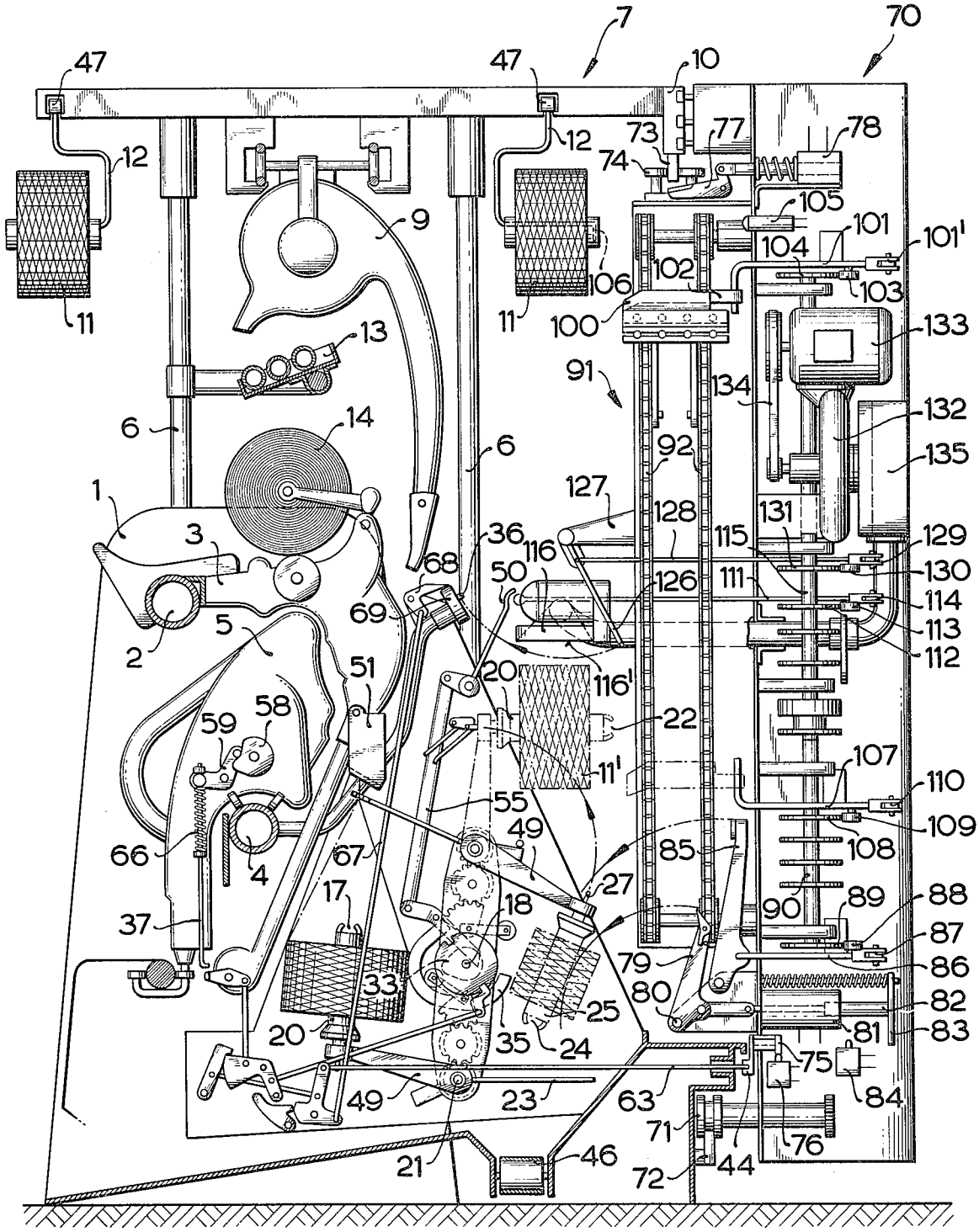

7
70
47
47
10
12
12
73
74
77
78
105
101
101'
104
102
106
103
9
11
11
100
133
13
91
134
132
6
14
6
92
135
1
127
128
131
3
36
116
115
129
68
50
126
111
130
69
114
5
113
2
112
51
20
116'
22
59
58
11'
107
110
55
49
109
66
67
85
108
4
27
17
18
90
89
88
37
87
79
86
33
80
82
25
20
35
24
81
83
75
49
23
63
84
71
21
46
76
72
44

FIG. 3

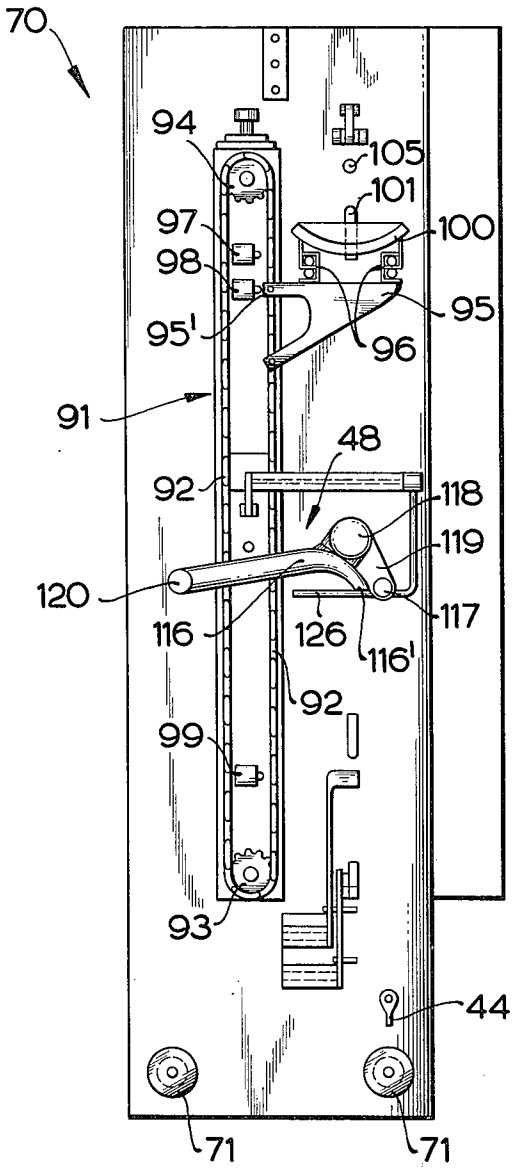
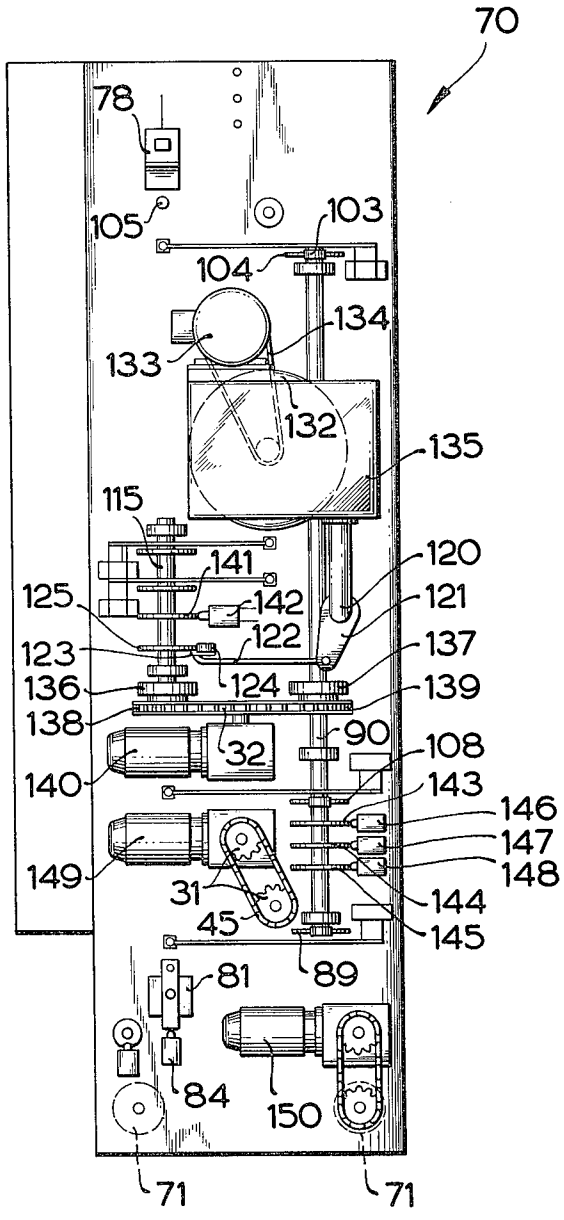

70
94
105
101
97
100
98
95
95'
96
91
48
92
118
119
120
117
116
126
116'
92
99
93
44
71
71

FIG. 4


70
78
105
103
104
134
133
132
135
115
141
120
125
142
121
123
122
137
136
124
139
138
90
32
108
140
143
146
147
148
149
31
144
45
145
89
81
84
150
71
71

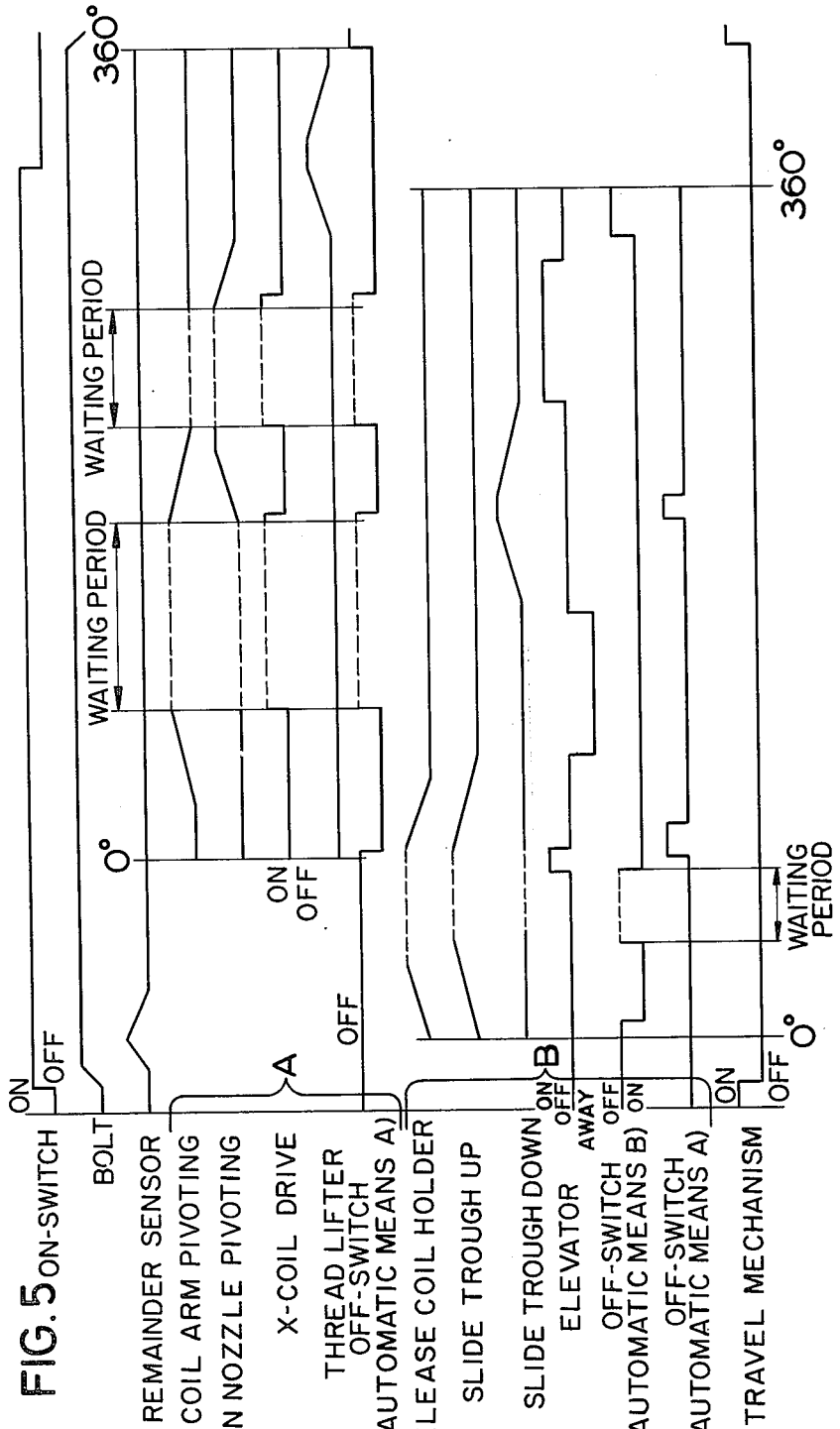

ON-SWITCH
ON
OFF
BOLT
0°
360°
WAITING PERIOD
WAITING PERIOD
REMAINDER SENSOR
COIL ARM PIVOTING
SUCTION NOZZLE PIVOTING
X-COIL DRIVE
ON
OFF
A
THREAD LIFTER OFF-SWITCH (AUTOMATIC MEANS A)
OFF
RELEASE COIL HOLDER
SLIDE TROUGH UP
SLIDE TROUGH DOWN
ON
OFF
B
ELEVATOR
AWAY
OFF-SWITCH (AUTOMATIC MEANS B)
OFF
ON
OFF-SWITCH (AUTOMATIC MEANS A)
ON
TRAVEL MECHANISM
OFF
0°
360°
WAITING PERIOD

FIG. 5

AUTOMATIC WINDING MACHINE

The invention relates to an automatic winding machine for large-volume supply coils that are to be unwound, and more particularly to such a machine wherein the supply coils are delivered by a transporting device to respective winding stations of the machine and are handled by a loading carriage that travels past the winding stations.

Machines of the foregoing general type have as their function the rewinding of large-volume supply coils, such as, for example, cross-wound coils or cheeses of OE spinning machines, colored coils or the like, so that they may be processed further. The supplying of the individual winding stations with supply coils should be automatic to unburden the servicing personnel and to minimize the down time during the coil supplying and loading operation.

In the German published, non-prosecuted patent application DOS No. **2,050,039** there has been disclosed a method and device, the use of which permits the loading of automatic winding machines of the type wherein a multiplicity of winding spindles are driven past a stationary readying, loading and knotting device. The method described in the aforementioned German published application and the device for carrying out the method are not applicable, however, for automatic winding machines wherein the winding stations are stationary.

Furthermore, in the German published, non-prosecuted patent application DOS No. **2 019 370,** there has been disclosed a device for loading spindles of textile machines wherein, by means of grippers or clamps, empty coil cores are removed, and large-volume coils are taken from a supply located above the machine and stuck onto the spindles. This heretofore known device is specially suited, however, for loading spindles of double twist-spinning machines and takes care of one spindle after the other, in succession, much like heretofore known types of doffers. Such a device is not suited for automatic winding machines because the individual winding station of automatic winding machines operate fully independently of one another, and their unwinding device require new supply coils at the most different times.

It is accordingly an object of the invention to provide an automatic winding machine with improved means for loading the supply coil unwinding positioning device thereof with large-volume supply coils while using a loading carriage that travels along the machine so as to significantly increase the production of the automatic winding machine.

With the foregoing and other objects in view, there is provided in accordance with the invention an automatic winding machine for large-volume supply coils that are delivered by a transporting device to respective winding stations of the machine whereat respective means for unwinding the supply coils are located, a coil loading carriage drivable past the winding stations, the coil loading carriage comprising both conveyor means for transferring supply coils from the transporting device to the coil unwinding means of the respective winding stations, as well as make-ready means for readying incompletely unwound supply coils to immediately continue the unwinding operation. In accordance with other features of the invention, the conveyor means comprises a receiving member, such as a sliding trough, for example, for directly receiving the supply coils from the transporting device.

The loading carriage is capable of traveling past a multiplicity of winding stations and represents the connecting link between the supply coils driven past by the transporting device above the winding stations, and the supply coil unwinding positioning device of an automatic winding machine that are provided with coil holders on which the supply coils are received. Every time that the supply coil unwinding positioning device has advanced an incompletely unwound supply coil or an empty coil core out of the unwinding position thereof and into the ejection position, a signal is emitted that causes the loading carriage to halt as it passes the respective winding station and to become actuated. Since the removal and transporting away of cores that are still wound present difficulties because of the great differences in diameter that have to be overcome and are, furthermore, uneconomical, it is desirable to leave an incompletely unwound supply coil in the respective supply coil unwinding positioning device to re-knot it and to further unwind it until it has been completely unwound.

In order to feed anew such a remainder coil to the winding process, in accordance with a further feature of the invention, the make-ready means is constructed for operating upon a supply coil located in a predetermined position in the coil unwinding means of the respective winding stations. In accordance with an especially advantageous feature of the invention, when the coil unwinding means of the respective winding stations have means for holding in ejection position a supply coil that has been at least partially unwound by the coil unwinding means, the loading carriage is provided with remainder sensing means for determining the winding condition of i.e., the amount of wound thread still remaining on, the supply coil in the ejection position of the respective coil unwinding means. By means of the remainder sensor, the loading carriage determines if an empty core or an incompletely unwound supply coil is located in the ejection position. If the remainder sensor determines the core is still wound, this wound core is swung into made-ready position and, thereafter, the broken thread end is searched for and then laid out at the winding station. In accordance with an additional feature of the invention, the loading carriage is provided with suction nozzle means for seeking the starting end of the thread carried by the supply coil that is located in the made-ready position of the respective coil unwinding means. In accordance with yet another feature of the invention, the loading carriage includes thread lifting means for laying out the thread starting end of the supply coil in the made-ready position so that it can be tied to the thread end of the take-up coil at the respective winding station. It is believed to be clear in view of the foregoing that a supply coil thus is always made ready for the unwinding operation within a winding station and not within the traveling loading carriage, and that the costly components of the readying device does not have to be at each winding station but rather only at one place, on the loading carriage.

If the remainder sensor has established, however, that the signal which causes the loading carriage to stop is attributed to a supply coil that has been emptied of its winding, the clamping members of the coil holder of the respective supply coil unwinding positioning device will then be released and the empty coil core removed.

Therefore, in accordance with a concomitant feature of the invention, the loading carriage is provided with pressure lever means mounted thereon for actuating the coil holder means to eject empty coil cores remaining after the respective supply coils have been unwound.

As mentioned hereinbefore, the conveyor means on the loading carriage for transferring the supply coils to winding stations comprise a receiving member that may be constructed as a sliding trough. In accordance with yet another feature of the invention, the sliding trough is horizontally and vertically displaceable. Since the loading carriage and the transporting device are movable in the same as well as opposite direction, care must be taken that the loading carriage always finds a new supply coil, when required. This is achievable in accordance with another feature of the invention wherein the loading carriage is provided with photo electric means for determining the presence of a supply coil to be transferred by the loading carriage from the transporting device to the coil unwinding means of the respective winding station. Further in accordance with the invention, the transporting devive is provided with registry means for the presence of a supply coil. Instead of a photo electric means, obviously also mechanical sensing devices can be used.

Since the unwinding time of large-volume supply coils is correspondingly long, while the time for the individual activities of the loading carriage is very short, however, relative thereto, a very large number of winding stations can be associated with one loading carriage. With automatic winding machines having stationary winding stations, frequently fifty winding stations may be assembled in one machine. The loading carriage is therefore definitely in a position to service many of such machines with, for example, a total of 100 to 200 or even more winding stations. It is accordingly advantageous if the path of the loading carriage along the winding machines is laid out so that, after traveling past all of the machines, a predetermined departure point is reached.

In the case where a pivoting or swiveling operation of the supply coil unwinding positioning device is released by a respective winding station before the loading carriage or even a member of the servicing personnel has brought a supply coil into the madeready position, the supply coil unwinding positioning device can be provided with a latching or bolting device which blocks the pivoting operation until the loading carriage or the servicing personnel release the latching or bolting device by laying out the thread starting end in readiness.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in automatic winding machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. **1** is a diagrammatic sectional view of an automatic winding machine with an unwinding device and empty core conveyor belt wherein one supply coil is shown in unwinding position and another in made-ready position;

FIG. **2** is a view similar to FIG. **1** of the automatic winding machine with a carriage for loading coils therein that are to be unwound, one of the supply coils being shown in unwinding position and an empty coil core or spool shown in ejection position;

FIG. **3** is an elevational view of the loading carriage as seen from the rear of the winding machine i.e., in a direction from the left-hand to the right-hand side of FIG. **2**;

FIG. **4** is a front elevational view of the loading carriage i.e., a view from the opposite side of FIG. **3**; and

FIG. **5** is a diagram of the movements of various components of the loading carriage.

Referring now to the drawing and first, particularly, to FIG. **1** thereof, there is shown therein an automatic winding machine having a lateral wall **1** with a mounting tube **2** on which a multiplicity of winding stations **3** are threadedly secured. A traveling knotting device **5** is mounted for reciprocating movement in a conventional manner on a support tube **4** also extending from the lateral wall **1.** A support frame **6** is also provided on the lateral wall **1** and carries a transport device **7** that is constructed as a circular or endless conveyer such as a chain conveyor, and can also be installed for use with several machines. Guides **47** in the conveyer device **7** are assembled with the runways **8** of a conventional blow-off device **9** and bus bars or live rails **10** for a coil loading carriage **70,** to be described hereinafter with respect to FIGS. **2, 3** and **4,** together with the support frame **6** thereof. Supply coils **11** that are to be unwound are stuck on hooks **12** that are displaced in the guides **47** along the winding machine. By means of the aforedescribed construction, monitoring of and possibly necessary engagement with the wind-up coil **14** as well as with the coil core magazine **13** is not hampered. A supply coil unwinding positioning device **16** located in the vicinity of the base of the machine corresponds to a device heretofore disclosed in application Ser. No. 244,445 of J. Rohner et al, filed Apr. 17, 1972 and assigned to the same assignee as that of the instant application, and, in the view of FIG. **1,** has a supply coil **11'** in suitable unwinding position **17** and another supply coil **11''** in made-ready position **22** for subsequent movement to the unwinding position **17.** Before a supply coil **11''** has been stuck onto the coil holder **20** by the coil supply carriage **70,** the coil holder **20** assumes the ejection position **24** shown in pattern after having been in the unwinding position **17.** The coil holder **20** is, respectively, brought, into the ejection position **24** with an empty coil core **25** when, in an exchange operation, a supply coil **11''** is swung from the made-ready position **22** thereof into the unwinding position **17.** In the ejection position **24,** an empty core **25** is able to be removed especially easily because it slides downwardly when the clamping elements of the coil holder **20** are loosened. Such a coil holder can be of the type desclosed in application Ser. No. 361,461, filed May 18, **1973,** of which applicant is one of the coinventors. In such a construction of the coil holder, by applying pressure in direction of the arrow **26** on the pin **27,** the clamping elements are loosened. The supply coil unwinding positioning device **16** shown in FIG. **1** differs

from the previously disclosed device of the aforementioned copending application Ser. No. 244,445 solely by the fact that the lay-out member **19** is double-armed. Each coil holder **20** can thus occupy the unwinding position **17** and two further positions, namely the ejection position **24** and the made-ready position **22**, the ejection position **24**, also at the exchange of a not yet fully unwound supply coil **11'** from the unwinding postion **17**, succeeding to the made-ready position **22**.

The coil holders **20** are articulatingly connected through coil arms **49** at the centers of rotation **21** to the lay-out arms **19**. Thread guiding members **23** are also pivotally mounted at the centers of rotation **21**. The thread guiding members **23** and the coil holder **20** are pivotable relative to one another, while the lay-out arms **19** are turned through their bifurcated spacing i.e., 180°, about the shaft **18**. This is necessary so that the components always assume the most advantageous position with respect to the neighboring machine parts, and the supply coil **11'** can adopt the position thereof optimal to a thread braking device **51**. The relative displacement of the coil arm **49** is effected by the movement of a cam lever **28** rotatably mounted in the lay-out arm **19**, the cam lever **28** being operatively connected through a toothed segment **29** and an intermediate gear **30** with the coil arm **49**. The pivoting of the coil arm **49** is controlled by the stationary cam discs **33** and **35** between which a roller **34** of the cam lever **28** is passed and, in this manner, the path of movement established by the cam discs **33** and **35** is transferred to the coil arm **49**. The thread guiding member **23** assumes an angle of about 90° to the lay-out arm **19** about the shaft **18** during the greatest part of the rotary movement of the lay-out arm **19**, and, in fact, under the action of a non-illustrated bending spring. Shortly before the supply coil **11'** assumes the position thereof shown in FIG. **1**, a lever **52** connected to the thread guiding member **23** runs up against a pin **53** that is fixed to the lateral wall **1**. The thread guiding member **23** is thereby pivoted so that it assumes an optimal position relative to the thread braking device **51** and simultaneously attains the required spacing from the supply coil **11'** so that a desired ballooning of the thread is achieved. As mentioned hereinbefore, the coil holder **20**, during the exchange into the made-ready position **22**, initially assumes the ejection position **24** shown in phantom. The position **24** is indeed advantageous for removing the empty coil core **25**, but not, however, for sticking a new supply coil onto the coil holder **22**. In order to facilitate the sticking of a new supply coil onto the coil holder **22**, therefore, the coil holder **20** is swung into the made-ready position **22** and accordingly disposed horizontally.

In the ejection position **24**, the roller **34** of the cam lever **28** engages the inner cam disc **33**. A lever **54**, which engages the roller **34**, is seated adjacent the cam disc **33**. Through the push rod **55**, the lever **54** can be turned by pivoting of the lever **50** so that the lever **54** lifts the roller **34**. The coil holder **20** is thereby pivoted so that it is oriented horizontally. A pin **27**, that is connected to the coil holder **20**, is then held fast by a pawl or catch **56**. When a new supply coil **11''** is stuck onto the coil holder **22** and an exchange operation occurs, the pin **27**, which has a square-off ends, runs therewith along the length of a guide **57**, whereby the coil arm **49** swings back again so far that the roller **34** engages the cam disc **33**.

At the absence of a thread in the thread braking device **51**, the travling knotting device **5** is caused to stop at the respective winding station and to start the exchange operation for the supply coil **11'**. A cam disc **58** in the traveling knotter **5** is set in rotary motion and pivots the cam lever **59** counterclockwise, as viewed in FIG. **1**. Consequently, a push rod **37** is forced downwardly, and a bell-crank **38** is turned counterclockwise, as viewed in FIG. **1**. Due to this pivoting movement, through a rod **39**, a pivoting fishplate **40**, a further rod **41** as well as a pawl lever **42** are actuated, the latter thereby freeing a blocking disc **43** so that it can rotate to the next stop position.

With the pivoting of the fishplate **40**, a pin **60** firmly connected thereto engages the pawl or latch **61** and turns it counterclockwise, as viewed in FIG. **1**. Accordingly, the nose of the pawl or latch **61** frees a control lever **62** which is pivotable clockwise through the biasing action of a non-illustrated torsion spring. Due to this movement, a control lever **63** is caused to slide toward the right-hand side of FIG. **1**. The end of the control lever **63** then projects somewhat out of the contour of the lateral wall **1** so that the coil loading carriage **70**, when passing by, receives the signal to become operational at the respective winding station. With the pivoting movement of the control lever **62**, a blocking lever **65** is turned so far clockwise, as a result of the operative connection of a rod **64** with the control lever **62**, that the nose of the blocking lever **65** slides over the contour of the pivoting fishplate **40**. Movement of the pivoting fishplate **40** in clockwise direction is thereby blocked. A renewed demand of the traveling knotter **5** will not lead to an introduction of the exchange operation because the blocking lever **65** blocks the movement of the pivoting fishplate **40**, and the movement of the cam lever **59** can be absorbed by the compression spring **66**. Finally, the pivoting movement of the control lever **62**, through the operative connection thereof with a rod **67**, has brought the bell-crank **68** also into engagement with a valve plate **69** that is subjected to a flow of suction air or vacuum. It a starting end **15** of the thread of a supply coil **11''** that is to be unwound, which is located in the made-ready position **22**, is laid out at the valve plate **69** by the coil loading carriage **70** or by one of the montioring personnel, while the valve plate **69** is pivoted and the thread starting end **15** is surrendered to an air flow, the bell-crank **68** is thus also simultaneously pivoted counterclockwise. Accordingly, the control leverl **62** again pivots so far counterclockwise that the pawl or latch **61** can firmly retain the control lever **62**. Through the turning of the control leverl **62**, the blocking lever **65** is swung into its starting position so that a new exchange operation at the supply coil unwinding positioning device **16** can now take place. In this manner, assurance is provided that the traveling knotter **5** will introduce a further exchange operation only if the thread starting end **15** of a supply coil **11''** held ready in the made-ready postion is laid out at the valve plate **69**. On the other hand, the signal for placing the coil loading carriage **70** in demand is again reset if the thread staring end **15** is laid out in readiness by the monitoring personnel.

From FIG. **2** it is apparent how the coil loading carriage **70** can travel past the winding stations **3**. The loading carriage **70** runs with two guide rollers **71** on

a support rail **72** that is fastened to the lateral wall **1**. A slide rail **73** is secured to the electrically charged rail **10**, the coil loading carriage **70** being guided by two additional guide rollers **74** along the slide rail **73**. The coil loading carriage **70** is formed of various members which perform the following functions: A control vane or wing **44**, at start-up, is swung so far against the projecting end of the control rod **63** that a control disc **75** connected to the control vane **44** actuates a switch **76**. A bolt lever **77**, through its operative connection with a pull magnet **78**, can be povited clockwise, as viewed in FIG. **2**, so that the point of the bolt lever **77** clicks into a notch formed in the guide rail **73**, the coil loading carriage **70** thereby being positioned at the respective winding station **3**. A remainder sensor **79** described a circular arc tangent to the outer diameter of the core **25** about a center of rotation **80**. A thrust magnet **81** pivots the remainder sensor **70**. If the armature **82** of the thrust magent **81** can carry out a complete stroke, a strap **83** secured to the armature **82** actuates a switch **84**. This is a signal that the coil core **25** is unwound and must be exchanged. If the thrust magent **81**, on the other hand, should not be able to effect its complete stroke because the remainder sensor **79** is held fast by a thread winding on the core **25**, the switch **84** is then not actuated. A pressure leverl **85** is applied to the pin **27** of the coil holder **20** when the pressure lever **85** is pivoted counterclockwise, as viewed in FIG. **2**. As the pressure leverl **85** is further pivoted, the pin **27** is displaced axially and the clamping action of the coil holder **20** is terminated. The core **25** can then slip off the coil holder **20**. The pressure leverl **85** is actuated through a rod **86** which is articulatingly connected to a cam lever **87** that is controlled by a cam disc **89** through a cam roller **88**, the cam disc **89** being, in turn, secured on a shaft **90**.

All of the control cams required for controlling the supply coil exchange operation are mounted on the shaft **90**. This control group is referred to hereinafter as Automatic Means B. The control of those members that are necessary for pivoting the coil holder **20** into the made-ready position **22** and for seeking and laying out in readiness the thread starting end **15** is effected by a control group referred to hereinafter as Automatic Means A. This subdivision is necessary so that two different control programs can be carried out, as the case may be, if a new supply coil **11** must be made ready for an empty core **25** or if only the coil holder **20** must be pivoted when an incompletely unwound supply coil has been brought into the ejection position **24** and only the thread starting end **15** must be newly laid out in readiness.

The coil loading carriage **70** is provided with a conveyer system formed essentially of an elevator **91** which functions to remove a supply coil **11** from the hook **12** of the transport or conveyor device **7** and lower it to the level of the horizontally disposed coil holder **20**, at which the supply coil **11** can be slipped onto the coil holder **20**.

As shown in FIG. **3**, two chain members **92** travel over reversing rollers **93** and **94**. A console **95** is fastened to a respective run of each of the chain members **92**, the console **95** in turn carrying a conventional telescopic guide **96** such as is used, for example, in office furniture, such as file cabinets, in order to be able to pull out drawers as far as possible. A receiving member formed of a sliding trough **100**, which receives a supply coil **11**, is connected to the telescopic guide **96**. Terminal switches **97**, **98** and **99** are actuated by a cam **95'** fastened to the console **95** just as the cam **95'** passes by the respective switches **97**, **98** and **99**. In FIGS. **2** and **3**, the elevator **91** is shown in a position which guarantees a predetermined level for the sliding trough **100** when the terminal switch **98** is switched off, and which permits the shifting thereof toward the left-hand side of FIG. **2** without striking a supply coil **11** that is being carried past by the transport or conveyer device **7**. The shifting movement is effected by a push rod **101** clearly shown in FIG. **2**. As the elevator **91** travels upwardly, an eye **102** secured to the sliding trough **100** slips over the bent part of the push rod **101** and forms a connection therewith. The push rod **101** is controlled by a cam lever **101'** through a cam roller **103** of a cam disc **104**. The cam disc **104** is mounted on the shaft **90** and forms part of the Automatic means B. A conventional photo electric means then gives a signal when a supply coil **11** is located precisely above the driven-out sliding trough **100**. In order for this signal to be produced, the hooks **12** of the transport or conveyer device **7** have tiltable reflection platelets **106** at the ends thereof, which reflect the light emitted from the light box **105** only when a supply coil **11** is stuck onto the hooks **12**. If the signal occurs, the sliding trough **100** can be be driven upwardly until the terminal switch **97** is switched on. The supply coil **11** is then received by the sliding trough **100** and can thereafter be removed from the hook **12** by a longitudinal movement of the push rod **101**. The elevator **91** then drives the sliding trough **100** down so far that the switch **99** is actuated. The sliding trough **100** holds the supply coil **11** then so that the middle point thereof coincides with the longitudinal axis of the coil holder **20**. As the sliding trough **100** has traveled downwardly, the eye **102** has slipped over the hook of the push rod **107**. By means of the push rod **107**, and due to the action of the cam disc **108**, the cam roller **109** and the cam lever **110**, the sliding trough **100** is displaced toward the left-hand side of FIG. **2** and the supply coil **11** is stuck onto the coil holder **20**. The previously described coil holder **20** is, moreover, made so that a supply coil through central pressure is able to be slipped onto the coil holder **20** without having to release the clamping. When a supply coil has been fully slid onto the coil holder **20**, the clamping is again effective, and the sliding trough **100** can be withdrawn by means of the push rod **107** without also taking the supply coil back therewith.

Before a supply coil **11** is stuck onto a coil holder **20**, the latter must be brought into horizontal position. As described hereinbefore, this is effected through pivoting the lever **50** counterclockwise. The bullet-shaped end of the push rod **111** engages, for this purpose, in a collet of the lever **50**. Shifting of the push rod **111** toward the left-hand side, as viewed in FIG. **2** is effected by the action of the cam disc **112** through the cam roller **113** and the cam lever **114**. The cam disc **112** is secured on the shaft **115** and forms part of the Automatic Means A. The division of all of the cam discs into both Automatic Means A and B is especially clearly apparent in FIG. **4**.

The thread starting end **15** of a made-ready supply coil **11** is sought out by placing the supply coil **11''** in rotation and a suction nozzle **116** is slid so close to the periphery of the supply coil **11''** that the suction air flow seizes the thread end. It is recognizable in FIG. **3**

that the suction nozzle **116**, in an advantageous manner, is assemblable together with a drive roller **117**, a drive motor **118** and an intermediate transmission **119** into a readying device **48**. The suction nozzle **116** can be swung so far downwardly about the axis **120** thereof until the drive roller **117** engages the periphery of a supply coil **11''**.

It is clear from FIG. **4** that a lever **121** is connected to the suction nozzle axis **120**. The cam disc **125** can control the lowering and lifting of the suction nozzle **116** through the rod **122**, the cam lever **123** and the cam roller **124**. The cam disc **125** is securely mounted on the shaft **115** and forms part of the Automatic Means A.

One can tell from FIGS. **2** and **4** that the required suction air is produced by a blower or fan **132** which is driven by a motor **133** through a drive belt **134**. Dust and thread remainders are collected in a filter box **135**. At a suitable location between the suction nozzle mouth **116'** and the suction nozzle axis **120**, the suction nozzle **116** is provided with a conventional non-illustrated photo electric means which emits a signal when the thread to which suction has been applied has been sufficiently unwound and sucked in. The moment this condition is reached, the driving movement for the suply coil can be turned off. The thread starting end of a supply coil **11''** that is seized by the suction nozzle **116** is drawn or pulled from a thread lifter **126** to the valve plate **69**. As shown in FIG. **2**, the thread lifter **126** is rotatably mounted in a bearing bracket **127**. The thread lifter **126** is controlled by a cam disc **131** through a push rod **128**, a cam lever **129** and a cam roller. The cam disc **131** is connected to the shaft **115**. The center of rotation of the thread lifter **126** in the bearing bracket **127** is selected so that the circular arc described by the thread lifter **126** is tangent to the surface of the valve plate **69** and intersects the pin **36** thereon. Thereby, the valve plate **69** is pivoted away, a suction opening for the thread is exposed and also the bell crank **68** is pivoted. On its path to the valve plate **69**, the thread lifter **126** seizes the thread running from the supply coil **11''** to the suction nozzle mouth **116'** and draws it as a loop to the valve plate **69**. Inasmuch as only a specific thread length is sucked into the suction nozzle **116**, the end of the thread is free when the thread lifter **126** opens the valve plate **69**, and then be readily subjected to suction.

It is furthermore apparent from FIG. **4**, that an electromagnetic clutch or coupling **136** is securely mounted on the shaft **115** of the Automatic Means A, and an electromagnetic clutch or coupling **137** is securely mounted on the shaft **90** of the Automatic Means B. Chain wheels or sprockets **138** and **139** are threadedly secured to the two electromagnetic clutches or couplings **136** and **137** and, through a drive chain **32**, are connected to one another. The drive chain **32** is driven by the transmission motor **140**. By means of both electromagnetic clutches **136** and **137**, the Automatic Means A or B can be switched on, depending upon the respective course of programming. The cam disc **141** on the shaft **115** actuates the shut-off switch **142** which switches off the Automatic Means A at specific instants of time. Furthermore, the cam discs **143**, 144 and **145**, which actuate the switches **146**, **147** and **148** are securely mounted on the shaft **90**. The switch **146** shuts off the Automatic Means B at specific instants of time. The switch **147** switches on the elevator **91**, and the switch **148** switches on the Automatic Means A. The transmission motor **149** drives the elevator **91** through the chain sprockets **31** and the chain **45**. The transmission **150** serves to drive the travel mechanism of the coil supply carriage **70**.

If an empty coil core **25** is stuck onto the coil holder **20** in the ejection position, as is seen in the displacement diagram of FIG. **5**, the course of movement or displacement at the coil loading carriage **70** is as folows: The instant the coil loading carriage **70** has reached a respective winding station, the switch vane or wing **44** is pivoted when brought into engagement with the switch rod **63**, and the switch **76** is actuated. Consequently, the transmission **150** for the travel mechanism of the loading carriage **70** is switched off and the transmission motor **140** for the drive of the Automatic Means A and B as well as the motor **133** for the blower or fan **132** is switched on. Simultaneously, the pull magnet **78** is electrically energized so that the latch or bolt lever **77** is receivable in a notch formed in the guide rail **73**. WIth slight delay, the push magnet **81** is also electrically energized so that the remainder sensor **79** is pivoted. Since the core **25** on the coil holder **20** is empty, the push magnet **81** can then perform the complete stroke thereof and actuates the switch **84**. The electromagnetic clutch **137** of the Automatic Means B is thereby switched on, and the shaft **90** starts to run. Then, the pressure lever **85** for loosening the clamping action of the coil holder **20** pivots, and the empty coil core **25** falls onto a conveyor belt **46**. Simultaneously, the push rod **101** pushes the sliding trough **100** so far that it is located beneath the conveyor or transport device **7**. Thereafter, the Automatic Means B is again switched off by the switch **146**. A waiting period for the Automatic Means B then occurs until a signal is emitted from the photo electric means **105** which indicates that a supply coil **11** is located exactly above the sliding trough **100**. With this signal, the elevator **91** is also switched on and therewith travels so high that the terminal switch **97** can be actuated. Moreover, the Automatic Means B again starts to run so that then the push rod **101** can withdraw the sliding trough **100** with the supply coil **11** received therein. Simultaneously, the pressure lever **85** is swung back. In the interim, the switch **148** has become actuated so that the electromagnetic clutch **136** has also been electrically energized and the Automatic Means A starts to run. The push rod **11** then presses against the lever **50** so that the coil arm **49** is pivoted and the coil holder **20** is brought into horizontal position. After the push rod **101** has completely withdrawn the sliding trough **100**, the elevator **91** is switched on and the sliding trough **100** is lowered such a distance that it actuates the terminal switch **98**. Meanwhile, the Automatic Means A is switched off for a predetermined waiting period by the shut-off switch **142**. The lowered sliding trough **100** becomes couples with the push rod **107** and is pushed by the latter against the coil holder **20**. When the supply coil **11** is stuck onto the coil holder **20**, the Automatic Means A is again switched on through the switch **148**. The push rod **111** is withdrawn and, simultaneously, the suction nozzle **116** is lowered. The withdrawal of the sliding trough **100** through the Automatic Means B is superimposed timewise on the just-mentioned movements of the Automatic Means A. If the push rod **111** has reached its end position, the Automatic Means A is switched off anew for a waiting period by the shut-off

switch **142.** This switching-off pulse is employed for switching on the drive motor **118** for the drive roller **117** at the suction nozzle **116.** The supply coil **11''** that has been stuck onto the coil holder **20** then turns, and the thread starting end **15** is then subjected to suction. In the interim, the switch **147** is actuated by the Automatic Means B, and the elevator **91** again runs upwardly until the terminal switch **97** is switched on. The cam disc packet of the Automatic Means B performs the remainder of the total rotation and is then finally switched off by the swtich **146.** When the suction nozzle **116** has sucked in the thread starting end far enough, a photo electric means emits a signal, as mentioned hereinbefore. The rotary motion for the supply coil that had been carried out by the motor **118** is thereby shut off, and the Automatic Means A again starts to run. Thereafter, the suction nozzle **116** lifted off or withdrawn, and the thread lifter **126** swings by beneath the suction nozzle mouth **116'**, seizes the sucked-in thread and draws it as a loop toward the valve plate **69.** At the end of its swing, the thread lifter **126** strikes against the pin **36** of the valve plate **69** and opens the latter. The thread is then completely withdrawn from the suction nozzle **116** and is seized by the suction air flow at the valve plate **69** and sucked in through the swing of the valve plate **69,** the bell crank **68** is pivoted with the control lever **62** counterclockwise, and the control rod **63** is withdrawn. The thread lifter **126** then also swings back, and the Automatic Means A is finally switched off. Also, the blower or fan **132** as well as the transmission motor **140** are switched off. On the other hand, the transmission **150** is switched on so that the coil loading carriage **70** can resume its travel past the individual winding stations.

If a partially wound coil core **25** is located on the coil holder **20** in the ejection position **24,** the following course of movements occur: Initially, the operations are the same as for an empty core **25.** When the push magnet **81** is electrically energized, it cannot completely swing the remainder sensor **79,** however, because the point of the remainder sensor **79** strikes the thread winding. The switch **84** is thereby also not actuated. The condition is evaluated or analyzed in the electrical circuit so that the electromagnetic clutch **136** of the Automatic Means A is subjected to a voltage i.e., electrically energized, and the shaft **115** is engaged or coupled by the clutch. The push rod **111** pushes against the lever **50** so that the coil arm **49** pivots, and the coil holder **20** is again disposed horizontally. The first waiting period of the Automatic Means A as shown in the displacement or motion diagram of FIG. **5** then occurs, the push rod **111** is immediately withdrawn and the suction nozzle **116** lowered. Thereafter, the motions with respect to the Automatic Means A run their course as herein aforedescribed. When the suction nozzle **116** has been lowered, the Automatic Means A is switched off and the drive for the supply coil **11** is switched on. If the thread has been sucked in far enough, the signal of the aforedescribed photoelectric means again switches off the drive of the supply coil and again switches on the Automatic Means A. The suction nozzle **116** then lifts up, and the thread lifter **126** draws the thread to the valve plate **69.** The control rod **63** is then withdrawn and the thread is subjected to suction. When the thread lifter **126** is again swung back, the Automatic Means A, the blower or fan **132** and the transmission motor **140** are switched off, and the transmission **150** for the travel mechanism of the loading carriage **70** is again switched on.

It is apparent from the displacement or motion diagram of FIG. **5** that seeking and laying-out or readying a thread starting end of a supply coil that has been swung into made-ready position, only two-thirds of the time required for exchanging an empty core with a new full supply coil is necessary. This advantage permits a multiplicity of winding stations to be serviceable by a single coil loading carriage **70.**

Obviously, under specific operating conditions, it can be sensible to control the loading carriage so that it only carries out a program "exchange empty cores with full supply coils". If, in such a case, a supply coil that has not been completely unwound is found in ejection position, then the loading carriage, after having sensed this partially wound coil, will continue traveling without doing anything further. Thereafter, monitoring personnel can manually swing the partially wound supply coil upwardly and lay out the thread starting end **15** at the valve plate **69.**

I claim:

1. In an automatic winding machine for large-volume supply coils having a plurality of winding stations, each of said stations having means for unwinding the supply coils, a transporting device located a distance away from said unwinding means and positioned relative to said winding stations to deliever said coils to respective winding stations of the machine, a coil loading carriage drivable past the unwinding means, said coil loading carriage comprising conveyor means movable alternatively into respective positions adjacent said unwinding means and said transporting device and transferring the coils to the coil unwinding means of the respective stations, said coil unwinding means having make-ready means for readying supply coils to immediately continue the unwinding operation.

2. Automatic winding machine according to claim **1** wherein said conveyor means comprise a receiving member for directly receiving the supply coils from the transporting device.

3. Automatic winding machine according to claim **2** wherein said receiving member is a sliding trough.

4. Automatic winding machine according to claim **1** wherein said make-ready means has means for operating upon a supply coil located in a predetermined position in the coil unwinding means of the respective winding stations.

5. Automatic winding machine according to claim **1** wherein the coil unwinding means of the respective winding stations have means for holding in ejection position a supply coil that has been at least partially unwound by the coil unwinding means, said loading carriage having remainder sensing means for determining the winding condition of the supply coil in the ejection position of the respective coil unwinding means.

6. Automatic winding machine according to claim **1** wherein the coil unwinding means of the respective winding stations has means for holding in made-ready position a supply coil that is ready to be unwound by the coil unwinding means, said loading carriage having suction nozzle means for seeking the starting end of the thread carried by the supply coil that is located in the made-ready position of the respective coil unwinding means.

7. Automatic winding machine according to claim **6** each said winding station including means for mounting

a take-up coil whereon thread unwound from the supply coils is wound, said loading carriage including thread lifting means for laying out the thread starting end of the supply coil in the made-ready position so that the thread starting end of the supply coil can be tied to the thread end of the take-up coil.

8. Automatic winding machine according to claim **1** wherein the coil unwinding means of the respective winding stations have coil holder means for receiving respective supply coils thereon, said loading carriage having pressure lever means mounted thereon for actuating said coil holder means to eject empty coil cores remaining after the respective supply coils have been unwound.

9. Automatic winding machine according to claim **1** wherein said loading carriage has photo electric means for determining the presence of a supply coil to be transferred by the loading carriage from the transporting device to the coil unwinding means of the respective winding station.

* * * * *