Sept. 12, 1961 H. GANZ 2,999,653

MACHINE FOR WINDING LOG ROLL

Filed April 11, 1957 8 Sheets-Sheet 1

Fig. 1.

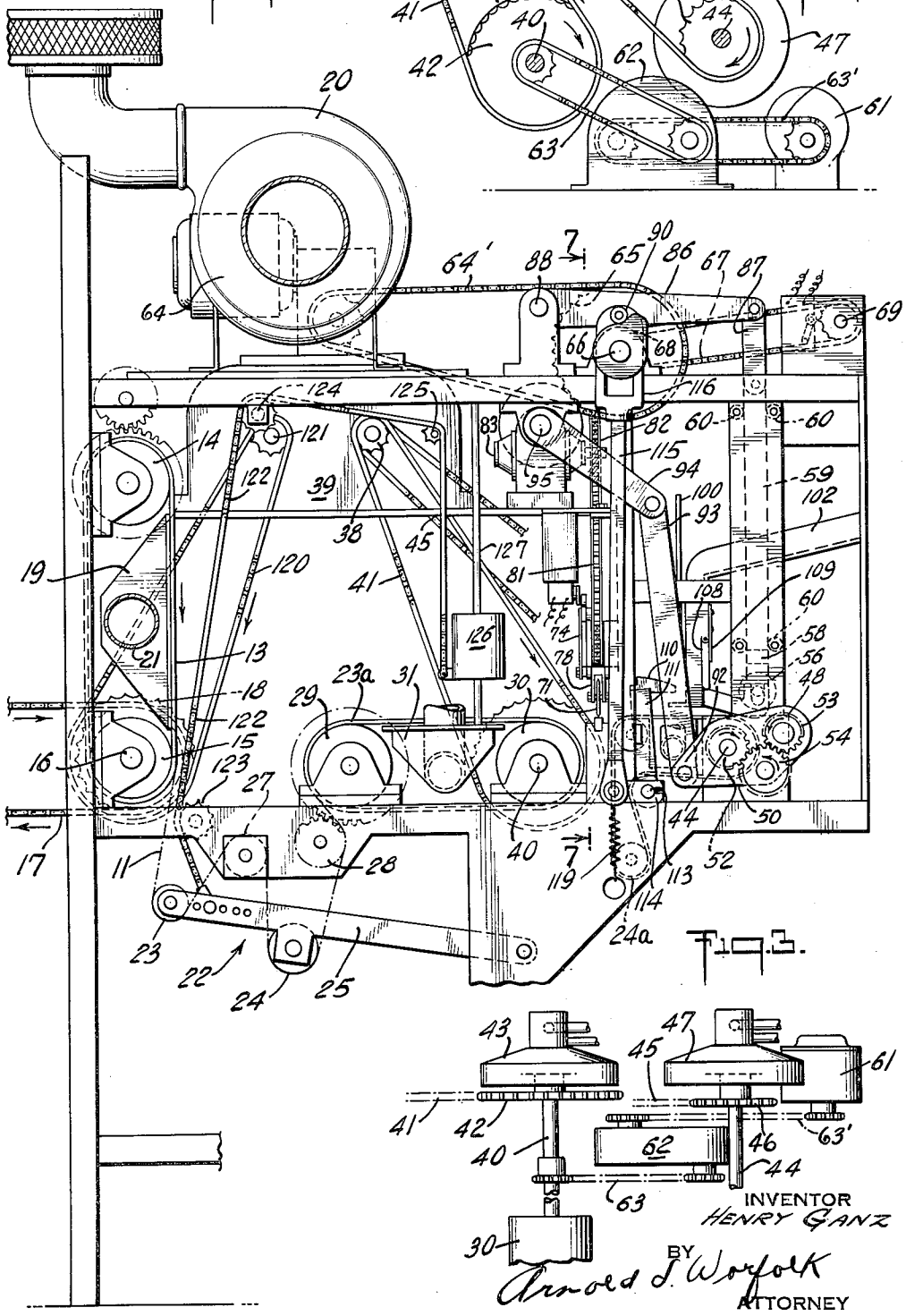

Fig. 2.

Fig. 3.

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MACHINE FOR WINDING LOG ROLL

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Fig. 4.

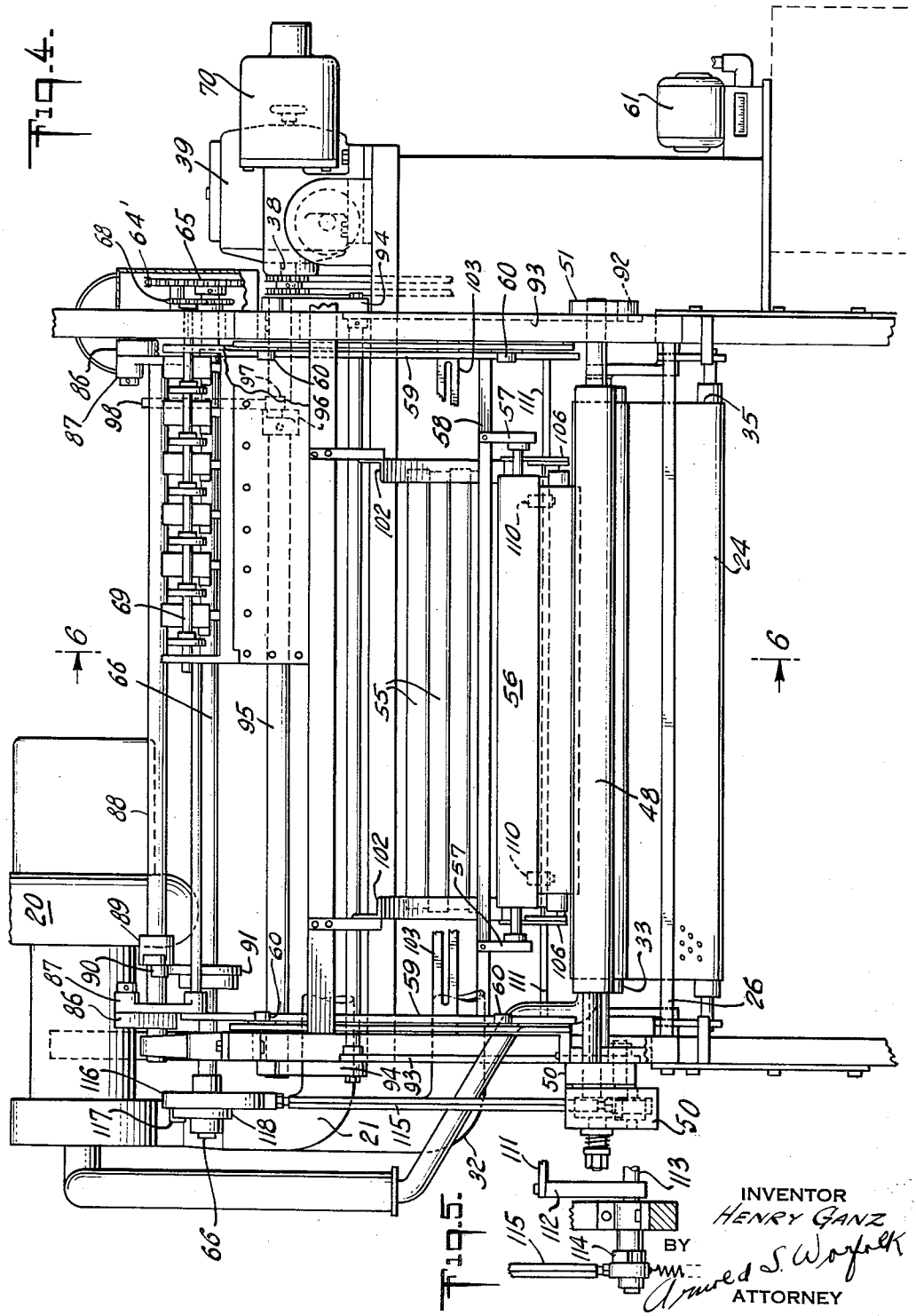

Fig. 5.

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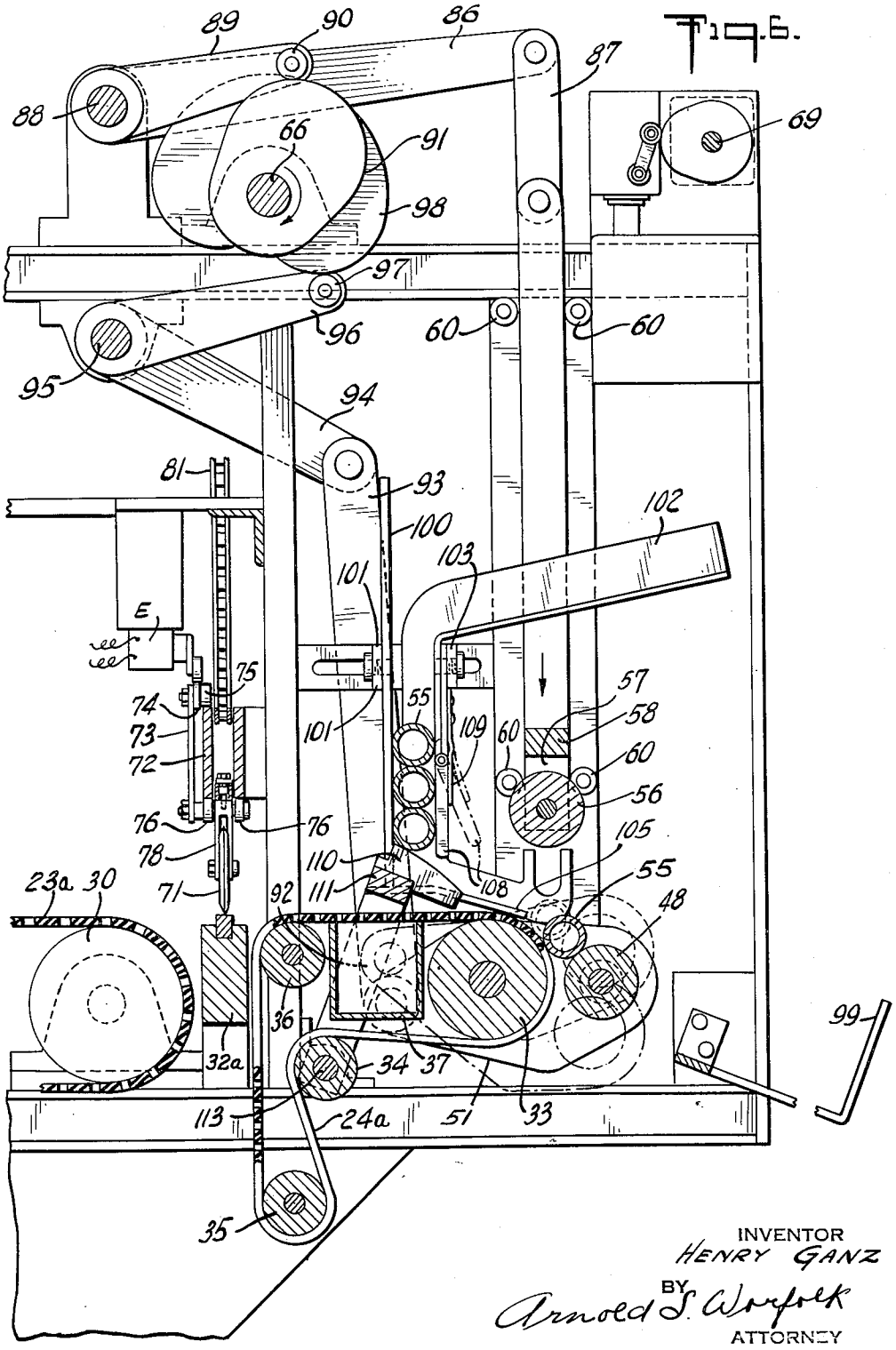
Fig. 6.



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MACHINE FOR WINDING LOG ROLL

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Fig. 7.

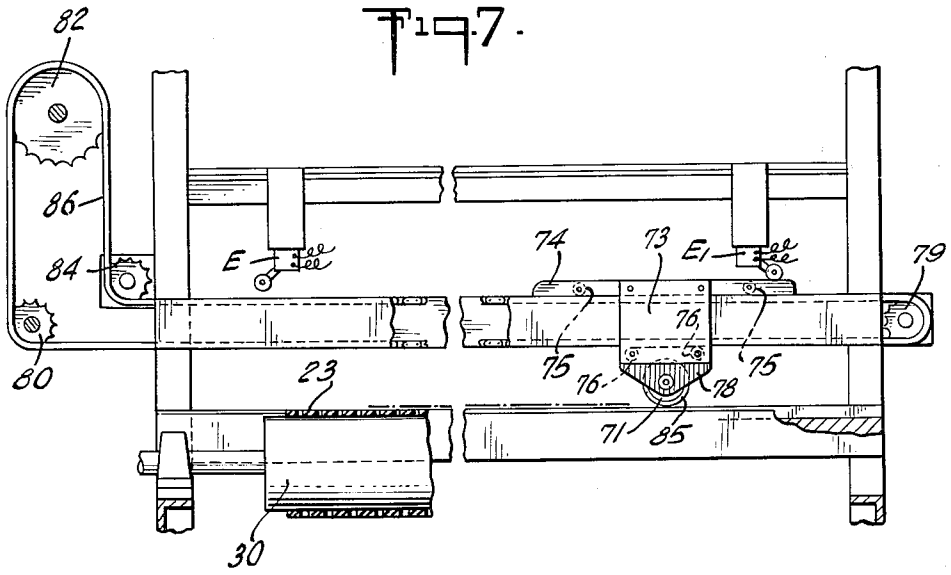

Fig. 8.

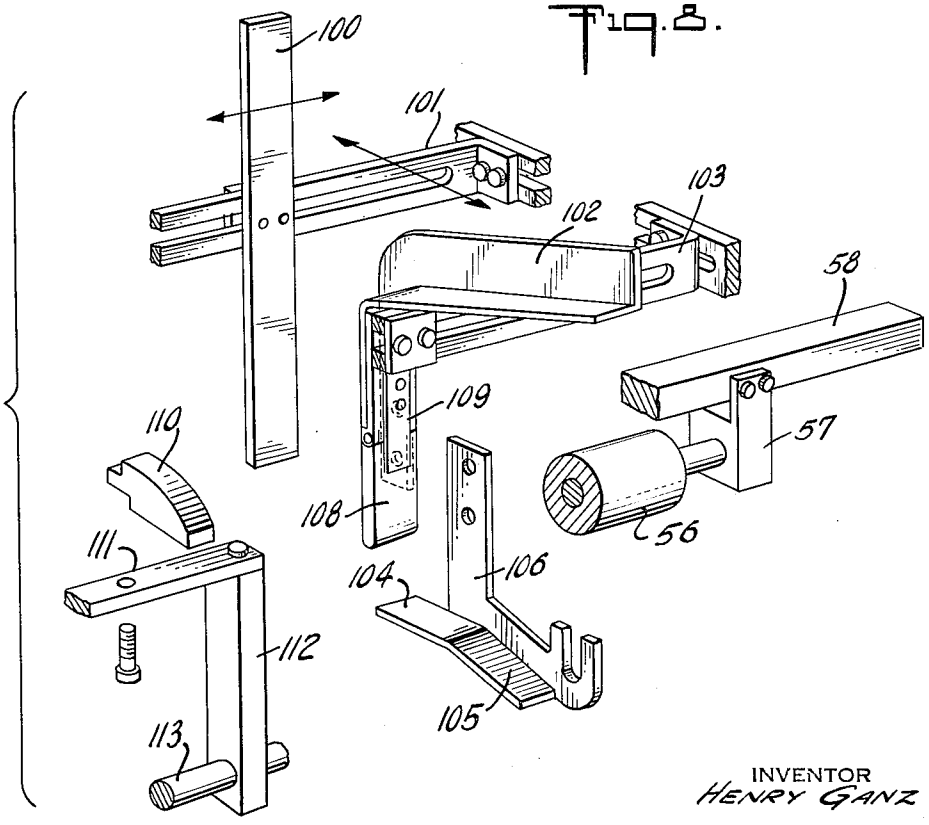

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Fig. 9.

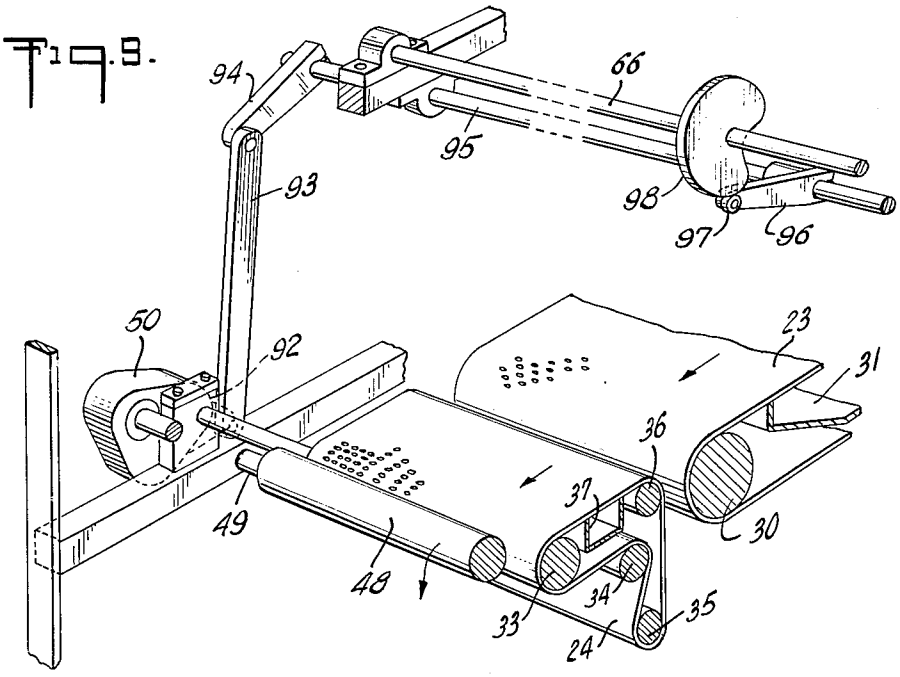
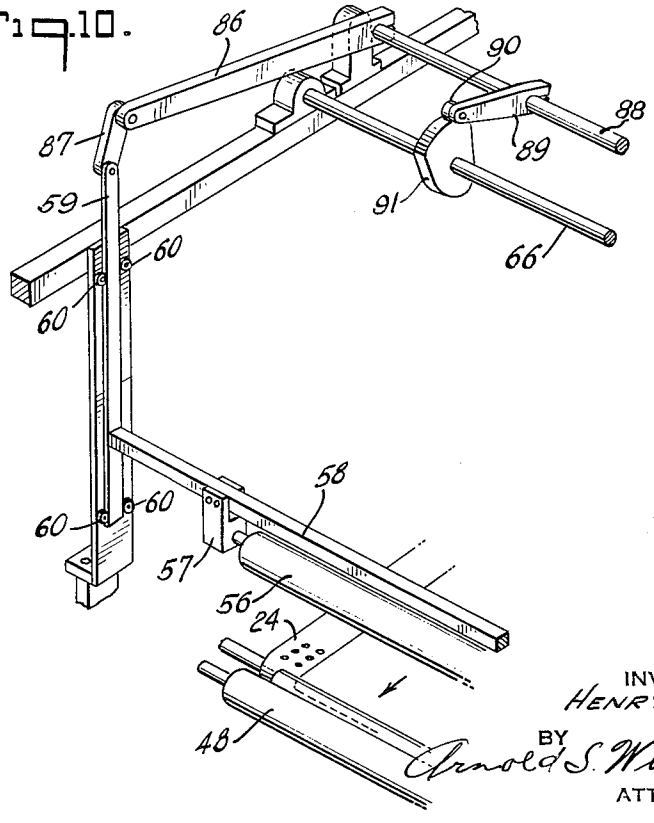


Fig. 10.



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MACHINE FOR WINDING LOG ROLL

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Fig. 11.

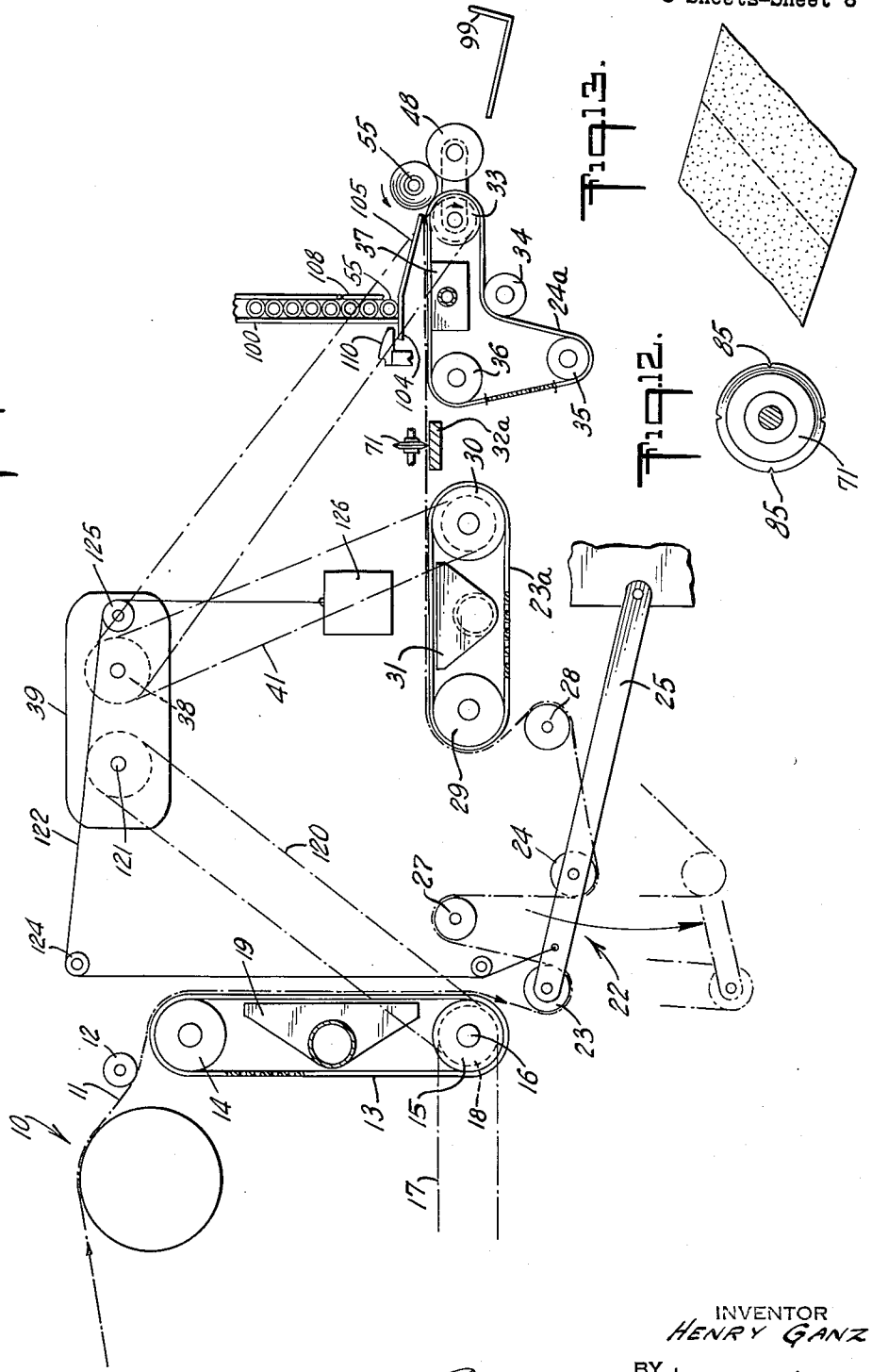

Fig. 13.

Fig. 12.

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Fig. 14.

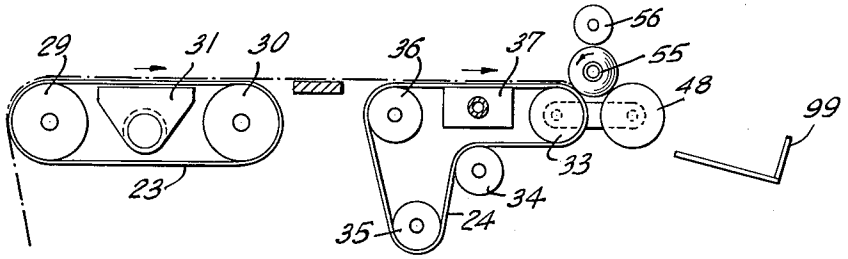


Fig. 14a.

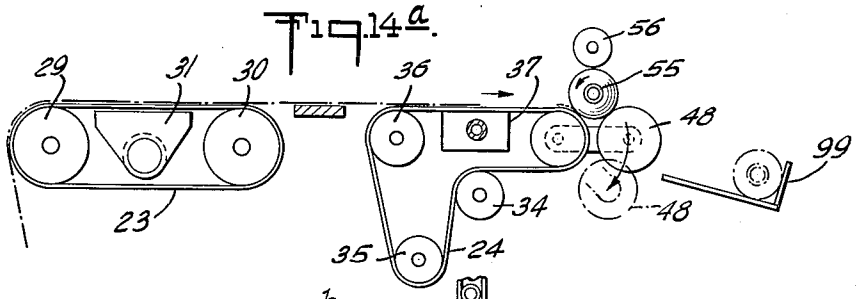


Fig. 14b.

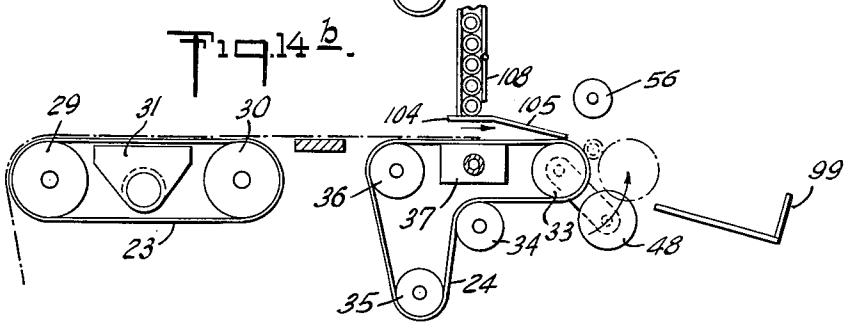
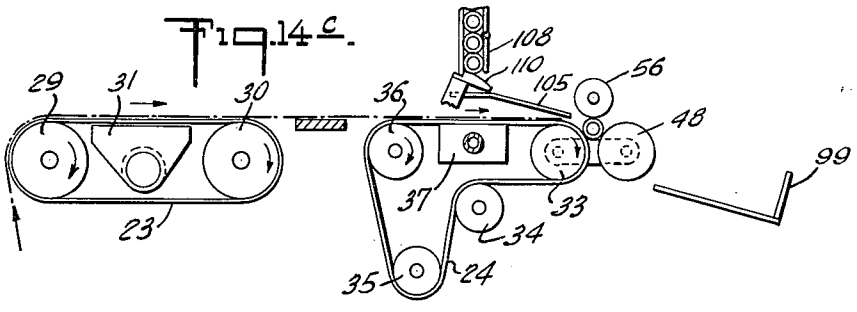


Fig. 14c.



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MACHINE FOR WINDING LOG ROLL

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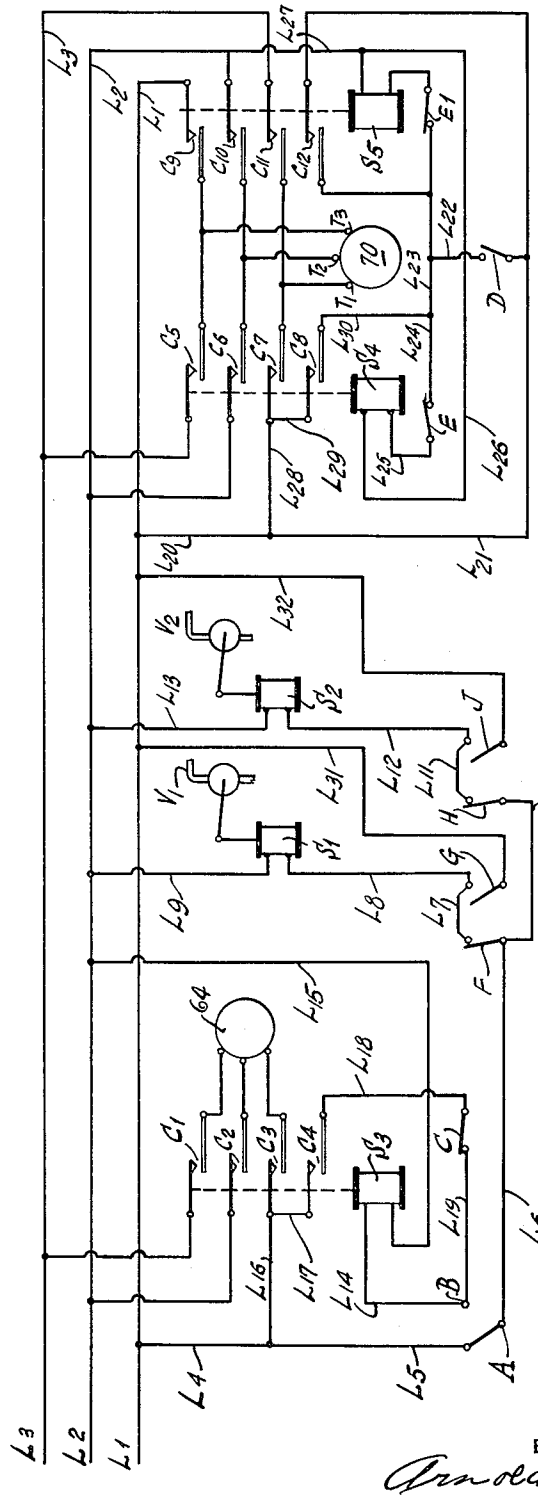
Fig. 15.



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United States Patent Office 2,999,653 Patented Sept. 12, 1961

2,999,653

MACHINE FOR WINDING LOG ROLL

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Filed Apr. 11, 1957, Ser. No. 652,218
13 Claims. (Cl. 242—56)

This invention relates to automatic sheet windup mechanisms in which sheet material from a continuously traveling source is wound on cores into rolls of given size, each roll, as completed, is ejected from the machine, and a fresh core is located in the windup position.

According to the present invention, sheet or web material, which may be adhesive tape in large widths, is supplied continuously to a windup mechanism in which a predetermined length of web material is severed from the supply, the windup operation completed and the wound up roll (termed a log roll) ejected automatically from the machine. In the meantime, a fresh core is automatically located in the windup position and a fresh length of web material fed to the core and the windup automatically started. During the interval required for feeding the core and ejecting the roll when no windup operation takes place, provision is made to accommodate the material fed to the windup mechanism from the continuous supply.

A better understanding of the invention may be had from the following description read in conjunction with the attached drawings of which;

FIG. 1 is a side elevation of a web windup mechanism incorporating the present improvements;

FIG. 2 is a side elevation of mechanism for synchronizing the feed of the sheet with devices for predetermining the length of material to be wound on the core;

FIG. 3 is a plan view of the mechanism shown in FIG. 2;

FIG. 4 is a front elevation of the machine shown in FIG. 1;

FIG. 5 is a detail view of part of the mechanism shown in FIG. 4;

FIG. 6 is a partial vertical sectional view on line 6—6 of FIG. 4 with the parts somewhat enlarged;

FIG. 7 is a vertical section on line 7—7 of FIG. 1 and illustrating details of the mechanism for transversely severing the sheet material;

FIG. 8 is an exploded diagrammatic view of mechanism for feeding new cores into a position to be wound with the sheet material and of a rider roll mechanism for holding the core in position during the windup operation;

FIG. 9 is a diagrammatic view in perspective illustrating a portion of the windup mechanism and of the mechanism for assisting in ejecting the log roll;

FIG. 10 is a diagrammatic view in perspective illustrating the mechanism for controlling the position of the rider roll during windup of the sheet material and ejection of the roll after the windup operation has been completed;

FIG. 11 is a diagrammatic view illustrating the operation of the machine;

FIG. 12 is a detail view of the sheet cutting knife;

FIG. 13 is a detail view showing the type of cut made by the knife shown in FIG. 12;

FIGS. 14, 14*a*, 14*b* and 14*c* are diagrammatic views illustrating various mechanisms in the operation of severing the sheet and ejecting the log roll; and

FIG. 15 is a circuit diagram illustrating how the various mechanisms are controlled.

The invention is directed primarily to a windup mechanism for web material. The windup mechanism may be located at the discharge end of any mechanism **10** for processing web material and from which the web material is continuously discharged through linear travel (FIGS. 1 and 11). The improved mechanism is shown in position to receive web material **11** as it is continuously discharged from coating apparatus used in the manufacture of pressure-sensitive adhesive tape. The web **11**, as it leaves the coating apparatus, passes an idler roll **12** onto a continuously traveling conveyer belt **13** which tracks around a pair of vertically spaced pulleys **14**, **15**, the lower of which is fixed on a shaft **16** driven through a chain drive mechanism **17** from a source of power not shown. The vertically spaced rolls **14**, **15** are journaled at their opposite ends in bearings mounted on the fixed side frame of the machine and the chain drive **17** is effected through a sprocket **18** fixed to the shaft **16** on which the lower pulley **15** is mounted.

The conveyer belt **13** is perforated so that a vacuum chamber **19** fixed between the vertical flights thereof with opening adjacent the inner face of the front flight, will act through the perforations to create a suction on the sheet material **11** in contact with the outer face of the front flight so that as the belt moves along, the sheet material moves with it at the speed of the belt and this is continuously fed to the windup mechanism.

The vacuum chamber **19** is in the form of a transverse box suitably secured to the supporting framework of the machine. A suction fan **20** located at the top of the machine has its intake connected through a duct **21** with the vacuum box **19** (FIGS. 1 and 4).

The continuously traveling web, as it leaves the conveyer belt, threads through a festooning device **22** to a pair of horizontally disposed conveyer belts **23***a* and **24***a* arranged in a tandem and which feed the web material linearly through the machine to a position near the front thereof where the web is wound in the form of a roll—technically termed a log roll—since in length, it is equivalent to the full width of the web as it is fed from the apparatus in which it is made.

The festooning device **22** comprises a frame which includes a pair of horizontal rolls **23** and **24** extending transversely of the machine, located in fore and aft spaced relation, and journaled at their opposite ends in a pair of arms **25** located one near each side of the machine. The arms are pivoted at their front ends in the fixed side frames of the machine, and extend rearwardly a distance such that the rearmost of the horizontal rolls **23** is below and somewhat to the rear of the front flight of the vertical conveyer belt **13**. A transverse cross brace **26** interconnecting the side arms gives rigidity to the frame and makes it capable of pivotal movement as a unit in an up and down direction (FIG. 4).

The flexible web **11**, as it leaves the front flight of the vertical conveyer belt **13** (FIGS. 1 and 11), passes down and around the rearmost roll **23** in the pivotable frame **22**, forwardly and over, another transverse idler guide roll **27** which likewise is horizontally disposed and journaled at its ends in the fixed side frames of the machine. From this latter roll, the web passes down and around the frontmost roll **24** in the pivotable frame and thence, after threading around and to the front of a guide roll **28** whose ends are likewise journaled in the side frames, comes into engagement with the top face of the upper flight of the endless conveyer belt **23***a* which is arranged to track around a pair of relatively wide horizontal pulleys **29**, **30** spaced in a direction fore and aft to the machine and whose ends are journaled in bearings fixed in the side frame thereof. The pulleys **29**, **30** are so disposed that both the upper and the lower flights of the belt travel in horizontal planes and the belt itself is perforated so that a vacuum box **31** located just beneath the upper flight will, upon establishment of a vacuum therein cause suction through the perforations. A sheet traveling in contact with the outer face of such flight will, by

virtue of the suction acting on it, be carried along positively by the belt as it travels along.

In threading upwardly from the frontmost roll **24** on the pivoted festoon frame to the horizontal conveyer belt **23***a* just described, the sheet **11** passes in front of and around the guide roll **28**.

The guide roll **28** is so located as to cause the sheet **11** to have a large arc of contact with the conveyer belt as it travels along with it. An intermediate spur gear driving connection between the rearmost pulley of the conveyer belt and the guide roll gives them the same peripheral speed.

The reason for pivotally mounting the festoon frame **22** on the main frame will be made clear hereinafter. For the moment, it is sufficient to say that the festoon frame preferably is counterbalanced, at least partially, by a spring or counterweight (not shown), or in some other suitable manner so that its full weight is not supported by the flexible sheet **11** as it travels through the machine. A counterbalanced arrangement is especially desirable if the web material is stretchable and if it is desired not to place so much tension on the web as to result in its being stretched.

The vacuum box **31** is suitably supported on fixed parts of the machine frame. At its left end (looking at the front of the machine), there is a connection in the form of a pipe **32** connecting it with the intake end of the suction fan **20** arranged at the top of the machine.

The traveling web **11**, upon leaving the upper flight of the conveyer belt **23***a*, passes over a fixed transverse horizontal bar **32***a* which is supported at its ends in the fixed side frame of the machine, and from this cross bar the web travels to the top horizontal and forwardly moving flight of web advancing conveyer belt **24***a*, which travels forwardly and around a transverse belt driving pulley **33**, rearwardly over a guide pulley **34**, downwardly and beneath a second guide pulley **35** and thence upwardly and around a third guide pulley **36**. Like the belt driving pulley **33**, all the guide pulleys extend transversely of the machine and are journaled at their opposite ends in the fixed framework of the machine. The guide pulley **36**, last mentioned, from which the belt passes to the belt driving pulley **33** is so located that the upper flight of the belt as it travels forwardly in the machine is approximately in the same horizontal plane as the top flight of the belt from which it receives the web.

Below the top flight of the frontmost conveyer belt **24***a* is a vacuum box **37** supported on the side frames of the machine and which establishes a suction through perforations in the belt to cause web material supported on the belt to travel at the same linear speed thereof. The vacuum in the box is established through a connection with the suction fan **20** at the top of the machine.

The web advancing conveyer belts **23***a*, **24***a* are driven at the same linear speed (FIGS. 1 and 2). To this end, both belts are driven from the same output shaft **38** of a variable speed device **39** mounted on the machine frame and which is referred to in greater detail later on. The drive to the shaft **40** of belt pulley **30** is through a chain **41**, a sprocket **42** normally free on the shaft **40** and driven by the chain, and an air clutch **43** associated with the shaft **40** and which upon establishment of air pressure therein, effects a driving connection between the sprocket and the shaft. The drive to the belt shaft **44** of the belt pulley **33** is through similar chain **45**, sprocket **46**, and air clutch **47** connections except that the sprocket **46** is somewhat smaller than the sprocket **42**, since its associated pulley **33** is correspondingly smaller than the pulley **30** associated with the sprocket **42** (FIGS. 2 and 3).

A short distance in advance of the front conveyer belt **24** and fixed on a transverse horizontal shaft which is parallel with such belt where it travels around its driving pulley there is a roll **48** adapted to rotate in the same direction as the driving pulley **33** of the belt (FIGS. 1, 4, 9, and 10). A core or cylinder resting in contact with the belt and in contact with the roll **48** will rotate by surface contact therewith. The roll **48** is fixed on a shaft **49** journaled at the left side of the machine in a gear casing **50** and at the right side of the machine in a supporting arm **51**. The casing and the arm are mounted for rocking movement at the opposite ends of the shaft **44** which supports the drive roll of the frontmost belt conveyer. In the gear casing **50** at the left of the machine, there is a gear train consisting of a pinion **52** on the shaft **44** associated with the belt drive roll and a pinion **53** on the shaft **49** associated with the cylinder drive roll (FIG. 1). An intermediate pinion **54** meshing with both the pinions **52**, **53** just mentioned insures their rotation in the same direction. The intermediate pinion is journaled in the gear casing **50**.

As previously stated, the gear casing **50** and the rocker arm **51** are pivotally mounted at the ends of the shaft **44** which supports the drive roll for the frontmost belt and in the normal position of the parts the gear casing and the rocker arm are so located as to present a cradle for a core or roll **55** (FIG. 11) just in advance of the leading portion of the frontmost belt **24***a*. As previously stated the belt **24***a* and the drive roll **48** constitute a mechanism acting through friction to windup sheet or web material as it leaves the frontmost belt. Initially this material, as it moves forwardly will engage, at its front edge, with a core **55** resting in the windup cradle and as the elements constituting the windup cradle rotate, upon rotation of the belt drive roll, sheet material advanced by the belt is wound up on the core.

In order to insure an appropriate driving friction between the core, or between the material on the core and the windup elements, there is provided a rider roll **56** horizontally disposed and journaled at its opposite ends in the blocks **57** fixed on and depending from a horizontal transverse cross bar **58** (FIGS. 1, 4, 6, 8 and 10). The cross bar **58** is attached, at its opposite ends, to opposed slide members **59** located one at each side of the machine and which are constrained, by spaced guide antifriction rollers **60**, to move up and down in a vertical direction. These guide rollers are rotatably mounted on pins presented by vertical frame members fixed at the opposite sides of the machine, and are so disposed as to engage the front and the rear edges of the vertically moving slide members **59**. These vertically movable slide members have sufficient range of travel in a downwardly direction to permit the rider roll **56** to rest on the core **55** as it is initially delivered in the windup position. Then, as the web material is wound on the core and the log roll builds up in diameter, the rider roll moves upwardly pressing, however, throughout the windup operation, on the log roll so as to insure that there is always an appropriate driving engagement between the log roll and the underlying cradle members which effect the windup operations.

The normal operation of the machine during a log roll windup operation will be clear from the mechanism as it has thus far been described. There now will be described mechanism which effects a stoppage of the machine when the log roll has been wound up to the desired diameter, the severing of the web material on the log roll from the main body thereof as it comes from the apparatus in which it is made, the ejection of the completed log roll and its replacement by a new core, and the reinauguration of a machine cycle to initiate the windup of the web material on a new core which automatically is brought into the windup position. Reference also will be made to mechanism for accommodating web material continuously fed from the machine in which it is made during the period when forward feed of the web is arrested for ejection of the completed log roll and injection of a new core into operative position.

In normal machine operation, i.e., during the winding of web material on the core, the air clutches **43**, **47** are in engagement, to supply power to the conveyer belt

drive pulleys. Air to clutches 43, 47 is supplied through valves V1 and V2 controlled from solenoids S1 and S2 and which are opened to admit air pressure to the clutches when the solenoids are energized. Referring to the circuit diagram (FIG. 15), solenoid S1 under the conditions stated is connected across power lines L1, L2 by leads L4, L5, connected to power lead L1, normally closed switch A, lead L6, normally closed switch F, leads L7 and L8, the winding of solenoid S1 and lead L9 back to power line L2. Solenoid S2 under such conditions is energized through leads L4, L5, normally closed switch A, leads L6 and L10, normally closed switch H, leads L11 and L12, the winding of solenoid S2 and the lead L13 back to power line lead L2.

The switch A is a single or double throw switch forming part of a device 61 available on the market and sold under the trademark Cyclomonitor.

The Cyclomonitor 61 functions to count revolutions and is driven from the rearmost conveyer belt pulley drive shaft 40 through an appropriate reduction gear box 62 and chain drive connections 63, 63' (FIGS. 2 and 4). Upon the conclusion of a predetermined number of revolutions which corresponds to a given yardage of web material wound up on the core, the Cyclomonitor opens the switch A and momentarily closes the switch B.

Opening the switch A de-energizes the solenoids S1, S2, and operates the air valve to shut off pressure to the air clutches 43, 47, thereby arresting rotation of the pulleys which drive the conveyer belts. Momentary closing of switch B connects a solenoid S3 across power lines L1, L2. This connection is through leads L4, L5, the switch B (momentarily closed), lead L14, the winding of solenoid S3 and finally through lead L15 to power line L2. Operation of solenoid S3 closes four contacts C1, C2, C3, and C4. Closed contact C4 shunts the switch B to lock in the solenoid even though the switch B is opened. This shunt connection, in addition to contact C4 includes a lead L16 and L17 on one side of the contact and lead L18, normally closed switch C, and lead L19 on the other side of the contact. Closed contacts C1, C2, and C3 connect a three phase induction motor 64 to the power lines L1, L2 and L3. Motor 64 is mounted at the top of the machine frame near the right side thereof looking at the machine from the front. This motor, through chain and sprocket drive 64', 65, rotates a cam shaft 66 that extends transversely of the machine and which at its ends is supported in bearings fixed on top frame members of the machine. A chain and sprocket drive 67, 68 from the cam shaft 66 just mentioned rotates a second cam shaft 69, also transversely arranged and supported atop the machine frame near the front. Both cam shafts 66 and 69 effect operations of the machine as will now be described.

As cam shaft 69 starts to rotate, two of the cams thereon operate immediately to open switches F and H thereon (FIG. 15) so that even though the Cyclomonitor is reset immediately for a new machine cycle of operation by the reclosing of switch A, such reclosing of the switch will not act at this point to actuate solenoid S1 or S2. The conveyor belts accordingly remain in their arrested positions.

Also as cam shaft 69 starts to rotate another of the cams thereon serves to close a switch D, thereby energizing a reversing motor 70 mounted on the machine frame and which operates a knife 71 to score the web transversely for later severance (FIGS. 6, 7, 12, 13 and 15). Closing switch D connects solenoid S4 or S5 between power lines L1, L2 depending on whether switch E associated with solenoid S4 or switch E1, associated with solenoid S5 is closed. Motor 70 rotates in one direction or the other to move the knife in one direction or the other depending on which solenoid is activated.

Thus, assuming switch E is closed, momentary closing of switch D will connect solenoid S4 between power lines L1 and L2. This connection is through leads L20, L21, switch D, leads L22, L23 and L24, switch E, lead L25, the winding of solenoid S4, leads L26 and L27 to lead L2. Operation of solenoid S4 closes four contacts C5, C6, C7, and C8. The closing of contact C8 shunts switch D through leads L28, L29 on one side of the contact and lead L30 on the other side of the contact to lock the solenoid in operation despite the opening of switch D. So long as solenoid S4 remains in operation, contacts C5, C6, and C7 connect power lines L1, L2 and L3, respectively, to motor terminals T1, T2, and T3 causing rotation of the motor in one direction.

When switch E1 is closed instead of switch E, momentary operation of switch D effects operation of solenoid S5 in a manner which will be clear from the description previously given in connection with solenoid S4. Solenoid S5 closes contacts C9, C10, C11 and C12. C12 locks the solenoid in operation, and the other contacts connect the power leads to the motor terminals. In this case, however, it will be observed that power line L1 is connected to motor terminal T3 and power line L3 to motor terminal T1. When thus connected, the motor rotates in the reverse direction from what it did before.

The knife 71 is a circular blade which is mounted for rotation at the bottom of a carriage supported for travel, from one side of the machine to the other, on a pair of spaced transverse horizontal bars 72 fixed on the machine frame.

The carriage includes a vertical side plate or apron 73, adjacent the rear face of the rearmost bar, a horizontal bar 74 secured at the top thereof and what is equipped at its ends with antifriction rollers 75, arranged to engage said bar at the top. The carriage further includes two pairs of antifriction rollers 76 arranged in spaced relation along the carriage on studs 77 projecting forwardly from the carriage, one roller of each pair engaging the lower edge of the front crossbar 72 and the other the lower edge of the rear crossbar 72. Ease of travel of the carriage as it moves from one side of the machine to the other is insured by the antifriction rollers to which reference has just been made.

The carriage further includes a vertically disposed member 78 slotted to accommodate the circular blade and which, near its upper edge, is secured to the studs 77 that support the antifriction rollers 76 which track along the bottom of the crossbar. The transverse bars 72 are equipped at each end with a sprocket wheel 79 and 80 and a chain 81 which is attached to the knife carriage atop the knife supporting member, passes around the sprockets 79 at the left of the machine (the right as shown in FIG. 7), cross the machine to sprocket 80 at the right of the machine, up over a sprocket 82 which is driven from the knife motor 70 through a reduction gear 83 having a fixed association with the knife motor, thence down to another sprocket 84 rotatively mounted at the right end of the knife carriage supporting bar 72 and back to its connection with the carriage. Normally the knife carriage is located so that the circular knife 71 is at one side of the machine beyond the edge of the traveling sheet. However, when the knife motor is started through operation of switch D by the control cam shaft as previously described, the carriage is caused to travel to the opposite side of the machine. In doing so, the knife on the carriage partially severs the sheet material which, as will be recalled, has been brought to rest by stoppage of the sheet conveyor belts.

The circular knife which is shown in detail in FIG. 12 is equipped at space intervals around the periphery with notches 85 so that the sheet is not fully cut as the knife passes from one edge to the other, but rather is left with unsevered portion so that the sheet can still advance as a unit upon the operation of the sheet conveyor belts even though the sheet at the line of severance is substantially weaker than it was before the cutting opera-

tion took place. The alternate cut and uncut portions are represented by the dotted line in FIG. 13.

It will be recalled that the direction of rotation of the motor which drives the knife carriage depends on whether the switch E or E1 is closed. These switches are supported on a fixed frame member and at opposite sides of the machine. They are adjacent the path of travel of the knife carriage (FIGS. 6 and 7). When the knife carriage is at one side of the machine, i.e., the side shown in FIG. 7, the switch E at the opposite side is connected to render active that solenoid S4 which will cause the carriage to move toward switch E when operation of the knife motor is inaugurated by the momentary operation of switch D. However, when the knife carriage in traversing the sheet approaches the end of the cutting operation, the knife carriage by engagement of the bar 74 at the top thereof with such switch E acts to break the circuit through solenoid S4 with the result that power to the motor 70 is shut off. The switch E1 at the opposite side of the machine, as the carriage leaves its vicinity, will close to prepare solenoid S5 for operation upon the next momentary movement of operation of switch D. The knife carriage moves in one direction only for each cutting operation and at the conclusion of such cutting operation i.e., when the carriage has completed its traverse, it is brought to rest as the bar 74 on the carriage opens switch E or E1 depending upon the direction of carriage movement. There is a sufficient overrun of the carriage to cause the knife to clear the edge of the sheet after power to the motor 70 has been discontinued.

Upon completion of the sheet severing operation, the conveyor belts are jogged forward. This jogging movement is of relatively short duration and the movement of the conveyor belt in front of the knife is for a slightly longer period than is the movement of the belt at the rear of the knife. In other words, both belts 23 and 24 advance to a position where the partially severed portion of the sheet is just about over the vacuum box associated with the belt at the front of the knife (FIG. 14). This jogging movement is effective by a cam on the control cam shaft 69 which operates to close switch G (FIG. 15). Switch G through leads L8 and L9 and through a lead L31 connects solenoid S1 across power lines L1 and L2. Operation of solenoid S1, in manner previously described, initiates operation of conveyor belt 23. The same cam controls the opening of switch G when the desired jogging operation has been completed (FIG. 14).

Simultaneously with jogging of belt 23, another cam on control cam shaft 69 closes switch J which through leads L12 and L13 and a lead L32 connects solenoid S2 across power lines L1 and L2. Operation of solenoid S2 jogs belt 24 until the same cam controls the opening of switch J. Switch J opens a little after switch G. The somewhat longer jogging of the belt 24 at the front of the knife serves to complete severing of the sheet which, of course, had previously been greatly weakened when it was cut transversely by the knife. The sheet conveyer belt 24 continues its jogging operation until the now severed section of the sheet is completely wound up upon the roll (FIG. 14*a*).

During the completion of the sheet windup operation, the now leading edge of the web material remains stationary because of the arrested position of the sheet conveyer belt 23 at the rear of the knife.

As soon as the sheet windup operation has been completed, the wound up log roll is ejected from the machine and a new core delivered to the windup position. To accomplish this, the rider roll 56 which normally rests on the log roll is raised clear of the log roll so as not to interfere with its ejection from the machine (FIGS. 1, 6 and 9). It will be recalled that the rider roll 56 is carried by vertical slides 59 located at opposite sides of the machine (FIGS. 5 and 7). These slides are connected at their upper ends to a pair of arms 86. The arms 86 are located one at each side of the machine and the connection is to the front end thereof through an intermediate link 87. These arms are fixed at their rear ends to a transverse rock shaft 88 journaled at its opposite ends in bearings fixed on the machine frame. Likewise fixed on this rock shaft is a shorter forwardly extending arm 89 which is equipped at its front end with a cam follower 90 which engages the periphery of an edge cam 91 fixed on the main cam shaft 66. In the normal position of the parts i.e. during the normal windup operation and with the main cam shaft at rest, cam follower 90 is opposite a low portion of cam 91 and the rider roll then bears, under the influence of gravity, on the log roll thereby to create the necessary driving friction between it and the underlying windup devices. However, after initiation of rotation of cam shaft 66 and after winding of the log roll has been completed, a high portion of cam 91 engages the cam follower thereby to turn the rock shaft 88 in a direction to lift the vertical slides 59 and raise the rider roll clear of the log roll (FIG. 14*b*).

Next, the front drive roll 48 is lowered to a position permitting the log roll to fall over it. To this end, the gear box 50 at the left of the machine and the shaft supporting arm 51 at the right, have arms 92 extending rearwardly for a short distance from their pivot points and these rearwardly extending arms are connected by means of links 93 to the front ends of a pair of arms 94 fixed to and extending forwardly from a transverse rock shaft 95 journaled at its opposite ends in bearings fixed to the machine frame (FIGS. 6 and 9). Also fixed to and extending forwardly from the rock shaft is an arm 96 whose front end is equipped with a cam follower 97 which tracks along the periphery of an edge cam 98 fixed on the main cam shaft 66. This edge cam 98 has a high portion for the majority of its periphery and during the normal position of the part and particularly when the main cam shaft 66 is at rest during the windup operation, the cam follower 97 is opposite the high portion of the cam and the front windup roll is in its normal position. However, after the main cam shaft has begun to rotate and after the rider roll has been lifted to free the log roll in manner previously described, a low portion of cam 98 arrives opposite the cam follower 97 permitting the rock shaft 95 to turn in a counter clockwise direction as viewed in FIG. 6, and the front drive roll 48 in a clockwise direction, both under the influence of gravity occasioned by the weight of said drive roll. When the drive roll achieves the lower dot and dash line position shown in FIG. 6, the log roll readily tumbles over the drive roll into a trough 98 fixed from a cam at the front of the machine and from which the log roll can readily be removed (FIG. 14*b*).

The main cam shaft 66 continues its rotation and as the high portion of cam 98 again arrives opposite its cam follower 97, rock shaft 95 turns in a clockwise direction to restore the drive roll 48 to its normal position.

When drive roll 48 has been restored to normal position a fresh core is automatically delivered to the nest between it and the adjacent drive belt 24. The cores are delivered to the windup position from a magazine which includes in part, a back support comprising a pair of vertical bars 100 supported on a transverse strut 101 having its ends connected in the side frame of the machine. Such bars are located near the ends of the cores for supporting them in vertical superimposed relation. Likewise near each end of the core, the magazine is defined at the front and at the corresponding end by the respective flanges of an angle iron 102 having one portion thereof vertically disposed and in fore and aft alignment with the vertical bar 100 constituting the rear of the magazine and another portion thereof extending forwardly and upwardly to present means in the nature of a chute in which the cores can be transversely posi-

tioned and from which they will roll down into the magazine. The angle irons 102 are also supported on a transverse strut 103 which is connected at its opposite ends in the side framework of the machine like the strut supporting the rear of the magazine. The connections between the bars 100 constituting the back of the magazine and the angle irons 102 constituting the front and the ends of the magazine, with their respective cross struts 101, 103 are such as to permit longitudinal adjustment along the supporting struts to accommodate the magazine for cores of different lengths. Connections are provided between the transverse struts supporting the magazine parts and the side frame work of the machine, such as to permit adjustment in a fore and aft direction of the strut members supporting the magazine so as to accommodate the magazine for cores varying in diameter.

The magazine further includes, at each end, a horizontal flange 104 constituting the bottom of the magazine, and a forwardly and downwardly sloping continuation 105 of this flange to support the cores as they move forwardly from the magazine into the windup position. These flanges 104, 105, are supported by angle plates 106 having a vertical leg fixed to the flanges of angles 102 constituting the ends of the magazine and a forwardly extending portion constituting a barrier against endwise movement of the cores as they traverse the space between the magazine and the windup position. The angle plates 106 have a vertical upwardly opening U-shaped slot 107 at their front ends to accommodate the rider roll shaft when the latter is in its lowermost position.

When a series of cores are located in the magazine, they are disposed one above the other for gravity feed and the one in lowermost position is held, at each end, against forward movement by a vertical retaining finger 108 which is hinged at its top to the leg of angle irons 102 defining the forward wall of the magazine at the corresponding end. The hinged finger is restrained against forward movement by a leaf spring 109 whose upper end is fixed to the fixed front member of the magazine but whose lower end rests yieldingly against the hinged finger.

In the normal position of the parts and when a core is located in the lowermost position in the magazine, there is located just to the rear of the core, a pair of pusher fingers 110 fixed to and extending forwardly from a transverse bail 111 secured at its end to normally vertical arms 112 whose lower ends are fixed to a rock shaft 113 (FIGS. 1, 4, 5, 6 and 8). The rock shaft is pivotally mounted at its ends in fixed side members of the machine and at its left end, there is fixed an arm 114 extending rearwardly where it is pivotally pinned at the lower end of a vertical bar 115. The vertical bar 115 extends upwardly to near the top of the machine where it is provided with a slotted cross head 116 which straddles the main cam shaft. A cam follower 117 near the top of the slotted cross head engages the periphery of an edge cam 118 fixed on the main cam shaft 66. The cam follower 117 normally rides on a low portion of the cam 118 in which position of the part the pusher fingers 110 stand clear and to the rear of the lowermost core in the magazine. The parts are normally held in such position by a tension spring 119 whose lower end is anchored in the machine frame and which pulls downwardly upon the vertical rod 115.

However, after a log roll has been ejected from the machine and the drive roll restored to its normal position, a high portion on cam 118 engages the cam follower 117 to lift the vertical rod 115 which, in turn, swings the pusher fingers 110 forward in a clockwise direction to engage the lowermost core and push it forwardly on to the downwardly sloping portions of those flange members 105 that bridge the distance between the magazine and the windup position of the core. In thus moving, the pusher fingers cause the hinged fingers constituting the lower portion 108 of the magazine front walls to swing forwardly and permit ejection of the core. As soon as the lowermost core has been ejected from the magazine, the fingers are pressed backwardly by their associated springs 109 so as to retain the next core in position in the magazine as the pusher fingers return rearwardly to their normal positions. Such return movement is permitted as the antifriction roller 117 on the vertical bar 115 moves down off the high portion of its associated edge cam 118 and is effected by the spring 119 which pulls downwardly on said vertical bar.

As a new core is being delivered to the windup position, the rider roll 56 moves downwardly under the influence of gravity and as permitted by the shape of its actuating cam 91 so that it arrives in position to engage the core at the top just about the time that such core arrives in windup position. This timing is desirable in order to prevent the cores, which are relatively light, from jumping out of the windup position when initially engaged by the drive roll.

As soon as a fresh core has been injected into the windup position, the cams on the control cam shaft which effect control of switches F and H operate to close such switches thereby to energize solenoids S1 and S2. Operation of solenoids S1 and S2 engages the air clutches which reinaugurates travel of the conveyer belts 23 to feed the web to the fresh core. And finally, the last cam in the control cam shaft momentarily opens switch C which breaks the locking circuit through solenoid S3 and thereby disconnects the motor 64 from the power line. Rotation of the cam shafts is thereby arrested while switch C is again allowed to close preparatory to a new cycle of operation upon completion of the next log roll.

Reference will now be made to the festooning device and how it operates to accommodate the continuously advancing web during the ejection of the completed log roll and its replacement by an empty core.

In the normal operation of the machine, i.e. when the log roll is being wound up, the two horizontal conveyer belts are driven at the same linear speed as the vertical belt 13 which delivers the web to the festooning mechanism. This is accomplished through a chain drive 120 from the drive shaft 16 of the vertical belt to the input shaft 121 of the variable speed drive mechanism 39 whose output shaft 38 drives the horizontal web conveyer belts as previously described. A suitable variable speed drive for the purpose is manufactured by the Link-Belt Company and sold under the name "P.I.V." variable speed drive. Such a drive is illustrated in a publication by the Link-Belt Company entitled Book No. 2274, copyright 1950. Because adequate description of the drive is given in that publication, no further description concerning it need be given here.

By means of this mechanism a continuous variation may be obtained between the speeds of the input and the output shafts 121 and 38 respectively. In the normal operation of the parts, there is no difference between the speeds of the input and the output shafts of the variable speed drive. However, when the horizontal web conveyer belts are arrested preparatory to initiating the web scoring operation and substitution of the completed log roll by an empty core, the advance of the web at the point where it passes to the horizontal belt from the guide roll 28 is arrested, whereas the advance of the web at the point where it leaves the vertical web conveyer belt 13 continues as before. The increase in the length of the web between these points is taken up by a downward pivotal movement of the festooning frame 24 which drops under gravity a distance as permitted by the increase in length of the web. As previously stated, suitable counterbalancing of the festooning frame may be employed, if desired, to decrease the tension in the web to the extent necessary to eliminate stretching.

As shown in FIG. 1, there is connected to the festoon-

ing frame at a point near its rearmost end, a chain **122** which passes around an idler sprocket **123** rotatably mounted on a pin projecting from the side frame of the machine, then over another sprocket **124** similarly mounted on the side frame of the machine near the top, and then over a sprocket **125** keyed on a shaft projecting from the variable speed drive mechanism. From the latter sprocket, the chain drops down vertically and is connected at its end with a weight **126** constrained to slide in a vertical direction up and down a guide rod **127**. The weight is merely to keep the chain **122** taut so as to render positive the control of the variable speed drive mechanism.

As the festoon frame moves downwardly as permitted by the increase in length of the festooning web, a rotary adjustment in a counterclockwise direction is effected in the shaft **125** of the variable speed drive with which the chain **122** is in contact. Such rotation of the shaft causes an adjustment in the speed of the output shaft **38** of the drive as compared with the speed of the input shaft **121** and the adjustment is such as to increase the speed of the output shaft in proportion to the degree of adjustment. According to this arrangement, when the air operated clutches which drive the horizontal web conveyer belts are engaged to initiate the advance of the web after a new core has been inserted in the windup position, the linear speed of such belts is above normal and of course substantially in excess of the speed of web travel as it leaves the vertical conveyer belt on its way to the festooning mechanism. This higher speed of the horizontal web conveyer belts takes up the excess length of web in the festoon that was occasioned by arrest of the web. As this excess length of web is taken up the festoon frame gradually rises to its normal position and as it does so, the variable speed drive is adjusted back to its normal 1:1 speed ratio as the weight **126** moves downwardly and through the chain **122** rotates the adjusting shaft **125** of the variable speed drive in a clockwise direction. Once the vertical web conveyer belt and the horizontal web conveyer belts have been restored to the same speed of operation, there is no further tendency on the part of the festooning frame to move about its pivot. Accordingly, there is no further adjustment in the variable speed drive and the speeds of all of the respective belts remain constant until there is a further stoppage of the mechanism upon the completion of the next log roll.

The invention has been described in connection with one embodiment thereof but many modifications thereof are included within its spirit. It is to be limited only by the scope of the appended claims.

I claim:

1. A machine for winding up web material into rolls of given length from a source of web material of substantially greater length and which comprises: delivery mechanism operating continuously to deliver web material at a given linear speed into the machine for winding, devices for feeding the web linearly forwardly to a windup station, a variable speed drive for said devices, means for establishing and disestablishing a driving connection between said drive and the feeding devices, control mechanism for automatically operating said means to disestablish said driving connection after a predetermined length of material has been fed and for automatically operating said means again to establish said driving connection, instrumentalities operable to store the material continuously delivered to the machine while the driving connection is disestablished, and means operable while the driving connection is disestablished for adjusting the variable speed drive according to the amount of such excess material delivered to operate said feeding devices, upon reestablishment of said driving connection, at a speed higher than the speed of delivery until all the excess material stored by said instrumentalities has been fed forward to the windup station.

2. A machine for winding up web material into rolls of given length from a source of web material of substantially greater length and which comprises: delivery mechanism operating continuously to deliver web material at a given linear speed into the machine for winding, devices for feeding the web linearly forwardly to a windup station, a variable speed drive for said devices, means for establishing and disestablishing a driving connection between said drive and the feeding devices, control mechanism for automatically operating said means to disestablish said driving connection after a predetermined length of material has been fed and for automatically operating said means again to establish said driving connection, a knife for at least partially severing a section of said web material, means under the control of the control mechanism for operating the knife when said driving connection has been disestablished, instrumentalities operable to store the material continuously delivered to the machine while the driving connection is disestablished, and means operable while the driving connection is disestablished for adjusting the variable speed drive according to the amount of such excess material delivered to operate said feeding devices, upon reestablishment of said driving connection, at a speed higher than the speed of delivery until all the excess material stored by said instrumentalities has been fed forward to the windup station.

3. A machine for winding up web material into rolls of given length from a source of web material of substantially greater length and which comprises: delivery mechanism operating continuously to deliver web material at a given linear speed into the machine for winding, devices for feeding the web linearly forwardly to a windup station, a variable speed drive for said devices, means for establishing and disestablishing a driving connection between said drive and the feeding devices, control mechanism for automatically operating said means to disestablish said driving connection after a predetermined length of material has been fed and for automatically operating said means again to establish said driving connection, windup means operable when said driving connection is established for winding up the web material in the form of a roll, a knife for at least partially severing the material on the roll from the remainder of the material, means under the control of the control mechanism for disestablishing the driving connection and for operating the knife when the driving connection has been disestablished, instrumentalities operable to store the material continuously delivered to the machine while the driving connection is disestablished, and means operable while the driving connection is disestablished for adjusting the variable speed drive according to the amount of such excess material delivered to operate said feeding devices, upon reestablishment of said driving connection, at a speed higher than the speed of delivery until all the excess material stored by said instrumentalities has been fed forward to the windup station.

4. A machine for winding up web material into rolls of given length from a source of web material of substantially greater length and which comprises: delivery mechanism operating continuously to deliver web material at a given linear speed into the machine for winding, devices for feeding the web linearly forwardly to a windup station, a variable speed drive for said device, means for establishing and disestablishing a driving connection between said drive and the feeding devices, control mechanism for automatically operating said means to disestablish said driving connection after a predetermined length of material has been fed and for automatically operating said means again to establish said driving connection, windup means operable when said driving connection is established for winding up the web material in the form of a roll, a knife for at least partially severing the material on the roll from the remainder of the material, means operable to discharge a roll from the windup means, independent means under the control of the control mechanisms for disestablishing the driving

connection and for operating the knife and the discharge means when the driving connection has been disestablished, instrumentalities operable to store the material continuously delivered to the machine while the driving connection is disestablished, and means operable while the driving connection is disestablished for adjusting the variable speed drive according to the amount of such excess material delivered to operate said feeding devices, upon reestablishment of said driving connection, at a speed higher than the speed of delivery until all excess material stored by said instrumentalities has been fed forward to the windup station.

5. A machine for winding up web material into rolls of given length from a source of web material of substantially greater length and which comprises: delivery mechanism operating continuously to deliver web material at a given linear speed into the machine for winding, devices for feeding the web linearly forwardly to a windup station, a variable speed drive for said devices, means for establishing and disestablishing a driving connection between said drive and the feeding devices, control mechanism for automatically operating said means to disestablish said driving connection after a predetermined length of material has been fed to the windup station and for automatically operating said means again to reestablish said driving connections, windup means at the windup station operable when said driving connection is established for winding up the web material into a roll, a knife for at least partially severing the material on the roll from the remainder of the materials, means operable to discharge a roll from the windup means, means operable to deliver a core on which material is to be wound to the windup station, independent means under the control of the control mechanism for disestablishing the driving connection and, when the driving connection has been disestablished, to operate the knife, the roll discharge means and the means for delivering a new core to the windup station, instrumentalities operable to store the material continuously delivered to the machine while the driving connection is disestablished, and means operable while the driving connection is disestablished for adjusting the variable speed drive according to the amount of such excess material delivered to operate said feeding devices, upon reestablishment of said driving connection, at a speed higher than the speed of delivery until all excess material stored by said instrumentalities has been fed forward to the windup station.

6. A machine according to claim 1 wherein the instrumentalities for storing web material delivered to the machine includes relatively movable frame elements normally positioned to accommodate a given length of web material in the form of a festoon, and adapted to move relatively to accommodate a greater length of web material upon disestablishment of the driving connection to the web feeding devices, and means controlled by the movement of one of said frame elements to adjust the variable speed drive to impart a higher speed to the web feeding devices upon reestablishment of the driving connection.

7. A machine according to claim 6 wherein the web feeding devices, upon reestablishment of the driving connection and through the higher speed of the traveling web imparted thereto by said feeding devices, act to restore the relatively movable frames back to their normal positions, said relative movement of the frames acting to adjust the variable speed drive to impart to the web fed by the web feeding devices a speed equal to the speed of web delivery to the machine.

8. A machine according to claim 2 wherein the knife is supported for movement from either side of the machine to the other, a reversible motor for effecting such movements of the knife, and means operable in one cycle of operation of the machine and as the motor moves the knife in one direction, to adjust the motor to effect the reverse movement of the knife during the next cycle of operation of the machine.

9. A machine according to claim 3 wherein the windup mechanism includes a driver roll forming part of a cradle acting to support web material as it is wound into a roll and to impart a winding movement thereto, a mounting for said driver roll adjustable from a normal position in which said material is supported to a position in which said material is discharged from the machine, and means operable when the driving connection thereto has been established, to effect such discharge adjustment of the roll.

10. A machine according to claim 5 wherein the means operable to deliver the core to the windup station includes a magazine built to accommodate a plurality of cores movable from the inlet to the outlet end of the magazine, means for ejecting a core from the outlet end of the magazine toward the windup station and means including devices common to the roll discharge means and the core ejecting means for operating them in timed sequence.

11. A machine according to claim 10 wherein the devices common to the roll discharge means and the core ejecting means includes a cam shaft, and means controlled by the control mechanism for initiating rotation of the cam shaft.

12. A machine according to claim 10 wherein the devices common to the roll discharge means and the core ejecting means includes a cam shaft, a second cam shaft driven from the first cam shaft, means controlled by the control mechanism for initiating rotation of the first cam shaft and the resulting rotation of the second cam shaft, and means on the second cam shaft operable to arrest rotation of the first cam shaft upon completion of a machine cycle of operation.

13. A machine according to claim 10 wherein the devices common to the roll discharge means and the core ejecting means includes a cam shaft, a second cam shaft driven from the first cam shaft, means controlled by the control mechanism for initiating rotation of the first cam shaft and the resulting rotation of the second cam shaft, and means on the second cam shaft for initiating operation of the knife and for causing arrest of the rotation of the first cam shaft upon completion of a machine cycle of operation.

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