Nov. 27, 1962 G. W. KARR 3,065,923

FLYING SPLICE UNWIND STAND

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Fig. 2

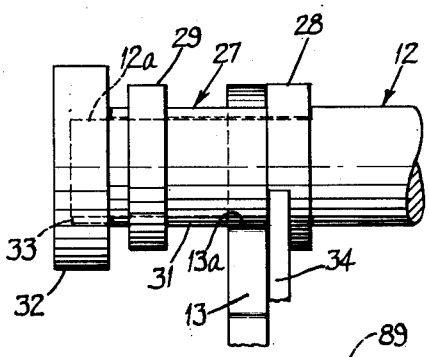
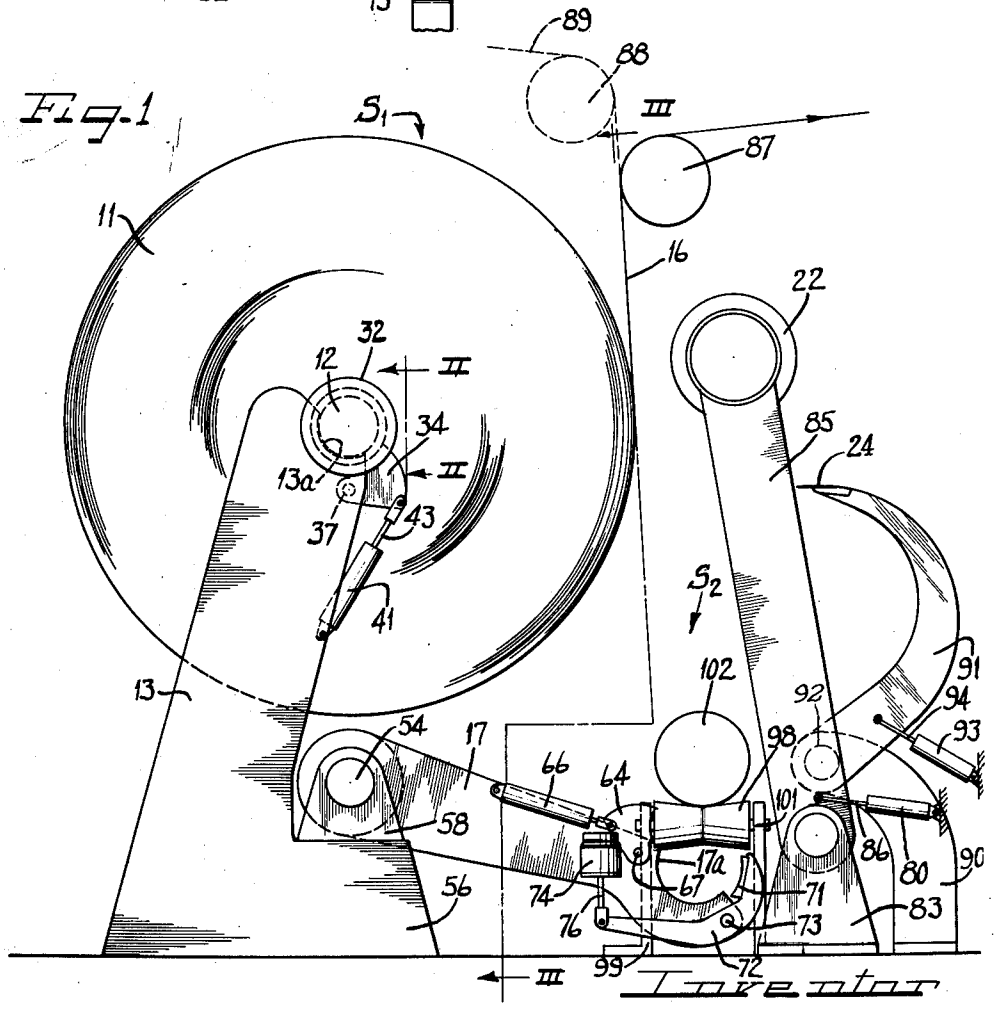


Fig. 1



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FLYING SPLICE UNWIND STAND

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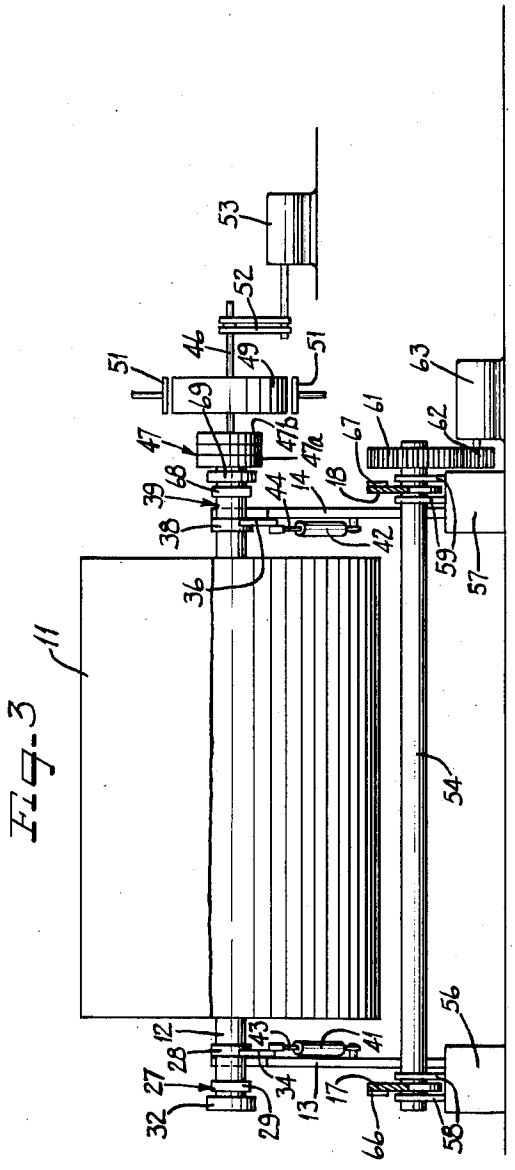


Fig-3

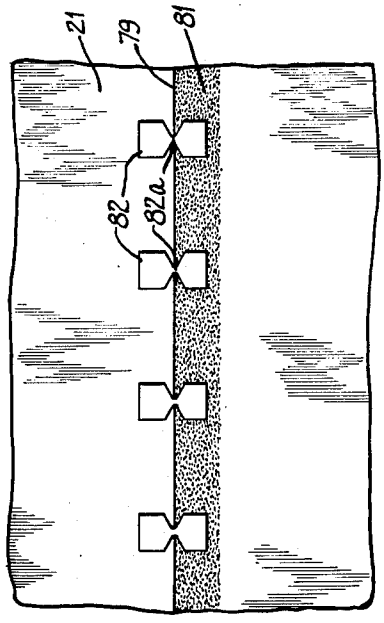


Fig-4

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FLYING SPLICE UNWIND STAND

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Fig-6

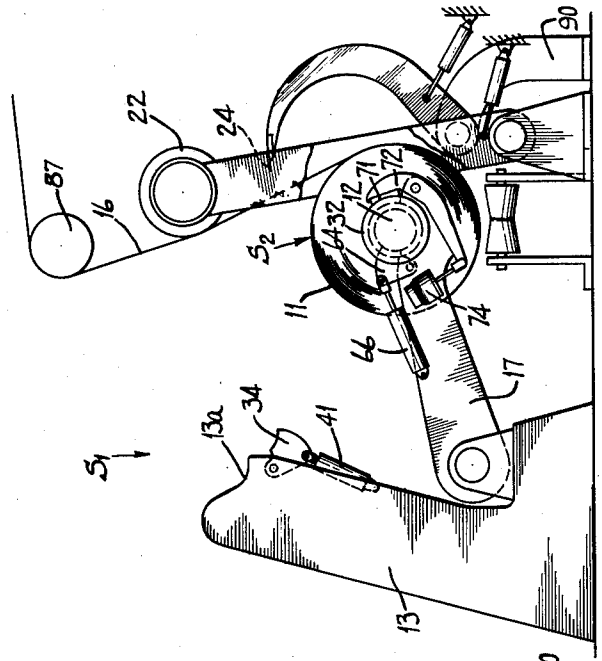
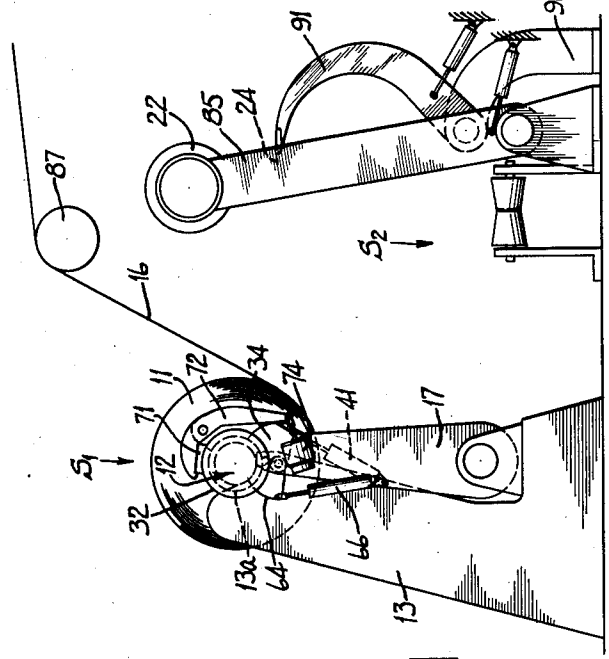


Fig-5



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FLYING SPLICE UNWIND STAND

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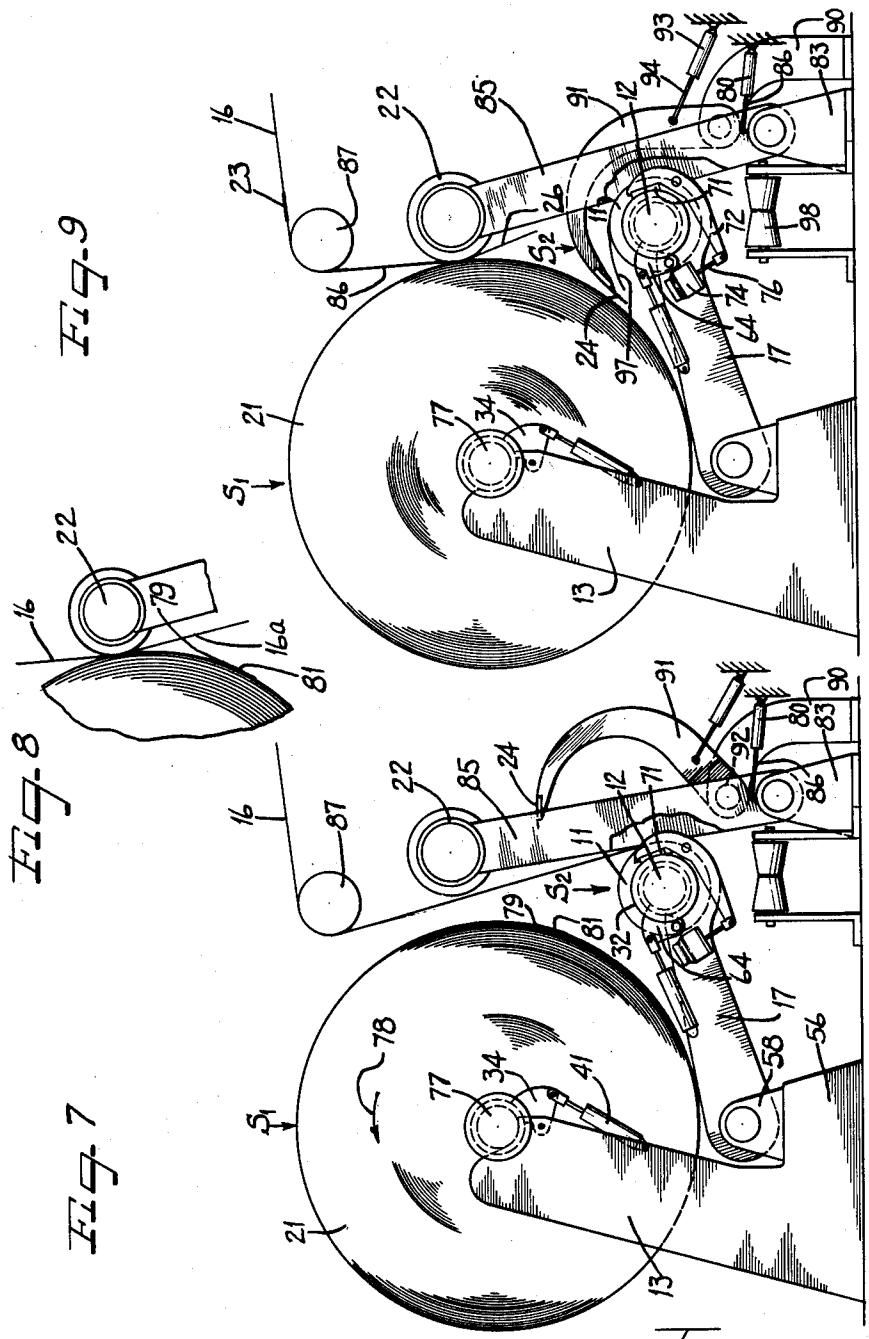


Fig. 9

Fig. 8

Fig. 7

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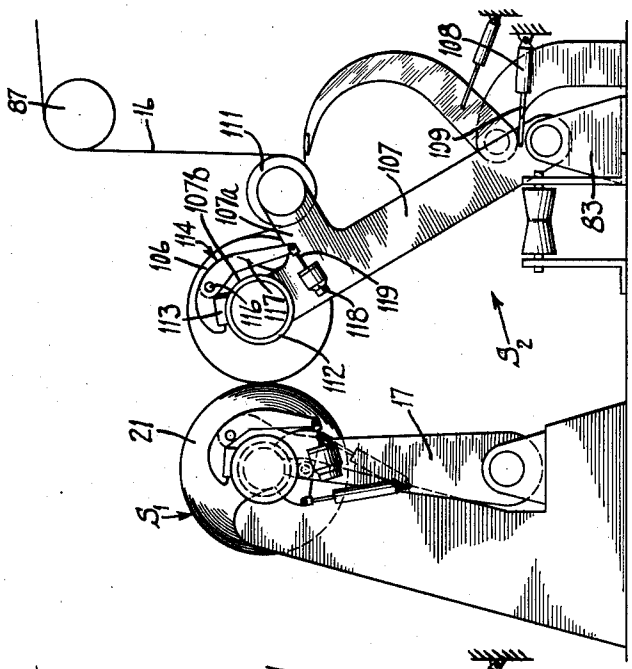


Fig-11

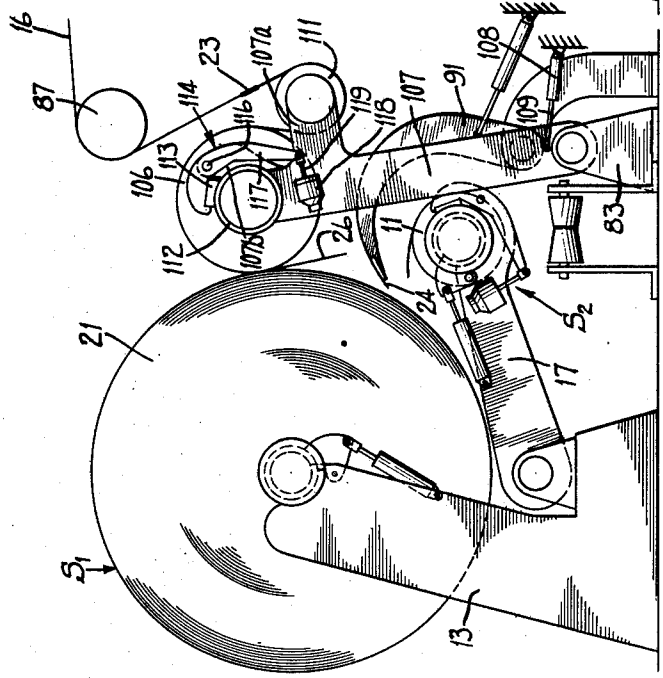


Fig-10

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3,065,923
FLYING SPLICE UNWIND STAND

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3 Claims. (Cl. 242—58.3)

The present invention relates to machines for unwinding rolls of paper or like web material, and more particularly relates to a machine for providing a continuous endless supply of traveling web material from successive parent rolls by splicing the lead end of a fresh roll to the web from an expiring unwinding roll without stopping the unwinding operation.

In unwinding parent rolls of paper or the like, it is advantageous and achieves a saving of time and expense, if operations do not have to be stopped when a parent roll becomes empty and a new roll is started. Considerable difficulties and disadvantages have been encountered in attempting to continuously unwind large parent rolls of paper. Devices heretofore provided have often required that the unwinding roll be reversed or rotated to provide access for supplying a second parent roll in order to attempt to splice the web material without stopping the unwinding operation.

It is an object of the invention to provide an improved machine and method for continuously unwinding a succession of large parent rolls of web material with a minimum of difficulty and avoiding disadvantages encountered with the devices heretofore provided.

Another object of the invention is to provide an improved unwinding machine capable of providing a flying splice to joint the lead end of a roll of web material to an unwinding web, in which very large and heavy rolls can be accommodated with a minimum of handling of the rolls, and with improved reliability and simplicity of operation.

Another object of the invention is to provide an improved flying splice unwind mechanism for continuously unwinding succeeding rolls of web material wherein the web material may be delivered from the rolls in a variety of directions without interfering with the operation of changing rolls, as fresh full rolls are supplied.

A further object of the invention is to provide an improved mechanism for automatically forming a flying splice and transferring a moving web from one unwinding roll to another, and improved mechanism for gripping and transporting the rolls, and to provide improved mechanism for forming the splice and cutting the web from an exhausted roll after a splice has been made.

Another object of the invention is to provide improved mechanism for transferring unwinding rolls of web material and controlling the speed of the rolls in a flying splice unwind mechanism.

Other objects and advantages will become more apparent with the teachings of the principles of the invention in connection with the disclosure of the preferred embodiments in the specification, claims and drawings, in which:

FIGURE 1 is an end elevational view of a mechanism embodying the principles of the present invention;

FIGURE 2 is an enlarged fragmentary sectional view taken substantially along line II—II of FIGURE 1, and illustrating the construction of the end of a core for supporting an unwinding roll;

FIGURE 3 is a vertical sectional view taken substantially along line III—III of FIGURE 1;

FIGURE 4 is an enlarged fragmentary view illustrating the arrangement at the lead end of the web material on a roll for forming the splice and separating the lead end from the roll;

FIGURE 5 is an end elevational view of the flying splice unwind mechanism of FIGURE 1, illustrating an unwinding roll in a primary station as the roll begins to get empty;

FIGURE 6 is an end elevational view similar to FIGURE 5 illustrating the unwinding roll transferred to a secondary station;

FIGURE 7 is an end elevational view, similar to FIGURES 5 and 6, illustrating a fresh roll in the machine;

FIGURE 8 is a fragmentary end elevational view of the elements of FIGURE 7, illustrating their position with the splice being made;

FIGURE 9 is an end elevational view illustrating the cutting of the web from the roll in the secondary station;

FIGURE 10 is an end elevational view illustrating an unwinding machine forming another embodiment of the invention with the parts of the machine illustrated just after a splice has been made; and,

FIGURE 11 is an end elevational view of the embodiment of FIGURE 10, illustrating the position of the parts as the parent roll is expiring, and before it is transferred from the primary unwind station to the secondary unwind station.

As shown on the drawings:

As illustrated in FIGURES 1 and 3, during normal unwinding operation a parent roll of paper or the like is being unwound and is carried on its core **12**, which is supported in a stand including upright supporting arms **13** and **14**. Web material **16** is drawn off of the roll **11** in a continual high-speed unwinding operation.

When the parent roll **11** becomes nearly unwound, as illustrated in FIGURE 5, a pair of transfer arms **17** and **18**, FIGURE 3, carry the parent roll **11** from a primary station S_1 to a secondary station S_2. The primary station is defined by the support arms **13** and **14**, and the secondary station is defined by the transfer arms **17** and **18**, after they have carried the unwinding roll **11** out of the primary station to permit a fresh roll **21** to be placed in the primary station S_1, as shown in FIGURE 7.

The fresh roll **21** is spun or rotated until its peripheral speed is substantially the same as the speed of the traveling web **16**, and a web-engaging pressure splice roll **22** then forces the traveling web **16** against the outer surface of the fresh roll **21**, and a traveling splice is automatically formed. As soon as a splice **23** is made, a knife **24** cuts the trailing end **26** of the web, feeding from the expiring roll **11**, and a continuous web is supplied with the second roll **21** now being unwound.

As to the structure in greater detail, the core for the unwinding rolls is supported and gripped in the primary station and is then released for being transported to the secondary station. It will be recognized that various gripping and supporting arrangements may be employed, and in a preferred embodiment illustrated in the drawings, the cores, as illustrated by the core **12** in FIGURES 1 and 2, have ends **12***a* which are journalled in a core bearing or hub **27**. Since both ends of the cores are identical in construction, only one end need be described in detail. The bearing **27** is provided with a cylindrical support section **31** bounded at its ends by annular flanges **28** and **29**. At the outer end of the core **12**, is a brake drum **32** which is keyed to the core, such as by key **33**, so that braking force will reduce or stop the speed of rotation of the core **12**, and the roll carried thereon. A feature of the invention is the provision of a braking arrangement which permits controlling the speed of the roll in the primary station, and also retaining positive control of the speed of rotation at all times, especially during the transfer of the roll from the primary station S_1 to the secondary station S_2, and at the secondary station.

The upright support arms 13 have an upwardly facing surface 13*a* which is opened in a direction facing the secondary station S_2 so that the core may be readily carried out of the arms 13 and 14 in an arcuate path from the primary station S_1 to the secondary station S_2. The cores are cradled at the upper end of the support arms 13 and 14 by the support surfaces curved upwardly at the rear edge of the surface. The cores are held on the support surface at the front edge by holding lugs 34 and 36, FIGURE 3, which are pivotally supported on the arms 13 and 14. The lugs are supported on pivot pins, such as 37, for the lug 34, FIGURE 1. In holding position, the lugs are swung upwardly against the outer surface of the annular flanges 28 and 38 of the hubs 27 and 39 at the ends of the core 12. When the core and roll 11 are to be carried to the secondary station S_2, the holding lugs 34 and 36 are swung downwardly to the position illustrated by lug 34 in FIGURE 6.

The lugs are power pivoted by suitable actuating means such as pneumatic or hydraulic cylinders 41 and 42, which are mounted on the support arms 13 and 14, and which operate pistons connected to piston rods 43 and 44, connected to control the pivotal position of the lugs 34 and 36. The lugs may also be mechanically locked in place by self-locking linkages, or may be mechanically operated.

Before a fresh roll is spliced to a traveling web from an emptying roll, the fresh roll is rotated until the peripheral speed approaches the speed of the web for smooth splicing operation. For this purpose, a roll drive shaft 46 connects to the core 12 of the roll through a clutch 47. The clutch has engageable clutch plates 47*a* and 47*b*, with plate 47*a* provided with means for disconnectibly connecting to the end of the core 12. The plate 47*a* is disconnected when the roll 11 is to be carried to the secondary station S_2. The clutch arrangement 47, as will be appreciated by those skilled in the art, may be of any suitable arrangement, and is not shown in detail. The clutch may be of the kind wherein slippage can occur, so that it may be used to aid in controlling the speed of the roll 11 during normal operation when a web 16 is being unwound thereform. Speed of rotation of the roll of paper is controlled by a brake drum 49 mounted on the main drive shaft 46, and engaged by brake shoes 51 for purposes of reducing the speed of the rotating roll 11. The operation of the brake drum 49 and the clutch 47 will be readily understood and appreciated in considering that to obtain either a uniform or varying controlled speed of travel of the unwinding web 16, as the diameter of the roll 11 decreases, the speed of the drum and revolutions per minute must be controllably changed. This speed is important in controlling the tension on the unwinding web to prevent overtension and tearing and to prevent undertension and wrinkling or loss of control of the web. When the clutch 47 is disconnected from driving the roll 11, and the brake 49 is no longer available to control the speed of the roll, the braking means provided on the transfer arms are in position to take over.

The drive shaft 46 of the roll is driven by belts 52 from a drive motor 53 which are used to accelerate the peripheral speed of roll 21 up to web speed for splicing.

The transfer arms 17 and 18 are mounted on a cross shaft 54 extending across the machine so that they will be pivoted together. The cross shaft 54 is mounted on bases 56 and 57 for the support arms 13 and 14, and bearings 58 and 59 on the bases pivotally support the shaft 54. The shaft is controllably driven, so that the transfer arms 17 and 18 swing between the primary support station S_1 and the secondary support station S_2, by a gear 61 secured to the shaft 54, and a meshing driving pinion 62 which is driven by a transfer motor 63. The motor 63 or other suitable power drive means is operated to pivot the transfer arms 17 and 18 to the accurate locations for supporting the rolls in the primary and the secondary stations.

Each of the transfer arms carries holding lugs, such as lug 64 on the arm 17. The lug 64 is supported on a pivot pin 67. The lugs are suitably power operated, such as by fluid pressure cylinders 66 and 67, to pivot the lugs between a core holding position and a core release position.

The arms have a support surface, such as 17*a* for the arm 17, which faces upwardly when the arms are in position to receive the core at the primary station S_1. The holding surface 17*a* curves upwardly and coacts with the holding lug 64 to provide a clamping support for carrying the core with its roll to station S_2. When the transfer arm 17 is pivoted upwardly from the position of FIGURE 1, to the position of FIGURE 5, to grip the core 12, the holding lug 64 is in the core release position. When the transfer arms are in the position to grip the core, the lugs are pivoted against the flanges 29 and 68, FIGURE 3, of the hubs at the end of the core. The holding lugs 34 and 36 are then swung to release position, and the transfer arms 17 and 18 are pivoted from the position of FIGURE 5 to the position of FIGURE 6 to carry the roll 11 from position S_1 to position S_2. The transfer arms are stopped in the position of FIGURE 6 to support the roll 11 while the web 16 continues to unwind.

Returning to the position of FIGURE 5, when the transfer arms are in the transfer position, the braking function is transferred from the brake drum 49 to the brake drums 32 and 69 at the ends of the core 12. Each of the transfer arms 17 and 18 may carry one or more brake shoes, with a shoe 71 on the transfer arm 17 coacting with the brake drum 32. The shoe is carried on a rocker arm 72 supported on a pivot pin 73. The brake shoe 71 is pivoted between braking and release position, and is controllably pressured against the drum 32 by the action of a brake cylinder 74. The brake cylinder contains a piston with a piston rod 76 connected to the brake arm 72. The cylinder is provided with connections, not shown, to admit pressurized hydraulic fluid or gas to control the pressure of the brake shoe and control the tension on the web 16. Thus, when the transfer arms 17 and 18 reach the position of FIGURE 5, pressure is applied to the brake shoes against the drums 32 and 68, and the clutch 47 is disconnected from the core 12.

When the roll 11 is in the secondary station S_2, the fresh roll 21 is brought into place and rested on the top of the support arms 13 and 14 with the holding lugs 34 and 36 holding a core 77 of the roll in place. The drive is then engaged with the core 77 and the fresh roll is spun in the direction of the arrow 78 until its peripheral speed approaches the speed of the moving web 16.

An automatic splicing arrangement is provided so that the traveling web 16 may be pressed against the surface of the rotating roll 21 and a splice will automatically be formed. For this purpose, the leading end 79, FIGURE 4, of the roll 21 has a surface 81 covered with an adhesive, preferably of the pressure-sensitive type. To prevent accidental unwinding of the lead end from the roll during handling and during the time it is rotated and brought up to splicing speed, the lead end 79 is temporarily held against the roll by short bits of tape 82, which have weakened areas 82*a* to permit the lead end to easily tear from the roll by breaking the tape when it adheres to the running surface of the web 16. There are, of course, many variations of this type of splice.

The pressure-engaging splicing roll 22 is carried on pivotal arms, such as 85, and is freely rotatable in bearings on the arms. The arms are pivotally mounted on a floor bracket 83 and are pivoted by operating means, such as a fluid pressure operated cylinder 80. Within the cylinder is a piston connected to a piston rod 86 connected to the arm 85. Admission of pressurized fluid to the cylin-

der **80** through fittings, not shown, moves the splicer roll **22** from a non-splicing position, as shown in FIGURE 7, to a splicing position, as shown in FIGURE 8. It will be understood that the arms **85** may be mechanically operated by an electric motor or by other mechanism.

The operator may observe the rotation of the fresh roll **21**, and may provide a mark at the end of the roll to indicate the location of the lead end **79** so that the splicer rolls can be brought against the traveling web **16**, ahead of the time when the lead end **79** reaches the roll **22** to insure a good splicing pressure. As soon as the lead end **79** passes up under the splicer roll, the adhesive area will adhere to the inner surface **16***a* of the traveling web **16**, and an end to surface splice will automatically be formed.

As illustrated in FIGURE 9, web material **86** will then automatically begin to unwind from the roll **21** and the splice **23** will draw the material along with the web material **16**.

Material is guided, as it leaves the unwinding rolls, over a guide roll **87** which is positioned to accommodate the unwinding web from the roll **11** in the secondary station, or from the roll **21** in the primary station. The present transfer arrangement is advantageous in that the material may be lead away in any direction, and, as illustrated in FIGURE 1, a guide roll may be positioned at **88** so that material **89** can be lead back up over the roll **11** in the primary station S_1. The material can be led away in this and various other directions, and it will not interfere with reloading the machine with a fresh roll or with removing the empty core from the machine.

Returning to FIGURE 9, as soon as the splice is made, the web **16** is separated by the cutting knife **24**. The knife is supported on a knife arm **91** suitably pivotally supported at its base such as on a support cross shaft **92** which is mounted on the floor on floor brackets **90**. The knife arm **91** is power operated such as by a pressure cylinder **93** having a piston slidably located therein connected to a piston rod **94**, connected to the arm. At the proper time, fluid is admitted into the end of the cylinder **93** to cause the knife arm to snap to the left, as shown in FIGURE 9, and cut the web **16** leaving the trailing end **26**. Pressure is immediately applied to the brake shoe **71** to stop rotation of the roll **11** and prevent continued unwinding of the cut end **97**.

The transfer arms **17** and **18** are then dropped downwardly to the position illustrated in FIGURE 1, and the holding lug **64** is moved to open position. This releases the core on a conveyor **98** supported on floor brackets **99** and **101** to convey the nearly empty core out of the unwinding machine. This is illustrated in FIGURE 1 with a core **102** being transported axially out on a conveyor **98** which may be a roller or a belt conveyor.

In continued operation of the machine, as illustrated in FIGURE 1, the roll **11** in the primary station S_1 is supported on the arms **13** and **14**, while a web is being unwound therefrom. Speed control of the roll is achieved by the brake shoes **51** applying a pressure on the brake drum **49**, FIGURE 3. When the roll becomes nearly unwound, as illustrated in FIGURE 5, the transfer arms **17** and **18** swing upwardly to grip the core **12** and carry the roll to the secondary station S_2 to the position of FIGURE 6. Speed control of the roll is transferred to the operation of the brake shoe **71**, as soon as the transfer arms are in the position of FIGURE 5, and at that time, the drive clutch **47** is disconnected from the core so that the roll can be transferred.

A fresh roll **21** is placed in the primary station S_1 as illustrated in FIGURE 7. The drive clutch **47** is connected to the core **77** of the roll, and it is rotated until its peripheral speed approaches the speed of the web **16**. The pressure splice roll **22** then forces the web **16** against the surface of the roll **21**, so that the adhesive area **81** will cause a flying splice to be formed, breaking the tape strips **82**. The trailing end of the web **16** is cut by the knife **24** and the supply of web material will continue, being unwound from the fresh roll **21**. When the fresh roll becomes nearly empty, the cycle will be repeated, and a continuous supply of web material will be provided without interruption, and without the necessity of slowing the machine.

In the embodiment of FIGURES 10 and 11, the splice roll has been exchanged for a rider roll **106** which functions both to control the speed of travel and hence the tension of the traveling web and to form the splice. The mechanism is illustrated in FIGURE 10 with the expired roll **11** held in the secondary station S_2 and the splice **23** having been made. The trailing end **26** has been cut and the web material is now feeding off of the fresh roll **21**.

FIGURE 11 illustrates the mechanism as the fresh roll **21** is becoming expired, and as the transfer arms **17** are gripping the roll before carrying it down to the secondary station S_2.

The rider roll **106** is carried at the upper end of support arms **107** which are mounted on the floor brackets **83**. The web **16** is carried over a substantial frictional arc of the surface of the rider roll **106** by the location of a guide roll **111** which draws the web material down to engage a larger arcuate area of the surface of the rider roll **106**. The guide roll **111** is freely rotatable and is carried on bracket extensions **107***a* on the arms **107**.

Control of the speed of the web being paid out from the parent roll is obtained in the embodiment of FIGURES 10 and 11 by controlling the speed of the rider roll **106**. For this purpose, the rider roll is provided with torque applying means in the form of a control brake or clutch. The roll is illustrated with a brake drum **112** which is suitably secured to rotate with the roll. The brake drum **112** is engaged by a brake shoe **113** carried on a brake arm **114**. The brake arm is pivoted at **116** on an upper portion **107***b* of the arm **107**. The lower end **117** of the brake arm is connected to a piston rod **119** which has a piston slidably mounted in a fluid cylinder **118**. Pressurized fluid is controllably directed to the cylinder through conduits, not shown, to apply a desired pressure to the brake shoe, and control the resistance on the traveling web **16**.

This embodiment is particularly well suited to apparatus wherein more uniform and accurate control must be obtained. This arrangement is especially useful in paper machines where a continuous web of soft paper, such as bock grade, is unwound. This is preferably wound more loosely, and is, therefore, more difficult to control from the center shaft of the parent roll.

In the position of the elements illustrated in FIGURE 11, the parent roll **21** is about to be transferred from the primary station S_1 to the secondary station S_2. The rider roll **106** is next swung away from the parent roll **21**, and the roll **21** carried on the transfer arms **17** down to the station S_2. The position of the parent roll is controlled by suitable mechanism for swinging the support arms **107**, and a fluid pressure cylinder **108** is shown having a piston rod **109** connected to the arms **107**.

When a fresh roll is placed in the primary station S_1, the rider roll **106** is brought against the fresh roll to splice the lead end of the web from the fresh roll to the traveling web from the expiring roll in the secondary station. As soon as the splice is formed, the knife **24** cuts the end of the web from the expiring roll and the supply of web material continues.

It will, of course, be understood that control of the speed of the rider roll **106** may be performed by other control mechanisms, and that brake drums and control brake shoes may be utilized on both ends of the roll.

Thus, it will be seen that I have provided an improved method and mechanisms for successively unwinding parent rolls of web material to supply a continuous length of material, meeting the objectives and advantages hereinbefore set forth. The features of the invention are well adapted to machines for high speed operation with large

heavy rolls of material such as paper, and the method is utilized with a minimum of operations. Transfer of the supply of paper web is accomplished from one roll to the other without having to rotate or excessively handle the rolls, and the supply can continue without change in speed.

I have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of my invention, and it is to be understood that I do not intend to limit the invention to the specific form disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by my invention.

I claim as my invention:

1. A mechanism for supplying a continuous web of paper or the like from unwinding parent rolls comprising in combination an unwind stand having a pair of spaced upright support arms adapted to support at their upper ends the core of a horizontal rotating parent roll, disconnectible clutch means for driving the parent roll in rotation at a peripheral speed substantially equal to a desirable web supply speed, releasable holding means at the upper end of each of said arms for retaining the core of the roll, a pair of transfer arms at each end of the roll adjacent said support arms and mounted for movement between a primary station defined by said support arms and a secondary station spaced from said primary station, means for driving the transfer arms in a transfer movement between said primary and secondary stations, releasable holding means on said transfer arms for receiving the core of a roll in the primary station and supporting it on the transfer arms to be carried to the secondary station, brake means on at least one of said transfer arms for coacting with the core to control the speed of the roll in the primary station and while it is being transferred to said secondary stataion and in said secondary station, means for accommodating a traveling web unwinding from a roll in said secondary station and positioned to also accommodate a web from a roll in said primary station, a splice roll rotatable on a horizontal axis, means for supporting and carrying said splice roll in a path against a web from a roll in said secondary station and forcing the web against the peripheral surface of a roll in said primary station the lead end of the web having adhesive splice means whereby the end will automatically attach to the traveling surface of the web unwinding from the roll in the secondary station, a traveling knife, and means for supporting and moving said knife in a path to engage the web unwinding from the roll in the secondary station at a location behind the splice whereby a continuous running web will be supplied.

2. A mechanism for unwinding and supplying a continuous web of material or the like from an unwinding parent roll comprising in combination support means for rotatably supporting an unwinding parent roll, a rider roll positioned to have web material drawn from the parent roll threaded over a portion of the surface of the rider roll, a braking means connected to the rider roll for applying a braking torque thereto whereby the speed of the web will be controlled, support means for supporting a fresh roll, means for driving the fresh roll to bring it to a rotational speed, and means for moving said rider roll in the path to engage the surface of said fresh roll after it has reached said speed and press the web from the parent roll against the fresh roll for forming a running splice with the leading end of the web on the fresh roll and receiving the web from the fresh roll in speed controlling contact obtained by controllably operating said braking means and said driving means.

3. A mechanism for unwinding and supplying a continuous web of paper or the like from an unwinding parent roll comprising first support means for rotatably supporting an unwinding parent roll, a rider roll positioned to supportingly accommodate the web from the parent roll, a guide roll positioned to guide the web over a substantial frictional engagement arc of the rider roll, a braking means connected to the rider roll for applying a braking torque thereto whereby the speed of the web will be controlled, second support means for supporting a fresh roll, means for driving the fresh roll to bring it to an operating speed, means for barking the fresh roll in said second support means, and means for moving said rider roll in a path to engage a fresh roll in said second support means and press the web from the parent roll in the first support means against the fresh roll for forming a splice with the leading end of the web on the fresh roll and for receiving the web from the fresh roll in speed controlling frictional engagement.

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