

April 17, 1956

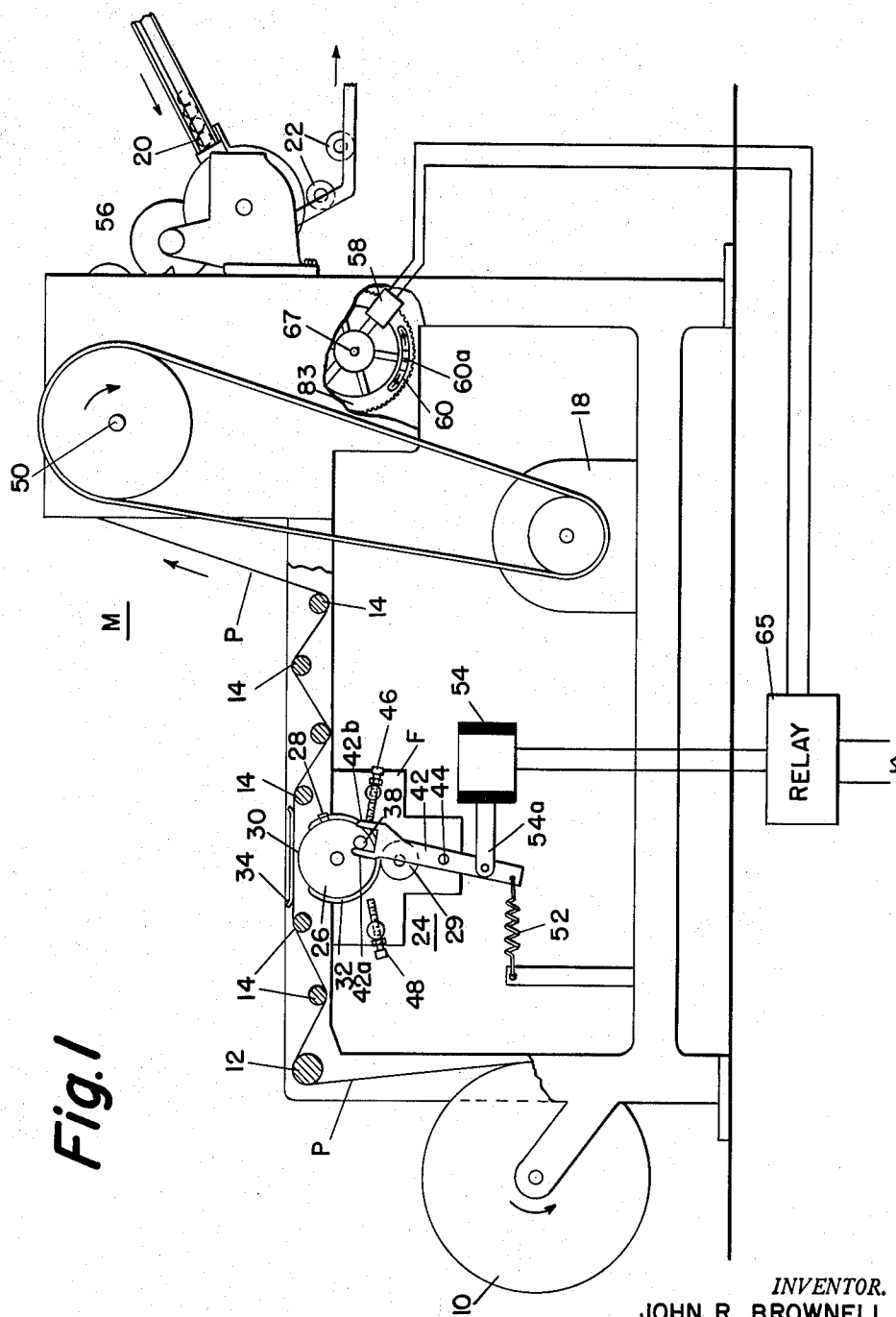
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2,741,983

METHODS OF AND APPARATUS FOR PRINTING ON A MOVING SURFACE

Filed June 6, 1951

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

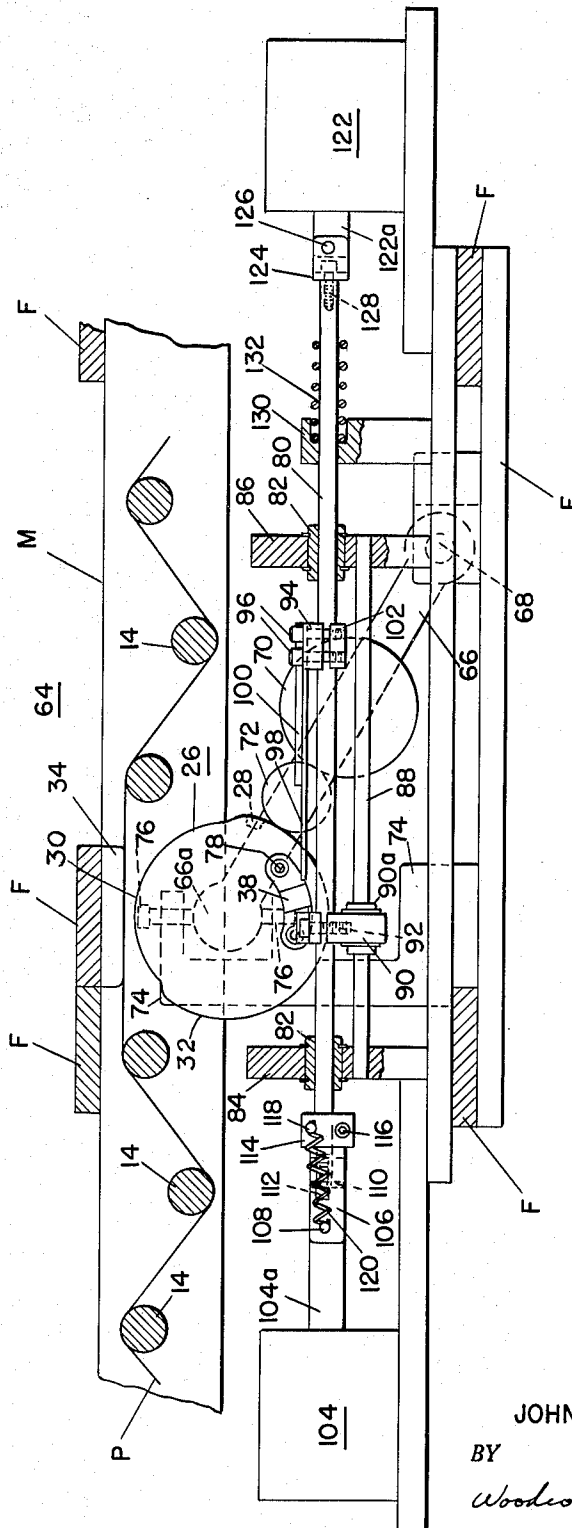


Fig. 2

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4 Sheets-Sheet 3

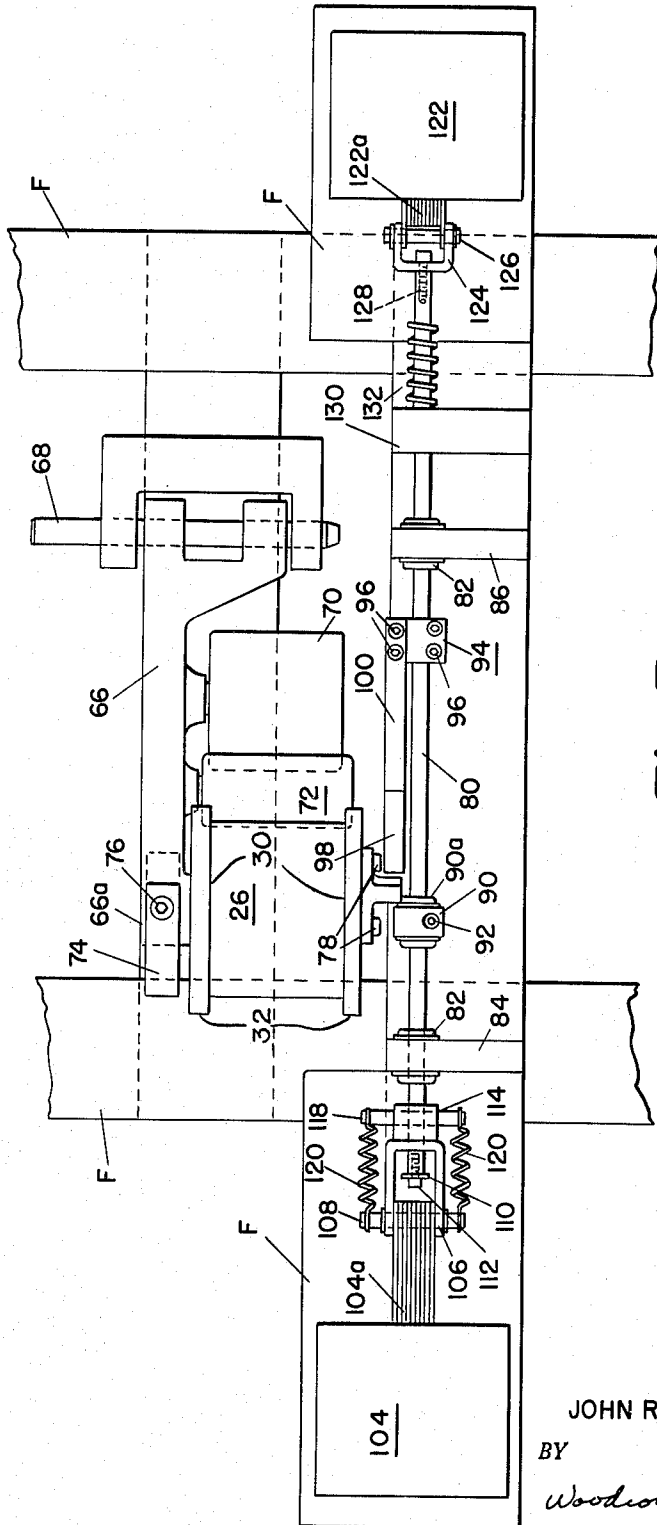


Fig. 3

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4 Sheets-Sheet 4

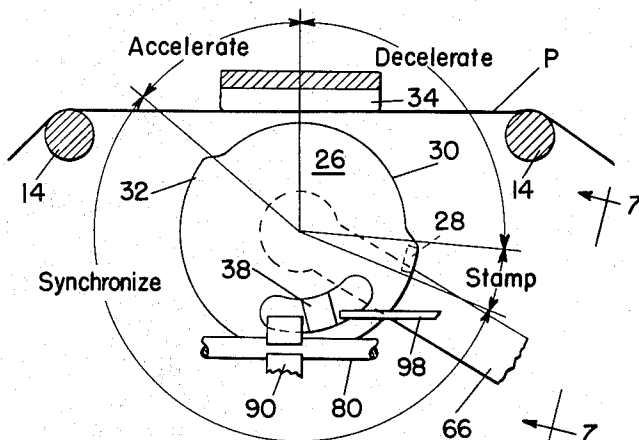


Fig. 4

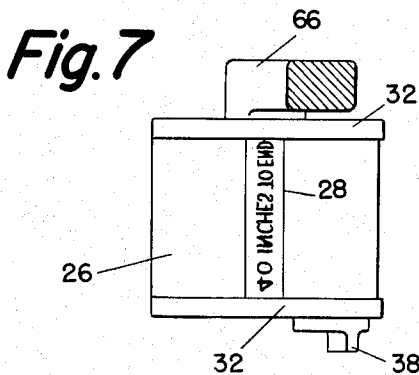


Fig. 7

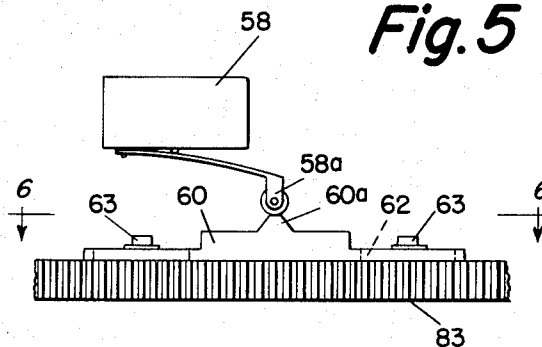


Fig. 5

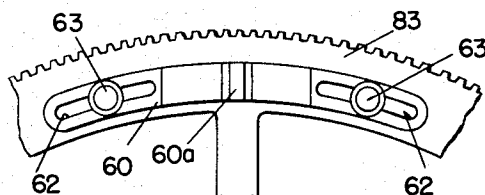


Fig. 6

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METHODS OF AND APPARATUS FOR PRINTING ON A MOVING SURFACE

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Application June 6, 1951, Serial No. 230,211

22 Claims. (Cl. 101—228)

This invention relates to printing indicia or legends on a moving surface and has for an object the provision of methods of and apparatus for printing said indicia or legends in predetermined locations on said moving surface and in avoidance of smearing of print during the printing operation.

When printing indicia on a surface in order to avoid the smearing of print, it is necessary that there be no relative motion between the printing stamp and the surface receiving the indicia. If this relationship is maintained during the printing operation, the indicia may be applied to the desired area of the surface without smearing of the print and this may be accomplished whether both the surface and the stamp be moving or at rest.

In the interest of saving time in performing the printing operation a number of times within a relatively short period on different surfaces or different areas of the same surface, it is necessary that the printing operation be performed while the surface or surfaces are moving. For example, in an automatic rewinding machine designed for rewinding paper or other strip material from a large supply roll or millroll into numerous small rolls, in order to run the machine continuously and at the same time print indicia or legends at intervals on the strip material it is necessary that the printing operation be performed while the strip material is moving.

More specifically, in the measurement field, recorders of the strip chart type are provided with rolls of chart paper approximately forty yards in length. These relatively small rolls are made up from a large supply roll or millroll. The chart paper is unwound from the large supply roll and passed through a rewinding machine from which small rolls having the chart paper cut to the proper length are delivered. For most convenient maintenance of the recorders, it is desirable to print within approximately forty inches of the end of the chart the legend "40 inches to end" in order to advise the operator that a new chart roll will soon be needed. The chart paper is passing through the rewinding machine at several hundred feet per minute continuously at the time when it is desired to print the legend on the paper. In order to avoid the necessity of stopping the rewinding machine every time forty yards of paper have passed through the machine to perform the printing operation, it is necessary that the printing operation be performed while the chart paper is moving.

In accordance with the present invention the process of printing indicia on a moving surface is accomplished by accelerating the peripheral speed of a stamping roller to approximately the linear speed of the moving surface prior to engagement of the roller with the moving surface, synchronizing the peripheral speed of the roller with the linear speed of the moving surface by bringing the roller into engagement with the moving surface, printing indicia on the moving surface while the roller and the moving surface are in engagement, and decelerating and stopping the roller in a position wherein the roller is disengaged with respect to the moving surface.

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More particularly, there is provided printing mechanism for printing indicia on a moving surface comprising a cylindrical member rotatable about an axis substantially parallel to the moving surface and extending transversely of the path of movement thereof, said cylindrical member having a peripheral recess normally providing clearance between said cylindrical member and the moving surface. There is also provided a printing element carried by the cylindrical member and spaced from the peripheral recess. Impulse mechanism is provided for imparting a blow to accelerate the cylindrical member to approximately the linear speed of the moving surface and for effecting driving engagement between the moving surface and the cylindrical member during which the printing element engages the moving surface. There is further provided means for arresting the cylindrical member when the recess is again adjacent the moving surface.

For a more complete understanding of the invention reference is to be had to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevation partly in section illustrating an application of the invention to an automatic rewinding machine;

Fig. 2 is an elevation partly in section of another modification of the printing mechanism embodying the invention;

Fig. 3 is a plan view of the printing mechanism shown in Fig. 2, the paper P and backing plate 34 being omitted;

Fig. 4 is a fractional view of a printing cylinder and associated backing plate and illustrates the various portions of the printing cycle of the printing mechanism;

Fig. 5 is a fractional plan view of parts shown in Fig. 1;

Fig. 6 is a view taken along the lines 6—6 of Fig. 5, and

Fig. 7 is a view of the printing cylinder taken along the lines 7—7 in Fig. 4.

Referring to the drawings, the invention in one form has been shown as applied to an automatic rewinding machine M which may be of the type disclosed in the Schultz et al. Patent 1,966,525, the description of which is hereby incorporated into this application and made part hereof by reference thereto. Referring to Fig. 1 there is shown a supply roll or millroll 10 from which the paper P is threaded upwardly and about a tension roller or take-up roller 12 and a series of guide rods 14 to a pair of driven rollers (not shown) within the enclosure of machine M, one of which turns with a rotary shaft 50 (so identified in the aforesaid patent), the latter being the main shaft for imparting movement to all driven parts of the machine. This shaft may be driven from an electric motor 18 by a belt and pulley arrangement as disclosed in the aforementioned patent. Each revolution of the pair of driven rollers, one of which turns with rotary shaft 50 and which may be of certain diameters, measures a fixed amount of paper.

The paper is wound on small tubes or cores 20 which are fed into the machine M from its opposite side. In order to determine the length of paper to be wound on the tubes, there is provided a change gear 83 fastened to a cam shaft 67. For clarity these parts have been identified by the same reference numerals as in the aforementioned patent. By changing the size of gear 83 the length of roll to be wound may be either increased or decreased, depending upon the corresponding change made in the size of gear 83. The cam shaft 67 may be driven from shaft 50 by means of any suitable chain and gear arrangement. The machine M also is provided with means 56 for periodically cutting the paper passing through the machine, the cutting operation taking place only after predetermined lengths of the paper have been

rewound onto the tubes or spools 20. This operation is fully disclosed in the aforementioned patent. After the rewinding operation has been completed, the finished rolls 22 are discharged from the machine M.

In order to print indicia or legends on the paper or other material as it passes through the rewinding machine, there is provided a printing mechanism 24 located adjacent the path of the paper or other strip material P intermediate the supply roll 10 and the paper driving roll carried by shaft 50 of machine M. The modification of the printing mechanism 24 shown in Fig. 1 comprises a rotatable body which may be in the form of a cylindrical member 26 which is supported for rotation about its axis by a frame F carried by machine M, the axis of cylindrical member 26 being substantially parallel to the strip material and extending transversely of the path of movement thereof. A printing element or stamp 28 comprising reversed letters or indicia of the desired legend is mounted on the periphery of the cylindrical member 26. An ink supply roll 29 is supported by frame F in a position adjacent cylindrical member 26 for supplying ink to printing element 28 upon each revolution of cylindrical member 26.

In the normal or disengaged position of the printing mechanism, the cylindrical member or roller 26 has a peripheral recess portion 30, which has a smaller radius than the remainder of the periphery of the cylindrical member 26, which faces the paper or strip material P and provides clearance therebetween. The peripheral recess portion 30 is spaced from the printing element 28. The cylindrical member 26 may be provided with rubber rims 32 at the opposite ends thereof and the peripheral recess portion 30 of the cylindrical member may be formed by the omission of or cutting away of the rubber rims 32 at this point on the cylindrical member.

A backing plate 34 is mounted on the machine M at a point adjacent the cylindrical member 26 but on the opposite side of the path of movement of the paper or strip material P. The backing plate 34 and the cylindrical member or roller 26 are so positioned with respect to each other such that when the drum 26 is rotated, the portion of its periphery having the maximum radius will press the paper or strip material P firmly against the backing plate 34. In the normal or disengaged position of the cylindrical member 26 there is no contact between the cylindrical member and the paper and accordingly there is no pressure between the paper P and the backing plate 34.

In order to actuate the printing mechanism 24 and thereby initiate a printing operation, there is provided an impulse mechanism for imparting a blow to accelerate the cylindrical member 26 to bring the peripheral speed of the portion of the periphery of the cylindrical member 26 which includes the printing element 28 to approximately the linear speed of the moving surface or strip material P and effect driving engagement between the moving surface P and the periphery of the cylindrical member 26 during which printing element 28 engages the moving surface P. In one form, as shown in Fig. 1, the impulse mechanism may comprise a driven element or projection 38 carried by cylindrical member 26. There is further provided a yoke means carried by frame F for embracing the driven element 38. The yoke means may be in the form of a pivotal member 42 having a bifurcated end including spaced elements 42a and 42b for receiving therebetween the driven element 38. The pivotal member 42 is pivoted at a fixed pivot 44 spaced from the bifurcated end including elements 42a, 42b. In order to limit the pivotal movement of pivotal element 42, there are provided stop means 46 and 48 carried by frame F and disposed on opposite sides of the pivotal element 42.

In order to bias the yoke means or pivotal member 42 against stop 46, there is provided a tension spring 52, one end of which is supported in fixed position and the opposite end of which is connected to the pivotal member 42.

To move the yoke means or pivotal member 42 including the bifurcated end thereof between the stop means 46 and 48, there is provided a solenoid 54 the core of which is mechanically connected to the yoke or pivotal member 42 at a point spaced from the pivot 44. Upon movement of the pivotal member 42 in a counterclockwise direction, an element 42b of its bifurcated end will move from a position against stop 46 and strike the driven element 38 carried by the cylindrical member 26 thereby rotating the cylindrical member about its axis and consequently removing the driven element 38 from its position within the bifurcated end between elements 42a and 42b.

As may be seen in Fig. 1, the spacing between elements 42a and 42b of the bifurcated end is greater than the diameter of the driven element 38. Thus the pivotal element 42 will move through a given distance prior to the element 42b striking the driven element 38 carried by cylindrical member 26. Thus there is a lost motion connection between the pivotal member 42 and the cylindrical member 26 thereby permitting the acceleration of the pivotal member 42 prior to its engagement with the driven element 38 carried by cylindrical member 26. This provision for accelerating the actuating means prior to engagement with the cylindrical member 26 permits the cylindrical member to be started with sufficient force to rapidly accelerate its peripheral speed to approximately the linear speed of the moving surface or strip material P passing through machine M.

After rotation of the cylindrical member 26 has been initiated and accelerated to approximately the linear speed of the moving surface P, the rubber rims 32 engage the moving surface and by means of the pressure produced between the paper and the rubber rims by the back-up plate 34, there is provided a frictional drive whereby the peripheral speed of the cylindrical member 26 will be synchronized with the speed of the moving surface with which it is in contact. As the printing element or stamp 28 is carried by the same portion of the periphery of cylindrical member 26 as the rubber rims 32, the velocity of the printing element 28 will be synchronized with the velocity or linear speed of the moving surface P. Accordingly the printing of the indicia or legend on the moving surface P will take place when there is no relative movement between the printing element 28 and the moving surface P. Thus, the smearing of print due to relative movement between the printing element and the moving surface P during the printing operation will have been eliminated.

While the printing operation is taking place, the yoke means comprising pivotal member 42 and its bifurcated end is returned to its original position with element 42b again against the stop member 46. The return movement of the pivotal member 42 may be accomplished by various means. For example, solenoid 54 may be a single-acting solenoid and after the pivotal element 42 has been rotated in counterclockwise direction to bring element 42a against stop 48, the coil of the solenoid 54 will then be deenergized and the return stroke of pivotal member 42 may be accomplished by means of spring 52. The purpose of returning the yoke means to its original position is to stop rotation of cylindrical member 26 after it has completed one revolution, i. e., one printing operation. This may be accomplished by moving the pivotal member 42 to its original position with element 42b against stop 46. Thus, when the driven element carried by cylindrical member 26 is again received within the spacing between the elements 42a and 42b of the bifurcated end, the driven element 38 will engage element 42a and thereby arrest rotation of the cylindrical member 26 with the recess portion 30 again adjacent the moving surface P.

Inasmuch as it is necessary to return the yoke means to its original position within a relatively short period of time, solenoid 54 may be of the double-acting type whereby the reverse stroke of the solenoid will assist spring 52

in returning the yoke means to its original position. It is of course to be understood that two single-acting solenoids may be provided, one on each side of the yoke means or pivotal member 42. In this arrangement one of the solenoids would provide for actuation of pivotal member 42 in one direction while the other solenoid would assist spring 52 in returning the pivotal member 42 to its original position. Spring 52 has the additional function of absorbing deceleration shock when the driven element 38 is again received within the bifurcated end of pivotal element 42 upon completion of a revolution of cylindrical member 26.

Due to the slight unbalance of the cylindrical member or printing roller 26, the driven element 38 will engage the element 42a between printing cycles, thus the lost motion connection between the pivotal member 42 and cylindrical member 26 will be maintained effective for each initiation of a printing cycle. It is to be understood that other methods of providing for lost motion between the actuating mechanism and the cylindrical member 26 may be provided. For example, the lost motion may be provided between the core 54a and its connection to pivotal element 42 as by a slot end pin connection. Also, solenoid 54 may be positioned on the opposite side of the pivotal element 42 to that shown in Fig. 1 with solenoid core 54a being used as a striker to strike the lower end of pivotal element 42 upon energization of solenoid 54, thereby imparting a blow to element 42 for rotating cylindrical member 26. Accordingly, the solenoid core 54a may be so adjusted with respect to pivotal element 42 that in the normal position there will be clearance between the core 54a and pivotal element 42, thereby providing a lost motion connection between the two to permit the core 54a to be accelerated prior to engagement with pivotal element 42 upon initiation of a printing cycle.

The printing cycle of the printing mechanism 24 may best be seen by reference to Fig. 4. As shown therein, the printing cycle has been divided into four portions, namely, accelerating, synchronizing, stamping and decelerating. As will be recalled, the cylindrical member or roller 26 is provided with a peripheral stamping portion and the axis of the roller is supported in a position substantially parallel to the moving surface P and extends transversely of the path of movement thereof. The printing of indicia on the moving surface P is performed by accelerating the stamping portion from zero velocity to a velocity substantially equal to the velocity of the moving surface P during a portion of a revolution of roller 26. The velocity of the stamping portion or element 28 is synchronized with the velocity of the moving surface P during a second portion of a revolution of roller 26 by bringing the traction surfaces of the rubber rims 32 into engagement with the moving surface P. The indicia or legend is printed on the moving surface P while the peripheral portion of the cylindrical member including the traction surfaces of rubber rims 32 and the moving surface P are in synchronization. The roller 26 is decelerated after the printing operation and after the rubber rims 32 are disengaged from the moving surface P during the remaining portion of the revolution of the roller 26 to bring the stamping portion or element 28 to rest in its original position.

As previously pointed out, machine M (Fig. 1) is an automatic rewinding machine for rewinding strip material from a supply roll 10 into strips of predetermined length on spools or tubes 20. The measuring gear 83 fastened to cam shaft 67 determines the length of paper to be wound on the tubes 20. After each revolution of the gear 83, a predetermined length of paper will have been wound on one of the tubes or spools 20. At this time the cutting mechanism 56 of machine M is actuated to sever the predetermined length of paper from the supply roll. In order to print the legend or indicia on the moving strip P at predetermined locations, it is necessary to energize the winding of the solenoid 54 whenever the predeter-

mined locations or areas on the strip material are passing through the printing zone defined between backing plate 34 and cylindrical member 26. This may be accomplished as shown in Fig. 1 by means of a switch 58 which is actuated by means of a cam surface 60a on cam plate 60 carried by gear 83.

As shown in Fig. 5, the switch 58, preferably of the micro type, is provided with a cam follower 58a. Upon each rotation of gear 83, the cam surface 60a of cam plate 60 will engage the cam follower 58a thereby depressing it for actuation of the switch 58. The cam plate 60 may be positioned around the periphery of gear 83 at a location such that the relay 65 and solenoid 54 will be energized at the proper interval to permit the printing element 28 to be rotated into position against the moving strip P at the predetermined location.

As previously pointed out, this invention is particularly applicable to printing a legend on chart paper for use in recorders of the strip chart type. The chart rolls are provided with strips of chart paper in the order of forty yards in length. In the use of a recorder it is preferable to notify the operator whenever the chart roll is nearing its end so that the operator will be advised that a new chart roll will soon be needed. While the legend indicating the number of inches to the end of the chart roll may be placed at any position, it has been found that a position approximately forty inches from the end of the chart provides for convenient maintenance of the recorders. As shown in Fig. 7, the cylindrical member 26 has been provided with a printing element 28, including the legend "40 inches to end" formed by reversed letters. It is to be understood that a legend may be printed at locations other than forty inches from the end of the chart rolls. Accordingly, the numerals of the printing element 28 would vary correspondingly.

As shown in Figs. 5 and 6 provision is made for adjusting the angular position of cam surface 60a about the shaft 67 of gear 83. The cam plate 60 is provided with elongated slots 62, through which screws 63 extend for securing the cam plate 60 to gear 83. By loosening the screws 63, fine adjustment of the cam surface 60a may be obtained, thus enabling the legend or indicia carried by the printing roller to be printed within relatively close limits at a predetermined location on moving surface P.

In one application of the invention the paper was passing through the rewinding machine at approximately 420 feet per minute, at which time the printing operation took place. By adjusting the cam plate 60, it was possible to print the legend on the paper within approximately plus or minus one-eighth of an inch of the predetermined forty-inch set point.

Referring to Figs. 2 and 3 there is shown a second modification of a printing mechanism embodying the invention, namely printing mechanism 64. The printing mechanism 64 utilizes the same principles as printing mechanism 24 of Fig. 1 and, for purposes of clarity, parts common to both printing mechanisms have been designated by like reference characters.

As shown in Fig. 2, the paper or other strip material P is threaded about a series of guide rods 14 and passes beneath the backing plate 34 and above the cylindrical member 26 of the printing mechanism. The printing mechanism 64, as a whole, and the backing plate 34 are all supported from the spaced guide rails of machine M by means of a frame F. The cylindrical member 26 is rotatably carried at one end of a connecting link 66, the latter being pivotally carried at its opposite end at pivot 68 by frame F. An ink supply roll 70 is also carried by link 66 and a transfer roll 72 is carried by link 66 and supported in between the cylindrical member 26 and the ink supply roll 70 for transferring the ink from the supply roll to the printing element 28 carried on the periphery of cylindrical member 26. The ink supply roll 70 is preferably covered with an absorbent material, for example, felt, for ease in transferring the ink sup-

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ply from within the roller 70 to the transfer roller 72. During each rotation of cylindrical member 26, the printing element 28 is brought into contact with transfer roller 72 and is thereby coated with sufficient ink to perform a printing operation.

In order to support the cylindrical member 26 in a position adjacent the backing plate 34, there is provided a support member 74 which is carried by frame F. The support member 74 is provided with a bifurcated end which embraces the end 66a of link 66 at which cylindrical member 26 is rotatably carried. The bifurcated end of support member 74 is provided with a pair of adjustable means, for example, screws 76, which engage the upper and lower surfaces of the end 66a of link 66 and thereby permit variation in the clearance between the cylindrical member 26 and the backing plate 34. This adjustment is particularly useful in fitting the printing mechanism to the machine M when it is first installed and after the printing mechanism is once installed it permits for varying the spacing or clearance between the cylindrical member 26 and the backing plate 34 to compensate for paper or strip material of different thicknesses.

As previously described in connection with Fig. 1, the cylindrical member 26 is shown in Figs. 2 and 3 as being provided with a pair of rubber rims 32 mounted on the periphery of cylindrical member 26 and having a portion of the rims cut away to form a recess peripheral portion 30. The cylindrical member 26 is also provided with a driven element 38 which has been illustrated as being secured to cylindrical member 26 as by screws 78.

The impulse mechanism or actuating means for the cylindrical member 26 of printing mechanism 64 will now be described. As shown in Figs. 2 and 3, there is provided a reciprocable member 80 supported at spaced locations by means of guide bearings 82 carried by upright members 64 and 86 of frame F. A guide rod member 88, Fig. 2, is rigidly carried by upright members 84 and 86 and is supported beneath the reciprocable member 80. The reciprocable member 80 is provided with a stop member 90 which is adjustably secured to the reciprocable member 80 as by screw 92. The lower end of stop member 90 is provided with a bearing member 90a through which the guide rod 88 is inserted. The stop means 90 may be tightly secured to reciprocable rod 80 by tightening the screw 92. Thus, when there is relative movement between reciprocable member 80 and guide rod 88, there will likewise be relative movement between stop member 90 and guide rod 88, the latter serving as a guide in cooperation with the bearing 90a during the reciprocable movement of member 80 and the stop member 90 which moves therewith. A resilient means 94 is adjustably secured to reciprocable member 80 as by screws 96 and at a point spaced from the stop means or member 90. The resilient means 94 comprises a pair of resilient members 98 and 100 which are carried by a block 102 which in turn is secured to the reciprocable member 80 by screws 96. By tightening screws 96 the block will be tightly secured to reciprocable rod 80 and thus the resilient means 94 will reciprocate with member 80. As shown in Figs. 2 and 3 the stop member 90 and the resilient means 94 are so adjusted along the reciprocable member 80 as to permit adequate clearance for the driven element 38 carried by cylindrical member 36 to be positioned therebetween. Thus, the reciprocable member 80, the stop means 90, and the resilient means 94, form a yoke means similar to the yoke means described in connection with Fig. 1 comprising the pivotal element 42 and its bifurcated end.

In order to actuate the reciprocable member 80 and thereby impart a blow to the cylindrical member 26 to accelerate it to approximately the linear speed of the moving strip P, there is provided a solenoid 104 which is supported by frame F and is mechanically connected

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to one end of the reciprocable member 80. As shown in Figs. 2 and 3, the core 104a of solenoid 104 is provided with a yoke link 106 which is secured to core 104a by means of a pin 103. The yoke link 106 is provided with an opening through which the adjacent end of reciprocable member 80 is inserted. After insertion of the end of reciprocable member 80, a stop member 110 is secured to the end of reciprocable member 80 as by a screw 112 thereby preventing the end of reciprocable member 80 from being withdrawn from the opening in yoke link 106 when there is relative movement therebetween. Reciprocable member 80 is also provided with a stop block 114 which is secured to member 80 as by screw 116. The stop block 114 is provided with a pin 118 which extends transversely therethrough and is parallel to pin 108 carried by the core of solenoid 104. A pair of tension springs 120 interconnect the corresponding ends of pins 108 and 118 and thereby bias the yoke link 106 against the stop block 114. With the parts in position as described, there is a clearance between stop 110 carried by reciprocable member 80 and the yoke link 106. This clearance or spacing provides a lost motion connection between the core 104a of solenoid 104 and reciprocable member 80, the purpose of which will be herein-after described.

At the opposite end of reciprocable member 80, there is provided a solenoid 122 which is mechanically connected to the adjacent end of reciprocable member 80. The core 122a of solenoid 122 is provided with a yoke link 124 and cross pin 126, the yoke link 124 being connected to the adjacent end of reciprocable member 80 as by a screw 128. The reciprocable member 80 also extends through an upright support 130 which in turn is provided with a compression spring 132 through which reciprocable member 80 axially extends.

The operation of the printing mechanism as a whole is as follows: The coil of solenoid 122 is continuously energized except for the fractional interval during a printing cycle when solenoid 104 is energized. Thus, with the parts in their normal position as shown in Figs. 2 and 3, the coil of solenoid 122 is energized and the coil of solenoid 104 is deenergized. Accordingly, the core 122a of solenoid 122 is in a retracted position and the core 104a of solenoid 104 is in a normal or extended position. When the predetermined area of strip P passes between the backing plate 34 and cylindrical member 26, the printing mechanism 64 will be actuated to perform a printing operation thereby printing the indicia or legend on the selected area of the strip P. As previously pointed out, energization of the actuating mechanism may be initiated by means of a cam and switch arrangement as described in connection with Figs. 1 and 5. With the modification shown in Figs. 2 and 3 wherein two solenoids are utilized, the switch 58 is preferably of the double throw type. With the cam and switch in the disengaged position as shown in Fig. 1, the coil of solenoid 122 will be energized and the coil of solenoid 104 will be deenergized. When gear 83 is rotated to a position whereby cam 60a actuates switch 58, Fig. 5, the coil of solenoid 104 will momentarily be energized simultaneously with a deenergization of the coil of solenoid 122. Upon energization of the coil of solenoid 104, the core 104a will be withdrawn into the solenoid 104 thereby causing reciprocable member 80 to be moved to the left as viewed in Figs. 2 and 3. As will be recalled, in the normal position there is a clearance between the yoke link 106 and the stop member 110 carried by the corresponding end of reciprocable member 80. Thus upon energization of solenoid 104, the core 104a thereof will travel a distance equal to that clearance prior to engaging the stop 110. In this manner the core 104a is permitted to accelerate prior to engagement with the stop 110 and thus there is imparted a sharp blow to reciprocable member 80. This blow is in turn imparted to the driven element 38 carried

by cylindrical member 26 through the resilient means 94 by member 98 which strikes the driven element 38 thereby rotating cylindrical member 26 about its axis. By imparting the blow to the driven element 38, the cylindrical member 26 is rapidly accelerated to approximately the linear speed of the moving surface prior to engagement with the moving surface P.

The spring 132 is so positioned with respect to its support 130 such that when solenoid 104 is energized the yoke link 124 will bear against the end of spring 132 and thereby place it under compression. After the initial blow has been imparted to the cylindrical member 26, the cam 60a is disengaged from the cam follower 58a of switch 58 thereby deenergizing solenoid 104 and again energizing solenoid 122. When this occurs the core 122a of solenoid 122 will be retracted to the position shown in Figs. 2 and 3 thereby returning the reciprocable member 80 and its associated parts to their normal position. As the spring 132 is under compression when solenoid 104 is energized and its core 104a is in a retracted position, the spring 132 will provide for initial acceleration in returning reciprocable member 80 to its normal position upon deenergization of solenoid 104.

While the foregoing operation has been taking place, the cylindrical member 26 has been going through the following cycle as shown in Fig. 4. The peripheral portion of the cylindrical member 26 including the stamping element 28 has been accelerated from zero velocity to a velocity substantially equal to the velocity of the moving surface P during a portion of a revolution of cylindrical member 26. During a second portion of the revolution, the velocity of this peripheral portion has been synchronized with the velocity of moving surface P by bringing the traction surfaces of rubber rims 32 into engagement with the moving surface P to provide a frictional drive therewith. While the peripheral portion or cylindrical member 26 and the moving surface P were in synchronization, the printing element 28 was brought in contact with the moving surface to print indicia at the predetermined location thereon. After the printing portion of the cycle, the cylindrical member 26 was disengaged from the moving surface P to permit deceleration of cylindrical member 26. As the cylindrical member 26 approached its original or normal position shown in Figs. 2 and 4, the driven element 38 first came in contact with resilient member 98 of resilient means 94, flexing it in a downward direction thus absorbing a substantial amount of the deceleration shock prior to engagement with the stop member 90 secured to reciprocable member 80 and thereby completing a printing cycle.

The various portions of the printing cycle described above may readily be altered. For example, the driven element 38 carried by the cylindrical member 26 may be positioned at various locations throughout an included angle equal to the included angle of the recess portion 30 and at the opposite side of cylindrical member 26. In this manner the accelerating and decelerating portions of the cycle may be either increased or decreased. By increasing or decreasing the traction surface of the rubber rims 32, the synchronizing portion of the cycle may be altered as well as the accelerating and decelerating portions of the cycle. If the synchronizing portion of the cycle is to be shortened, the traction surfaces of the ends 32 will be correspondingly shortened. Accordingly, the length of the peripheral recess 30 will be correspondingly lengthened.

While the invention has been described in connection with a rewinding machine, it is to be understood that it is applicable to printing indicia or legends on any moving surface. For example, the printing mechanism, either modification 24 or 64, may be supported beneath a conveyor over which boxes or other containers pass. Indicia or legends may be printed on the containers or boxes by actuating the printing mechanism each time a box or

container passes over the printing roller 26. This could readily be accomplished by positioning the switch 58 so that it will be actuated whenever a box or container reaches the location adjacent the printing roller 26.

While the cylindrical member or printing roller 26 has been described as being provided with rubber rims 32 at the opposite ends thereof, it is to be understood that the rubber might extend the full length of the cylindrical member 26 with an appropriate opening being provided therein for the protrusion of printing element 28 and a relief portion on the periphery to form the recess 30. Also it is to be understood that member 26 need not be cylindrical. For example, the member 26 may be a rotatable body having a non-circular periphery. It is sufficient if the periphery of the rotatable body include a convex portion, the radii of which are equidistant from the axis of rotation while the remaining peripheral portion of the body have smaller radii than the radii of the convex portion. Thus the convex portion will provide the curved surface necessary for synchronizing the peripheral speed of the body with the linear speed of the moving surface to prevent relative motion between the printing element and the moving surface during the printing operation and the remaining peripheral portion of the body, having the smaller radii, will provide the recess portion to disengage the rotatable body from the moving surface and provide clearance therebetween.

It is also to be understood that other changes and modifications of the invention may be made within the scope of the appended claims and that the invention is not limited to the specific arrangements shown.

What is claimed is:

1. Printing mechanism for printing indicia on a moving surface comprising a freely rotatable cylindrical member having a peripheral portion including a stamp for driving engagement with the moving surface and a recess peripheral portion for disengaging said cylindrical member with the moving surface, and impulse means having structure for striking cooperating structure on said cylindrical member for periodically initiating free rotation of said cylindrical member to bring said first-named portion including said stamp into driving engagement with the moving surface for printing indicia on the moving surface and for maintaining said cylindrical member in its disengaged position after each printing operation, said striking structure and said cooperating structure following dissimilar paths during the printing operation.

2. Printing mechanism according to claim 1 wherein said striking structure of said impulse means is movable into and out of engagement with said cooperating structure of said cylindrical member, said striking structure being out of engagement with said cooperating structure of said cylindrical member during each printing operation by said stamp to permit rotation of said cylindrical member controlled solely by said moving surface.

3. Printing mechanism comprising a cylindrical member supported for rotation about its axis, said cylindrical member having a portion including a printing element for engaging a moving surface to print indicia thereon and having a recess portion for disengaging said cylindrical member with the moving surface during each revolution of said cylindrical member, a driven element carried by said cylindrical member, and impulse means including means for striking said driven element in a transverse direction with respect to said axis of said cylindrical member to rotate said cylindrical member about its axis to bring said first-named portion of said cylindrical member including said printing element into engagement with the moving surface for a printing operation, said striking means being disengaged from said driven element during the printing operation, and means for reengaging said driven element after said printing operation to maintain said cylindrical member in its disengaged position with respect to the moving surface.

4. Apparatus for printing indicia on a moving surface

comprising a rotatable body including a stamping portion on its periphery and a peripheral recess spaced from said stamping portion normally providing clearance between said rotatable body and the moving surface, impulse means having structure for striking cooperating structure on said body for rotating said body and accelerating said stamping portion from zero velocity to a velocity substantially equal to the velocity of the moving surface, said striking structure and said cooperating structure following dissimilar paths during the printing operation, means carried by said rotatable body and engageable with the moving surface to form a tractive coupling therebetween for synchronizing the velocity of said stamping portion with the velocity of the moving surface during the printing operation, and means for decelerating and stopping said rotatable body to bring said stamping portion to rest in its normal disengaged position.

5. Apparatus for printing indicia on a moving surface comprising a rotatable body disposed for rotation about an axis substantially parallel to the moving surface and extending transversely to the path of movement thereof, said body having a non-circular periphery, said periphery including a convex portion the radii of which are equidistant from the axis of rotation, the remaining peripheral portion of said body having smaller radii than the radii of said convex portion, said convex portion including a printing element, and impulse means for rotating said body to initiate a printing operation comprising a driven element carried by said body, yoke means for embracing said driven element, means for moving said yoke means in one direction to initiate rotation of said body about its axis and thereby remove said driven element from its position within said yoke means, and means for moving said yoke means in reverse direction to receive said driven element again within said yoke means after said printing operation and upon completion of a revolution of said body.

6. The combination set forth in claim 5 wherein said yoke means comprises a pivotal element having a bifurcated end, said element being pivoted at a point spaced from said bifurcated end.

7. The combination set forth in claim 5 wherein said yoke means comprises a reciprocable member having stop means and a resilient member carried thereby and spaced one from the other for receiving therebetween said driven element.

8. The combination set forth in claim 5 wherein said means for moving said yoke means in one direction comprises solenoid means, and said means for moving said yoke means in reverse direction includes spring biased means.

9. The combination set forth in claim 5 wherein said means for moving said yoke means includes solenoid means operable in reverse directions.

10. Apparatus for printing indicia on a moving surface comprising a backing element, a rotatable cylindrical member disposed on the opposite side of the path of the moving surface from said backing element and having a portion of its periphery forming a convex surface, the radii of which are equidistant from the axis of rotation for pressing the moving surface against said backing element and the remainder of the periphery having smaller radii than said first-named portion forming a recess in the periphery of said cylindrical member to disengage the cylindrical member from the moving surface, driving means operable in one direction for rotating said cylindrical member to bring said first-named portion of the periphery of said cylindrical member into engagement with the moving surface, mechanical means for cyclically connecting said cylindrical member and said driving means, said mechanical means including a lost motion connection to permit acceleration of said driving means prior to rotation of said cylindrical member, said driving means being operable in a reverse direction for reconnecting said mechanical means and said cylindrical member to decelerate and stop said cylindrical member upon completion of a revolution.

11. Printing mechanism comprising a rotatable body supported for rotation about its axis, said rotatable body having a portion of its periphery lying on a convex surface, the radii of which are equidistant from the axis of rotation and including a printing element for engaging a moving surface to print indicia thereon, the remainder of the periphery of said rotatable body having smaller radii than said first-named portion to provide a recess in the periphery of said rotatable body for disengaging said rotatable body with the moving surface during each revolution of said rotatable body, a driven element carried by said rotatable body, and actuating means having structure for engaging said driven element to rotate said rotatable body about its axis to bring said first-named portion of the periphery of said rotatable body including said printing element into engagement with the moving surface for a printing operation, said actuating means being disengaged from said driven element during said printing operation and reengaging said driven element after said printing operation to maintain said rotatable member in its disengaged position, said driven element and said structure following dissimilar paths during the printing operation.

12. Printing mechanism comprising a cylindrical member supported for rotation about its axis, said cylindrical member having a curved peripheral portion including a printing element for engaging a moving surface to print indicia thereon and having a recess peripheral portion for disengaging said cylindrical member with the moving surface during each revolution of said cylindrical member, impulse mechanism for imparting a blow to accelerate said cylindrical member to approximately linear speed of the moving surface and effecting driving engagement between the moving surface and said cylindrical member during which said printing element engages the moving surface, said impulse mechanism after imparting said blow being disconnected with respect to said cylindrical member during said printing on the moving surface, and a lost motion connection effective between said impulse mechanism and said cylindrical member to permit acceleration of said impulse mechanism prior to its engagement with said cylindrical member, and means for arresting said cylindrical member when said recessed peripheral portion has been rotated to a position adjacent the moving surface to maintain said cylindrical member in its disengaged position.

13. Printing mechanism for printing indicia on a moving surface comprising a cylindrical member rotatable about an axis substantially parallel to the moving surface and extending transversely of the path of movement thereof, said cylindrical member having a peripheral recess normally providing clearance between said cylindrical member and the moving surface, a printing element carried by said cylindrical member and spaced from said peripheral recess, impulse mechanism having structure for imparting a blow to cooperating structure on said cylindrical member in a transverse direction with respect to the axis of said cylindrical member to accelerate said cylindrical member to approximately linear speed of the moving surface and effecting driving engagement between the moving surface and said cylindrical member during which said printing element engages the moving surface, said impulse mechanism after imparting said blow being disconnected with respect to said cylindrical member during said printing on the moving surface, and means for arresting said cylindrical member when said recess is again adjacent the moving surface.

14. The combination set forth in claim 13 wherein the impulse mechanism and arresting means comprise a driven element carried by said cylindrical member, a pivotal member having a bifurcated end for receiving therebetween said driven element, said pivotal member being pivoted at a point spaced from said bifurcated end, stop means disposed on opposite sides of said pivotal element for limiting the pivotal movement thereof, solenoid means mechanically connected to said pivotal member at a point

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spaced from the pivot for movement of said bifurcated end of said pivotal element between said stop means, said bifurcated end upon movement in one direction striking said driven element carried by said cylindrical member and rotating said member about its axis thereby removing said driven element from within said bifurcated end, and spring means connected to said pivotal element for biasing said pivotal element against one of said stop means, said spring means absorbing deceleration shock when said driven element is again received within said bifurcated end upon completion of a revolution of said cylindrical member.

15. The combination set forth in claim 13 wherein the impulse mechanism and arresting means comprise a driven element carried by said cylindrical member, reciprocable means including stop means and a resilient means disposed on opposite sides of said driven element, solenoid means for moving said reciprocable means in one direction to move said resilient means against said driven element thereby rotating said cylindrical member and removing said driven means from its position between said stop means and said resilient means, a lost motion connection between said reciprocable means and said solenoid means to permit acceleration of said solenoid means prior to movement of said reciprocable means, and a second solenoid means for moving said reciprocable means in reverse direction to return said reciprocable means to its original position to receive said driven means again between said resilient means and said stop means upon completion of a revolution of said cylindrical means, said driven means first striking said resilient means for reducing deceleration shock prior to engagement with said stop means.

16. In a machine for automatically rewinding strip material from a supply roll into strips of predetermined length on cores having rotatable means for predetermining the length of the material to be rewound on each spool including knife means for severing the predetermined lengths of material from the supply roll, apparatus for printing indicia on a surface of the strip material as it passes through the rewinding machine comprising a cylindrical member rotatable about an axis substantially parallel to the surface, said cylindrical member having a peripheral recess normally providing clearance between said cylindrical member and the moving surface, a printing element on the periphery of said cylindrical member and spaced from said recess, impulse mechanism having structure for imparting a blow to cooperating structure on said cylindrical member in a transverse direction with respect to the axis of said cylindrical member to accelerate said cylindrical member to approximately the linear speed of the moving surface and effecting driving engagement between the moving surface and said cylindrical member during which said printing element engages the moving surface, said impulse mechanism after imparting said blow being disconnected with respect to said cylindrical member during said printing on the moving surface, means for arresting said cylindrical member when said recess is again adjacent the moving surface, and means cooperating with said rotatable means to actuate said impulse mechanism at a predetermined location on the strip material.

17. In a machine for automatically rewinding strip material from a supply roll into strips of predetermined length on cores and including rotatable means for predetermining the length of material to be rewound on each core, apparatus for printing indicia on the strip material as it passes through the rewinding machine comprising a backing plate supported adjacent one side of the moving strip material, a cylindrical member rotatably supported on the opposite side of the path of the moving strip material and having a portion of its periphery lying on a convex surface, the radii of which are equidistant from the axis of rotation and including a printing element for printing indicia on the moving strip material by pressing the moving strip material against said backing plate, the remainder of the periphery of said cylindrical member having smaller radii

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than said first-named portion forming a recess in the periphery of said cylindrical member to disengage said cylindrical member with the moving strip material, driving means operable in one direction for rotating said cylindrical member to bring said first-named portion of the periphery of said cylindrical member with said printing element into engagement with the moving strip material for a printing operation, mechanical means for cyclically connecting said cylindrical member and said driving means, said mechanical means including a lost motion connection to permit acceleration of said driving means prior to rotation of said cylindrical member, said driving means being disconnected with respect to said cylindrical member during a printing operation and operable in a reverse direction for reconnection with respect to said cylindrical member to decelerate and stop said cylindrical member upon completion of a revolution thereof, and means cooperating with the rotatable means to actuate said driving means and initiate said printing operation at predetermined locations on said strip material.

18. A system for applying material to a precise portion of a linearly moving surface comprising means controlling the movement of said surface, material-applying means including a high friction tractive coupling element to be driven by said moving surface, actuating means operated in timed relation with means for moving said surface to periodically initiate operation of said material-applying means precisely to regulate the linear position along said moving surface at which said applying means will apply material to said surface, and means operable under the control of said actuating means cyclically to move said element into engagement with said moving surface for producing a tractive coupling between said element of said applying means and said moving surface to synchronize movement of said applying means with movement of said moving surface, the latter surface through said tractive coupling providing the sole positive drive of said applying means during the period of applying material to said surface to eliminate relative linear movement between said applying means and said moving surface during said period of applying material to said surface.

19. The method of printing indicia on a moving surface comprising the steps of accelerating the peripheral speed of a printing member to approximately the linear speed of the moving surface prior to engagement of the printing member with the moving surface, bringing the printing member into engagement with the moving surface, driving the printing member from the moving surface to effect control of the peripheral speed of the printing member by the moving surface for synchronizing the peripheral speed of the printing member with the speed of the moving surface, printing indicia on the moving surface while the printing member and the moving surface are in driving engagement, and decelerating and stopping the printing member in a position wherein the printing member is disengaged with respect to the moving surface.

20. The method of printing indicia on a moving surface which comprises applying a tangential force to a printing member in one direction for accelerating rotation of the printing member from zero surface velocity to a surface velocity substantially equal to the velocity of the moving surface during a portion of a revolution of the printing member, rotating the printing member into engagement with the moving surface during a second portion of a revolution of the printing member, driving the printing member from the moving surface to effect control of the rotation of the printing member by the moving surface for synchronizing the surface velocity of the printing member with the velocity of the moving surface, printing indicia on the moving surface while the printing member and the moving surface are in synchronization, decelerating rotation of the printing member after the printing operation and during the remaining portion of a revolution of the printing member, and applying a tangen-

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tial force to the printing member in an opposite direction to said first-named force to bring the printing member to rest in its original position.

21. The method of printing indicia on a moving surface which comprises the steps of striking a printing member to effect free rotation of the member about an axis and to accelerate the surface velocity of the printing member from rest to approximately the velocity of the moving surface prior to engagement with the moving surface, rotating the printing member into engagement with the moving surface, driving the printing member from the moving surface for control of the rotation of the printing member by the moving surface in synchronizing the movement of the printing member with the moving surface, printing indicia on the moving surface while the printing member and the moving surface are in engagement and in synchronization, and decelerating the printing member after disengagement with the moving surface to the initial rest position of the printing member.

22. The method of printing on a moving surface which comprises starting and accelerating the rotation of a printing member from a position of rest to an angular

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velocity such that the peripheral speed of the printing member is substantially equal to the speed of the moving surface while the printing member is freely turning through a fraction of a revolution, bringing the printing member into engagement with the moving surface, driving the printing member from the moving surface for producing equality between the peripheral speed of the printing member and the speed of the moving surface before printing on the surface, printing on the moving surface while said equality of said speeds exist, and quickly reducing the angular velocity of the printing element after the printing operation but before completion of a single revolution of the printing member to return the printing member to rest in its original position.

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