Dec. 23, 1958 A. J. SARKA 2,865,450

APPARATUS FOR TREATING STRIP AND THE LIKE

Filed Dec. 9, 1954

4 Sheets-Sheet 1

FIG. 1.

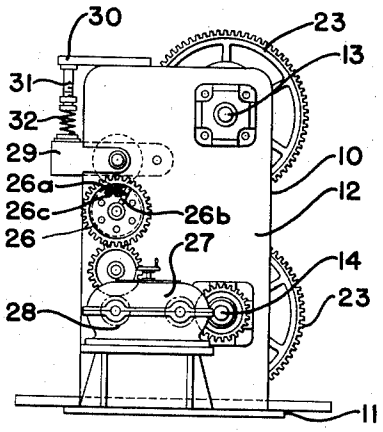


FIG. 2.

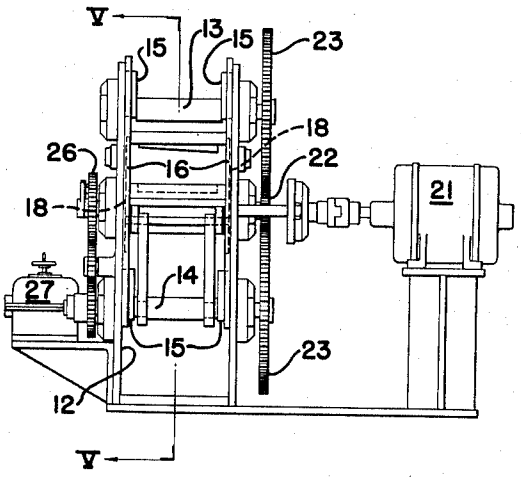


FIG. 3.

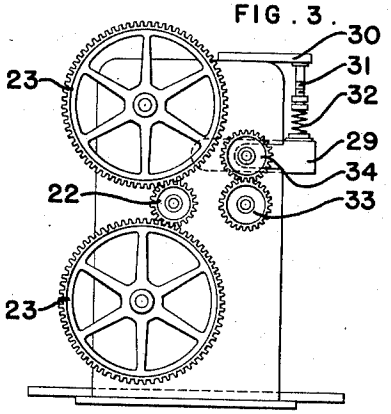


FIG. 4.

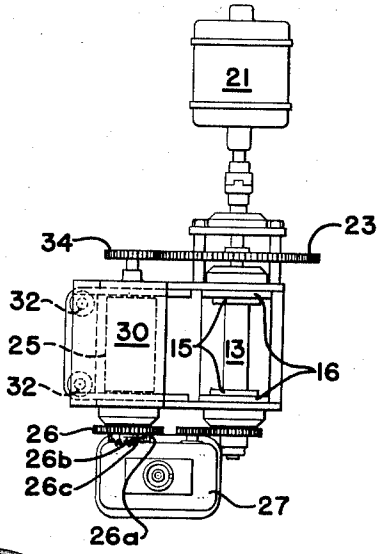
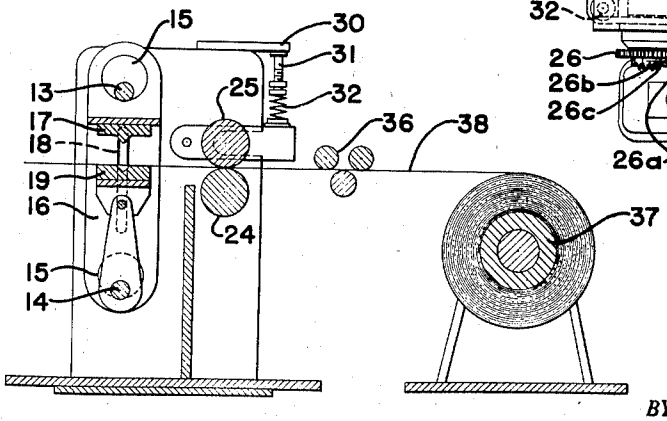


FIG. 5.



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FIG. 6D.

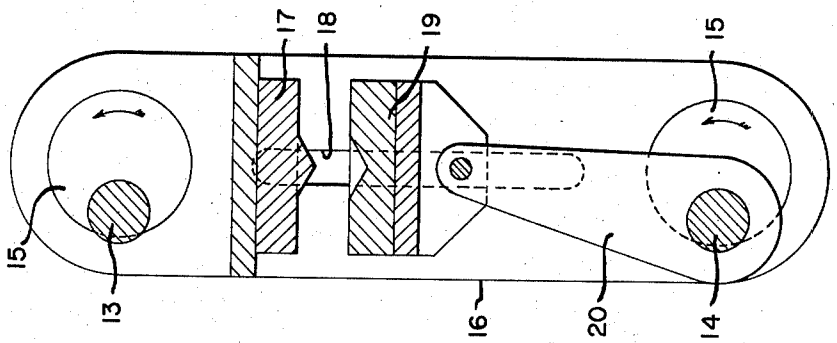


FIG. 6C.

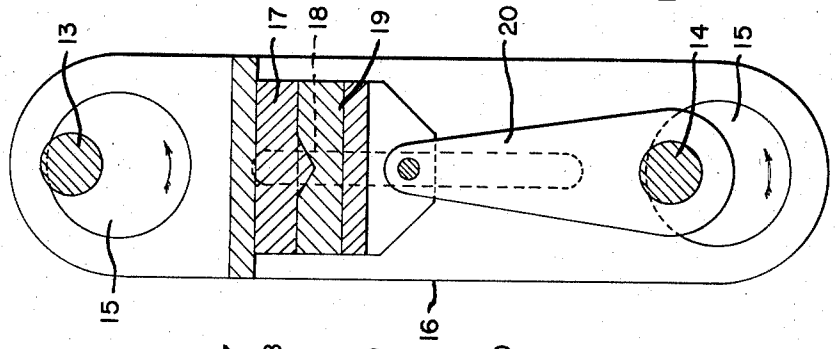


FIG. 6B.

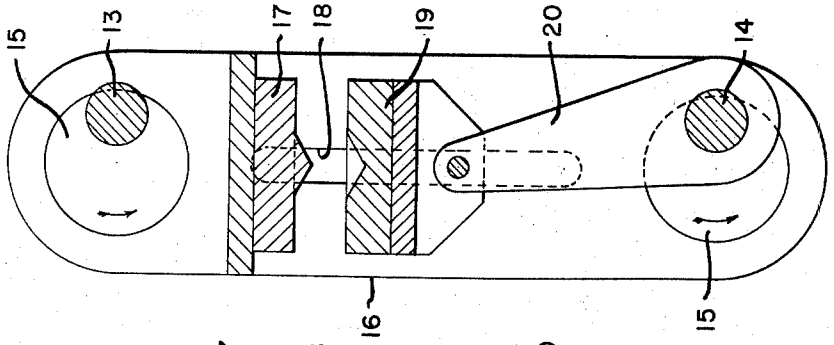
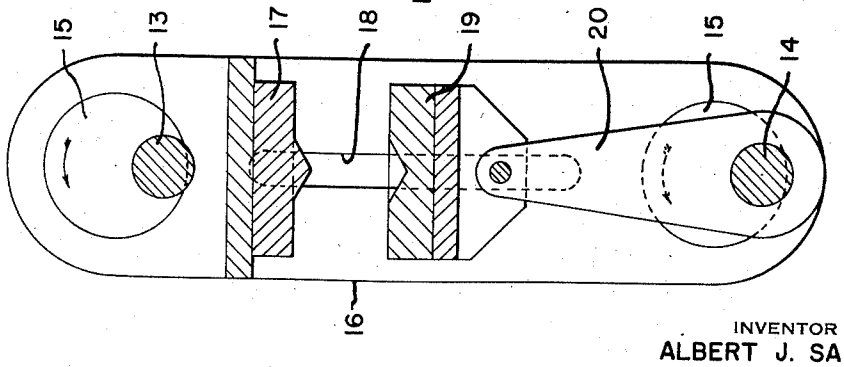


FIG. 6A.



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FIG. 8.

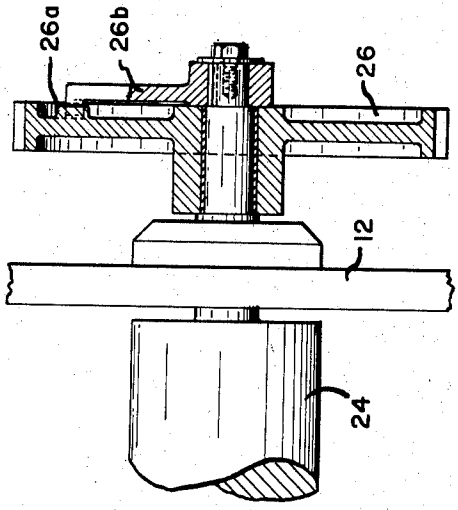
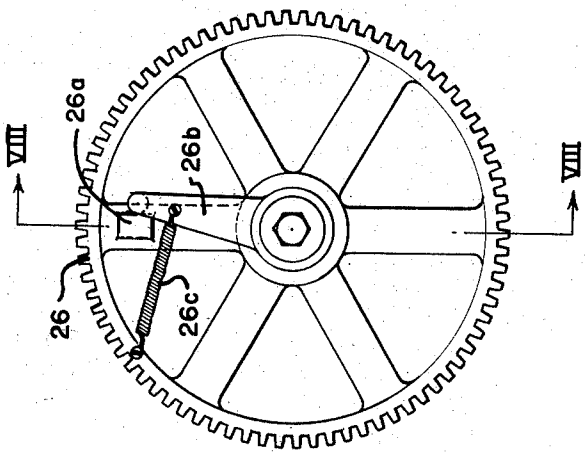


FIG. 7.



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FIG. 9D.

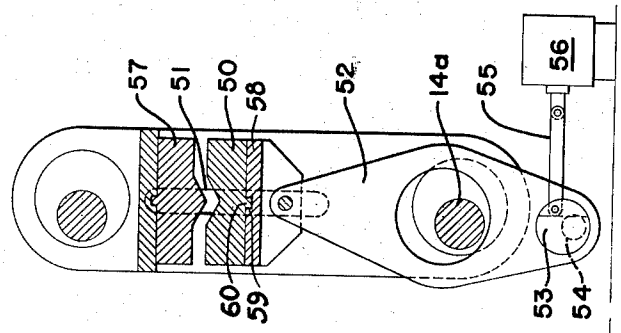


FIG. 9C.

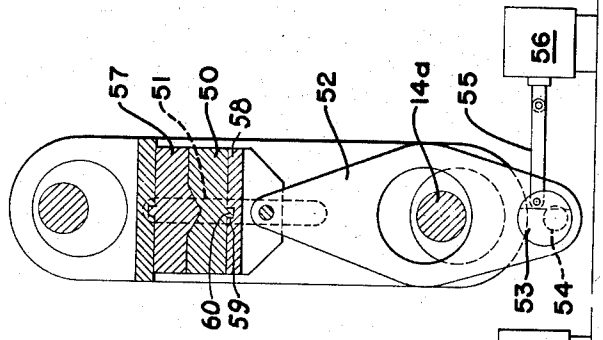


FIG. 9B.

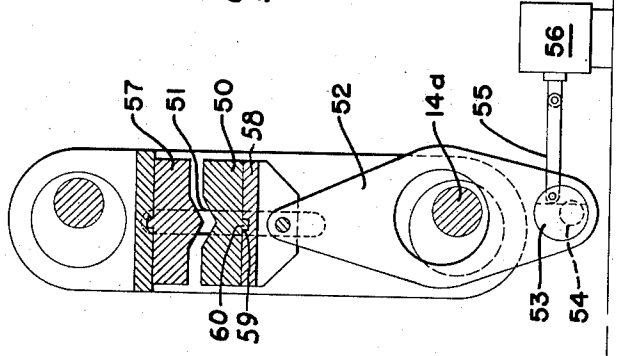
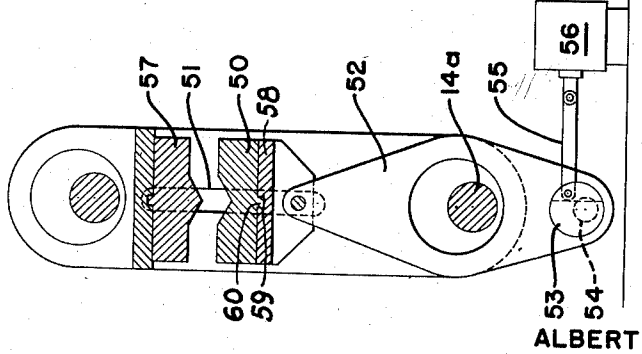


FIG. 9A.



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United States Patent Office 2,865,450
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2,865,450

APPARATUS FOR TREATING STRIP AND THE LIKE

Albert J. Sarka, Maple Heights, Ohio, assignor to Wean Equipment Corporation, Cleveland, Ohio, a corporation of Ohio

Application December 9, 1954, Serial No. 474,250

18 Claims. (Cl. 164—49)

This invention relates to apparatus for treating moving material in strip-like form without interrupting the movement of the material. For purposes of explanation and illustration the invention will be described as embodied in a punch press, although it may be similarly embodied in a flying shear, a stamping machine or similar strip treating mechanisms.

It has been one of the great problems in high-speed strip production to treat the strip, e. g., cut it into lengths, to stamp indicia upon it, to punch or otherwise form it or to otherwise treat the strip at fixed intervals as it is being processed at high speeds. The usual and well known methods of treating strip are not satisfactory for treating high-speed strip for the reason that the strip tends to "pile up" at the treating machine, is torn or otherwise damaged or the spacing is inaccurate. There have been many and varied machines proposed for treating such strip, but in every case these devices are subject to the disadvantages of complex design, high cost, excessive space requirements, need for highly skilled operating personnel and most important very definite limitations as to accuracy and operating speed.

The strip treating mechanism of the present invention provides a simple solution to the aforementioned problems and to the disadvantages of the prior art equipment. The mechanism of this invention may be used for shearing, contour cutting, stamping, pressing or otherwise treating a rapidly moving strip. In this application, however, it will be specifically described as embodied in a punch press for punching rapidly moving strip material. The invention provides a continuously operable means feeding strip material and the like in a path, means on the continuously operable means whereby a portion of the strip may be drawn under tension through the continuously operable means at a rate of speed in excess of the speed of said continuously operable means and then returned through the continuously operable means to the relative position it would have had had no withdrawal been effected, and means receiving the strip from the continuously operable means intermittently acting on the strip and moving the strip at a rate of speed in excess of the rate of feed whereby the strip is drawn intermittently under tension through the continuously operable means at a rate in excess of the rate of feed.

Preferably there is provided a continuously operable means feeding strip material and the like in a path, means on the continuously operable means whereby a portion of the strip may be drawn under tension through the continuously operable means at a rate of speed in excess of the speed of said continuously operable means and then returned through the continuously operable means to the relative position it would have had had no withdrawal been effected, a first member for acting on the strip and the like mounted to operate in a circular path at a peripheral speed in excess of the rate of feed, a portion of which circular path lies substantially in the first mentioned path, a guide extending generally transversely of the first mentioned path mounted to move with the first member, a second member for acting on the strip and the like mounted to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed. Preferably the continuously operable feeding means includes a pair of pinch rolls driven from a variable speed drive through a main drive gear mounted on the shaft of one pinch roll. Preferably the main drive gear is freely rotatable on the pinch roll shaft and the shaft is provided with a fixed arm adjacent the main drive gear and lying in a parallel plane which arm is engaged by a pin on the main drive gear extending parallel to the axis of the pinch roll shaft. Resilient means such as a spring connects the pin and arm to hold them normally in contact. The first member acting on the strip is preferably mounted in a floating frame surrounding the path of strip travel and mounted on spaced apart eccentric cams. These cams are identical in size and shape and rotate about parallel axes in the same direction so that all points on the frame describe a circle of identical size during each revolution of the cams. The second member is preferably mounted in guides on the frame on the side of the strip opposite the first member and pivoted to an arm rotatable on a fixed axis opposite the first member so that the second member is caused to reciprocate in the guideways while it moves with the frame as the frame revolves about its cams.

Means may be provided on the first and second members for receiving interchangeable platens so that the punch press as described herein may be converted to a shear, a stamping machine or other strip treating mechanism simply by changing the platens. Preferably this is accomplished by providing platen holders with cooperating indexing means in each member.

Certain features, advantages and objects of this invention have been outlined above. Other features, advantages and objects will be apparent from a consideration of the following description and the accompanying drawings, in which—

Figure 1 is a side elevational view of a punch press according to my invention;

Figure 2 is an elevational view of the discharge end of the punch press of Figure 1;

Figure 3 is a side elevational view of the press of Figure 1 looking from the right of Figure 2;

Figure 4 is a top plan view of the press of Figure 1;

Figure 5 is a vertical section on the line V—V of Figure 2;

Figures 6A, 6B, 6C and 6D are vertical sectional views through the floating frame and illustrate diagrammatically the sequence of motion of the floating frame and press members thereon during a single cycle.

Figure 7 is an enlarged elevational view of the pinch roll drive gear wheel used in the embodiment shown in Figure 1;

Figure 8 is an enlarged section on the line VIII—VIII of Figure 7; and

Figures 9A, 9B, 9C and 9D show a second embodiment of this invention permitting the treating of multiple lengths.

Referring to the drawings there is illustrated a housing **10** having a base **11** and side members **12**. A pair of parallel shafts **13** and **14** are journaled for rotation adjacent the top and bottom of the side members **12**, verti-

cally one above the other. Each of these shafts is provided with eccentric cams 15 adjacent the side members 12. A floating frame made up of side frames 16 mounted for rotation on the cams 15 and spacer members (not shown) is provided between the side members 12 of the housing. A top press die 17 is fixed between the side frames 16 below the upper shaft 13 to travel with the side frames. Each side frame 16 is provided with a vertical slot 18 within which a lower press die 19 is vertically reciprocable. The lower press die 19 is pivotally mounted on the end of vertical arms 20 which are in turn pivoted on the lower shaft 14 alongside the eccentric cams 15. The two shafts 13 and 14 are driven by a motor 21 acting through a drive pinion 22 and identical gears 23 on the shafts 13 and 14.

A pair of pinch rolls 24 and 25 are provided within the housing side members 12 adjacent the floating frame to continuously feed strip on a path through the frame. The lower pinch roll 24 is journaled in the side members 12. A gear wheel 26 is freely rotatable on the end of the lower pinch roll 24 and is driven by a variable speed gear drive 27 of the PIV or equivalent known type from a gear 28 on the lower shaft 14. The gear wheel is provided adjacent its outer periphery with a lug 26*a* which extends axially outwardly therefrom to lie in the path of an arm 26*b* fixed on the lower pinch roll 24. The outer extremity of the arm 26*b* is provided with a spring 26*c* which connects to the gear wheel 26 tending to normally hold the arm 26*b* against the lug 26*a*. The upper pinch roll is journaled in lever arms 29 pivotally mounted on the side members 12 above the bottom pinch roll 24. Outwardly extending arms 30 are fixed to the side members 12 above the lever arms 29 and parallel thereto. Suspended from each arm 30 is a screw jack 31 bearing against a spring 32 which in turn bears upon the free end of the corresponding lever arm 29. By adjusting the position of the screw jack 31, the pressure on the lever arm 29 and thereby the pressure between the pinch rolls may be varied. The lower pinch roll 24 is provided with a gear 33 which drives the upper pinch roll 25 through a gear 34.

A set of rollers 36 in the form of a roller leveler may be provided in advance of the pinch rolls to level the strip leaving the uncoiler 37 and align it with the roll nip. The operation of the punch press described above will be perhaps best explained by reference to Figure 1 and the diagrammatic showing of Figures 6A through 6D. The strip 38 to be treated leaves the uncoiler 37 and passes through the roller leveler 36 into the nip between the pinch rolls 24 and 25. The strip is fed by the pinch rolls at a constant rate of speed through between the side frames 16 of the floating frame and between the upper die 17 and lower die 19. As the motor drives shafts 13 and 14 the eccentric cams 15 carry the side frames 16 of the floating frame in a circle about the two shafts as illustrated in Figures 6A through 6D at a peripheral speed in excess of the rate of strip feed by the pinch rolls 24 and 25. This in turn carries the upper die 17 through a circle identical with that of the frame and below the shaft 13. At the same time the lower die 19 is moved reciprocally in the slot 18 and back and forth horizontally with the floating frame, thereby following an arcuate path (see Figures 6A through 6D). Both the upper die 17 and the lower die 19 move with the same speed as the frame and in excess of the rate of speed of the strip fed by the pinch rolls so that when the strip is engaged between them as at position 6C they exert a tension on the strip, pulling it through between them. The pinch rolls are accordingly moved at a rate of speed greater than their normal speed of feed. When this occurs the arm 26*b* is carried away from the lug 26*a* on the gear wheel 26 against the tension of the spring. As the dies 17 and 19 release the strip (position 6D) the spring 26*c* acts to retard the rotation of the pinch roll and to return the arm 26*b* to its position against the pin or lug 26*a*. This in turn causes the strip to be fed back through the pinch rolls until the pinch roll resumes its normal position with respect to the drive gear wheel 26. In this way a constant amount of strip material is handled at each revolution of the floating frame and differences in speed between the rotation of the frame and pinch roll feed are compensated for without causing variations in the length of strip treated.

In the punch press described above, an impression can be made consistently within a given length. In order to permit variations in length of multiples of the basic length, a modified form of structure may be used. In this modification, the drive, the housing, the eccentric cams and the floating frame structure remain the same. The lower platen 50 is still reciprocable in slots 51 identical with those of Figures 1 through 5. However, the lower platen 50 is pivoted on the ends of arms 52 which surround the lower shaft 14*a* out of contact with it. The arms 52 are pivoted on eccentric cams 53 mounted on a separate shaft 54. The eccentric cams are connected through a shaft 55 to a double acting solenoid 56 which acts to rotate them about the shaft 54 and thereby raise and lower the pivotal axis of the arms 52. By lowering the pivotal axis of the arms 52 the lower platen is caused to follow an arcuate path slightly below the path of travel of the strip so that its travel never intersects the path of the upper platen 57. This is illustrated in Figures 9A through 9C. When the pivotal axis of the arms 52 is raised the operation of the two platens is as described in connection with Figures 6A through 6D. This action is specifically illustrated in Figures 9A through 9D.

In order to permit the ready interchange of platens 50 and 57, a lower platen holder 58 may be provided for reciprocation in the slots 51 to carry the platen 50. The platen holder 58 may be provided with an indexing guide 59 such as a slot to receive an indexing member 60, such as a depending shoulder fitting in slot 59, on the platen 50. A similar indexing guide and indexing member may be provided on the upper platen holder and platen. By using platen holders, various interchangeable platens such as punches, shear blades, stamps and the like may be substituted for the die platens 50 and 57 as shown in the drawings.

While certain preferred embodiments of this invention have been illustrated and described it will be understood that the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, tension means on the continuously operable means whereby a portion of the strip may be drawn under tension through the continuously operable means at a rate of speed in excess of the speed of said continuously operable means and then returned through the continuously operable means to the relative position it would have had had no withdrawal been effected, a first member for acting on the strip and the like mounted to operate in a circular path at a peripheral speed in excess of the rate of feed, a portion of which circular path lies substantially in the first mentioned path. a guide extending generally transversely of the first mentioned path mounted to move with the first member, a second member for acting on the strip and the like mounted to reciprocate in the guide and means causing the second member to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed.

2. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding

strip and the like in a path, means on the continuously operable means whereby a portion of the strip may be drawn under tension at spaced intervals through the continuously operable means at a rate of speed in excess of the continuously operable means and then retarded until the strip assumes the same relative position it would have had had no withdrawal been effected, a first member for acting on the strip and the like mounted to operate in a circular path at a peripheral speed in excess of the rate of feed, a portion of which circular path lies substantially in the first mentioned path, a guide extending generally transversely of the first mentioned path mounted to move with the first member, a second member for acting on the strip and the like mounted to reciprocate in the guide and means causing the second member to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed.

3. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, means on the continuously operable means whereby a portion of the strip may be drawn under tension at spaced intervals through said continuously operable means at a rate of speed in excess of the continuously operable means and then retarded until the strip assumes the same relative position it would have had had no withdrawal been effected, a first member for acting on the strip or the like mounted to operate in a circular path a portion of which lies substantially in the first mentioned path, a guide extending generally transversely of the first mentioned path mounted to move with the first member, eccentric drive means actuating said first member to operate in said circular path, a second member for acting on the strip and the like mounted to reciprocate in the guide and means causing the second member to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed.

4. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like, means on the continuously operable means whereby a portion of the strip may be drawn under tension at spaced intervals through the continuously operable means at a rate of speed in excess of the continuously operable means and then retarded until the strip assumes the same relative position it would have had had no withdrawal been effected, an eccentrically driven floating frame surrounding the path of travel on the exit side of the feeding means all points of which frame move in a circular path, a first member for acting on the strip or the like, said first member being mounted on said frame on one side of the path of strip travel and adapted to pass on the first mentioned path during a portion of its movement with the frame, a second member for acting on the strip reciprocably movable in said frame transverse to the path of travel of the strip and means causing the second member to reciprocate in the frame and move generally in unison with the first member and to move substantially into the path of strip travel substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed.

5. A strip treating machine for treating rapidly moving strip comprising continuously operable means feeding strip material in a path, an eccentrically driven floating frame surrounding the path of strip travel on the exit end of the feeding means all points of which frame move in a circle whose radius equals the throw of the eccentric drive, a first member on said frame on one side of the path of strip travel, guideways on the floating frame transverse to the path of strip travel and spaced from the first member, a second member reciprocally movable in said guideways on the opposite side of the path of strip travel from the first member, a pair of arms pivoted on an axis spaced at the opposite side of the path of strip travel from the first member, said arms pivotally engaging the second member causing it to reciprocate in the guideways and move generally into the path of strip travel simultaneously with the first member to engage the strip between the first and second member whereby the strip is moved with said members, drive means driving the floating frame, connections from said drive means to the continuously operable means, said connection continuously driving a freely rotatable drive gear on the continuously operable means, drive means fixed on the continuously operable means engageable by said drive gear to drive the continuously operable means in one direction and tension means connecting the drive gear and drive means tending to maintain the drive means in engagement with the drive gear while permitting said drive means intermittently to rotate in the feeding direction at a speed greater than the rotational speed of the drive gear.

6. A strip treating machine as claimed in claim 5 wherein the pair of arms are pivotally mounted on eccentric cams and means are provided for rotating said eccentric cams within the arms to vary their pivotal axis whereby the second member is raised and lowered into and out of position to intersect the path of strip travel.

7. Apparatus for treating rapidly moving strip and the like comprising means for continuously feeding the strip material in a path, tension means in the continuously operable means whereby the strip may overrun the feed at spaced intervals and be immediately thereafter returned to the relative position it would have had had no overrun been effected, a floating frame surrounding the path of strip travel on the exit side of the feeding means, spaced rotary cam means acting on the frame to cause it to move in a circle whose radius is the length of throw of the eccentric, drive means simultaneously driving the feeding means and the cam means, a first member fixed to said frame on one side of the path of strip travel, guide means on the frame on the side opposite the path of strip travel from the first member and transverse thereto, a second member movable in said guide means, connecting means holding the second member spaced adjacent the path of strip travel and causing the second means to reciprocate in the guide means and move generally in the direction of strip travel in unison with the first member to engage the strip and carry it between said members while being acted on during a portion of their movement whereby the strip is drawn through the continuously operable means at a speed in excess of the normal rate of feed, said connecting means pivoted about an axis spaced from the path of strip travel, means in the connecting means for varying the pivotal axis thereof to raise and lower the second member to and away from the path of strip travel and means for rotating the cam means to raise and lower said second member.

8. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, a first member for acting on the strip and the like mounted to operate in a circular path a portion of which lies substantially in the first mentioned path, a guide extending generally transversely

of the first mentioned path mounted to move with the first member, a second member for acting on the strip and the like mounted to reciprocate in the guide, means causing the second member to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage and act upon the strip whereby the strip is moved with the members during a portion of their movement, drive means driving the first member, and connections from said drive means to the continuously operable means, said connection continuously driving a freely rotatable drive gear on the continuously operable means, drive means on the continuously operable means engageable by said drive gear to drive the continuously operable means in one direction and tension means connecting the drive gear and drive means tending to maintain the drive means in engagement with the drive gear while permitting said drive means intermittently to rotate in the feeding direction at a speed greater than the rotational speed of the drive gear.

9. Apparatus for treating rapidly moving strip as claimed in claim 8 wherein the drive gear is provided with a pin extending out of the plane of the gear and the drive means is an arm extending radially outwardly parallel to the drive gear in the path of the pin on the drive gear.

10. Apparatus for treating rapidly moving strip as claimed in claim 8 wherein the continuously operable means includes a pair of pinch rolls, a drive gear freely rotatable on one of said pinch rolls and provided with a pin projecting out of the plane of the gear and the drive means is an arm fixed to the pinch roll carrying the drive gear, said arm extending radially outwardly parallel to and adjacent the drive gear and in the path of the pin on the drive gear.

11. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, tension means on the continuously operable means whereby a portion of the strip may be drawn under tension through the continuously operable means at a rate of speed in excess of the speed of said continuously operable means and then returned through the continuously operable means to the position it would have had had no withdrawal been effected, and means receiving the strip from the continuously operable means intermittently acting on said strip and moving said strip at a rate of speed in excess of the rate of feed whereby the strip is drawn intermittently under tension through the continuously operable means at a rate in excess of the rate of feed.

12. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, means receiving the strip and the like from the continuously operable means intermittently acting on the strip and moving said strip at a rate of speed in excess of the rate of feed, drive means driving the means acting on the strip and connections from said drive means to the continuously operable means, said connections continuously driving a freely rotatable drive gear on the continuously operable means, drive means on the continuously operable means engageable by said drive gear to drive the continuously operable means in one direction and tension means connecting the drive gear and drive means tending to maintain the drive means in engagement with the drive gear while permitting said drive means intermittently to rotate in the feeding direction at a speed greater than the rotational speed of the drive gear.

13. Apparatus for treating rapidly moving strip as claimed in claim 12 wherein the drive gear is provided with a pin extending out of the plane of the gear and the drive means is an arm extending radially outwardly parallel to the drive gear in the path of the pin on the drive gear.

14. Apparatus for treating rapidly moving strip as claimed in claim 12 wherein the continuously operable means includes a pair of pinch rolls, a drive gear freely rotatable on one of said pinch rolls and provided with a pin projecting out of the plane of the gear and the drive means is an arm fixed to the pinch roll carrying the drive gear, said arm extending radially outwardly parallel to and adjacent the drive gear and in the path of the pin on the drive gear.

15. In apparatus for treating rapidly moving strip and the like having means intermittently acting on the strip and moving the strip in a path and drive means driving the means acting on the strip, a continuously operable means feeding strip and the like on said path to the means acting on the strip and connections from the drive means to the continuously operable means, said connections continuously driving a freely rotatable drive gear on the continuously operable means, drive means on the continuously operable means engageable by said drive gear to drive the continuously operable means in one direction and tension means connecting the drive gear and drive means tending to maintain the drive means in engagement with the drive gear while permitting said drive means intermittently to rotate in the feeding direction at a speed greater than the rotational speed of the drive gear.

16. Apparatus for treating rapidly moving strip as claimed in claim 15 wherein the drive gear is provided with a pin extending out of the plane of the gear and the drive means is an arm extending radially outwardly parallel to the drive gear in the path of the pin on the drive gear.

17. Apparatus for treating rapidly moving strip as claimed in claim 15 wherein the continuously operable means includes a pair of pinch rolls, a drive gear freely rotatable on one of said pinch rolls and provided with a pin projecting out of the plane of the gear and the drive means is an arm fixed to the pinch roll carrying the drive gear, said arm extending radially outwardly parallel to and adjacent the drive gear and in the path of the pin on the drive gear.

18. Apparatus for treating rapidly moving strip and the like comprising continuously operable means feeding strip and the like in a path, means on the continuously operable means whereby a portion of the strip may be drawn under tension at spaced intervals through said continuously operable means at a rate of speed in excess of the continuously operable means and then retarded until the strip assumes the same relative position it would have had had no withdrawal been effected, a first member for acting on the strip or the like mounted to operate in a circular path a portion of which lies substantially in the first mentioned path, a guide extending generally transversely of the first mentioned path mounted to move with the first member, eccentric drive means actuating said first member to operate in said circular path, a second member for acting on the strip and the like mounted to reciprocate in the guide, connecting means joined at one end to the second member causing the second member to reciprocate in the guide and move generally in the direction of the first mentioned path generally in unison with the first member and to move substantially into the first mentioned path substantially simultaneously with the first member to engage the strip and the like between said first and second members whereby the strip is moved with said members during a portion of their movement and is drawn under tension through the feeding means at a speed in excess of the rate of feed, said connecting means pivoted at the other end about an axis spaced from the path of strip travel and means acting on the connecting means for varying the position of the pivotal axis thereof to raise and lower the second member toward and away from the path of strip travel whereby the distance between the said first

and second members is selectively varied to control the intersection of the second member with the path of strip travel.

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