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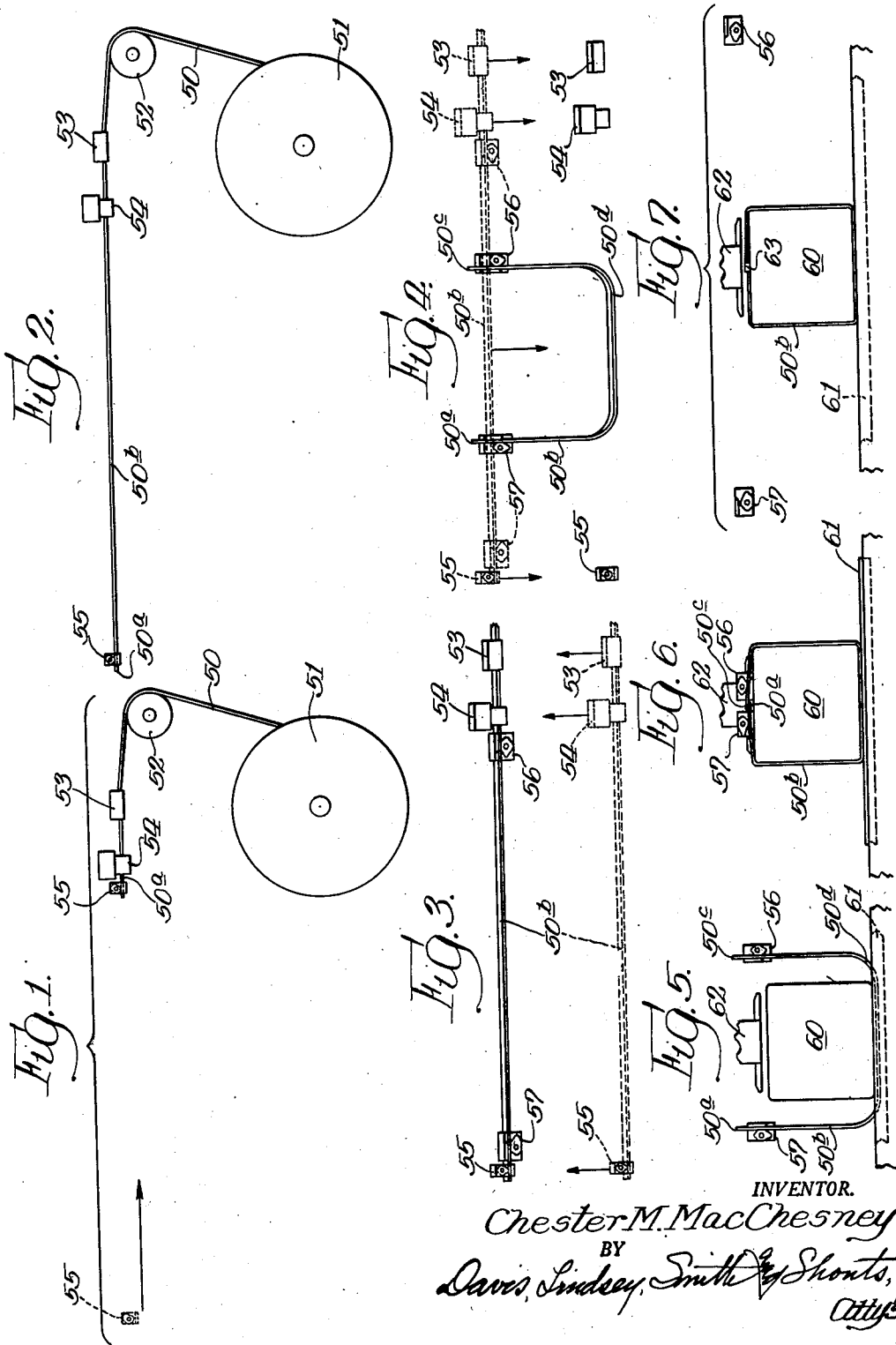
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2,612,833

METHOD OF AND APPARATUS FOR BINDING BOXES

Filed Dec. 22, 1944

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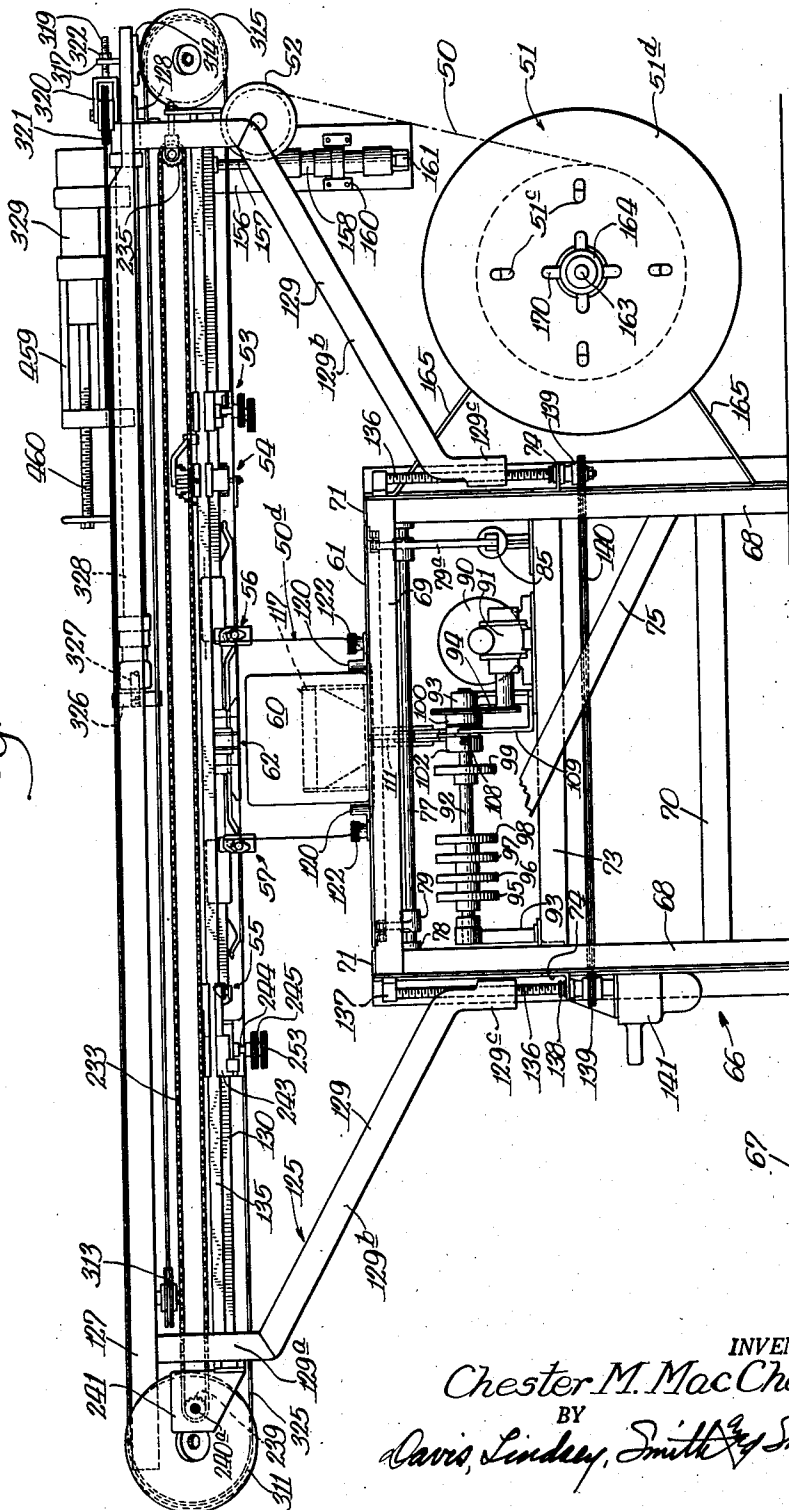
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METHOD OF AND APPARATUS FOR BINDING BOXES

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Fig. 8.



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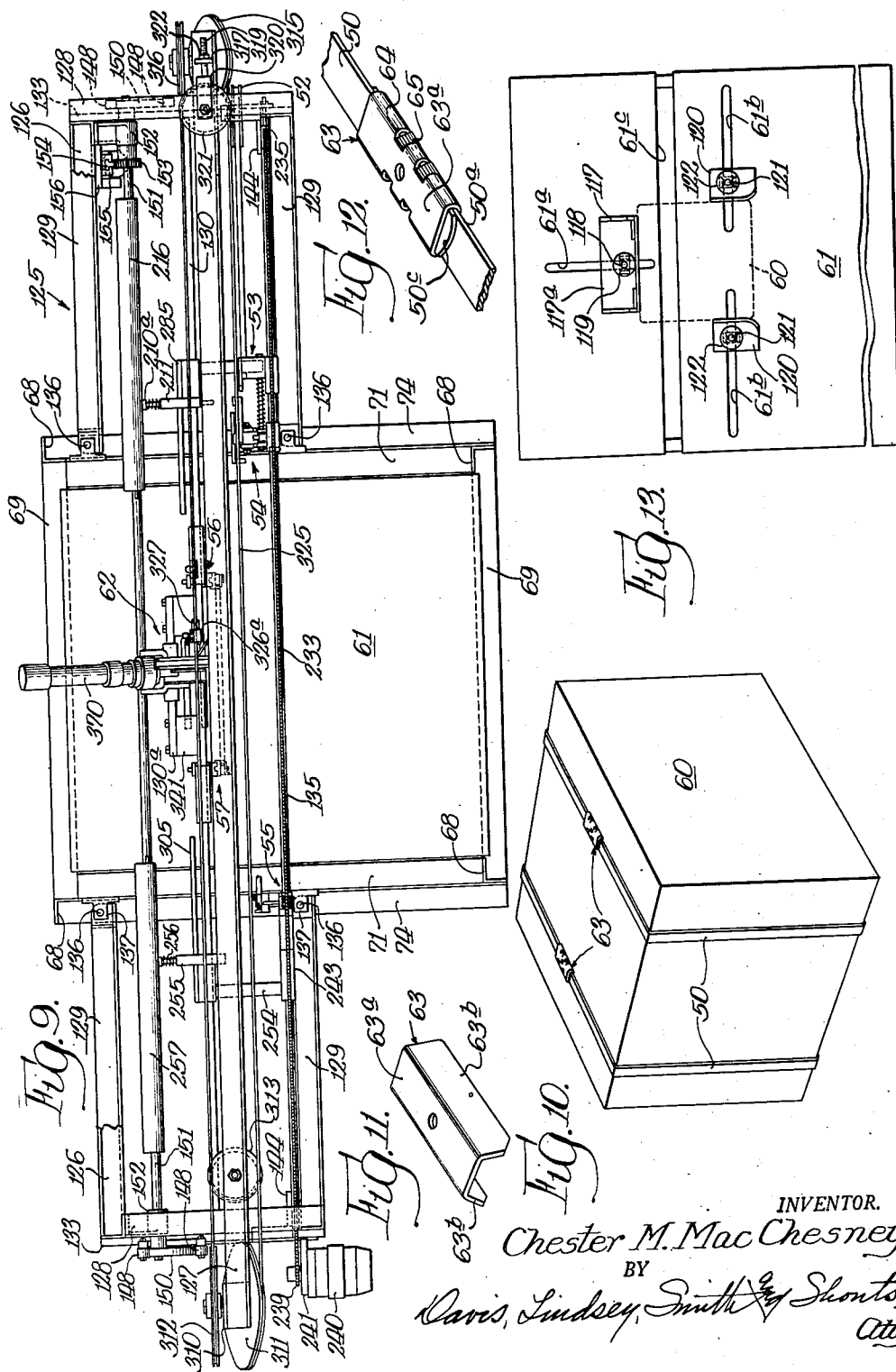
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 3



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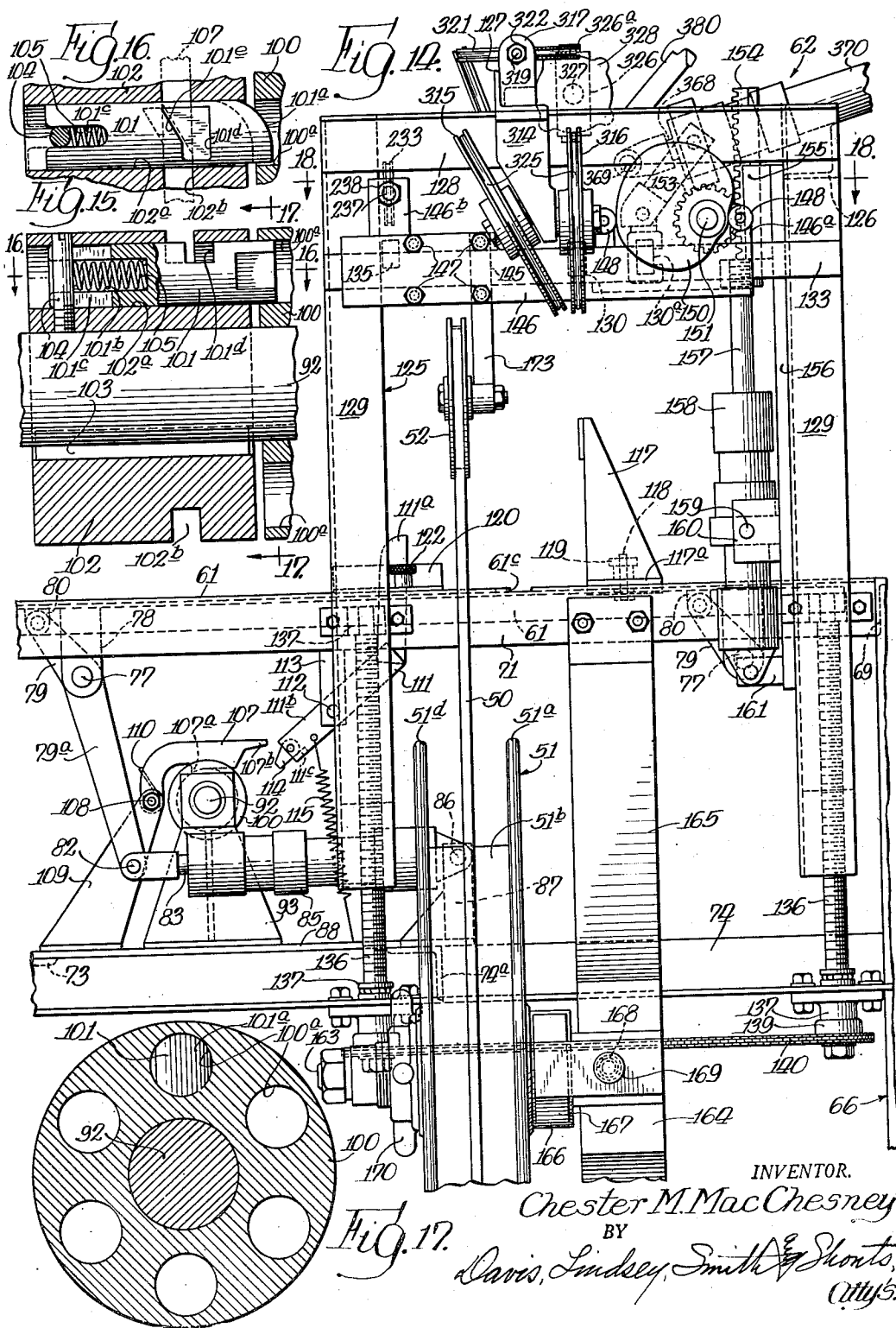
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 4



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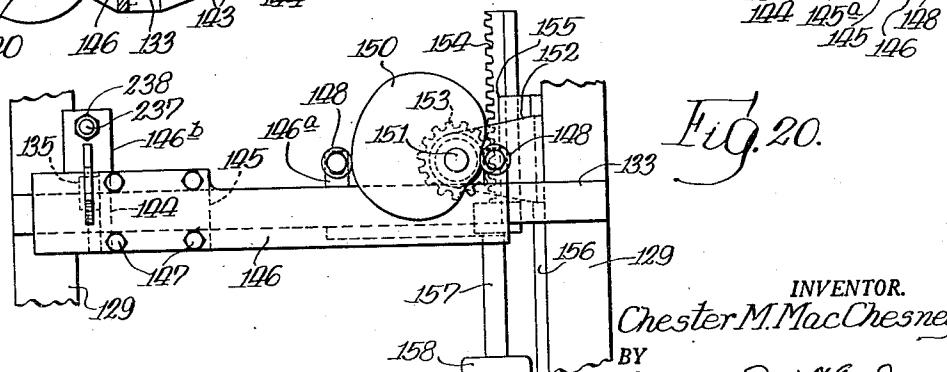
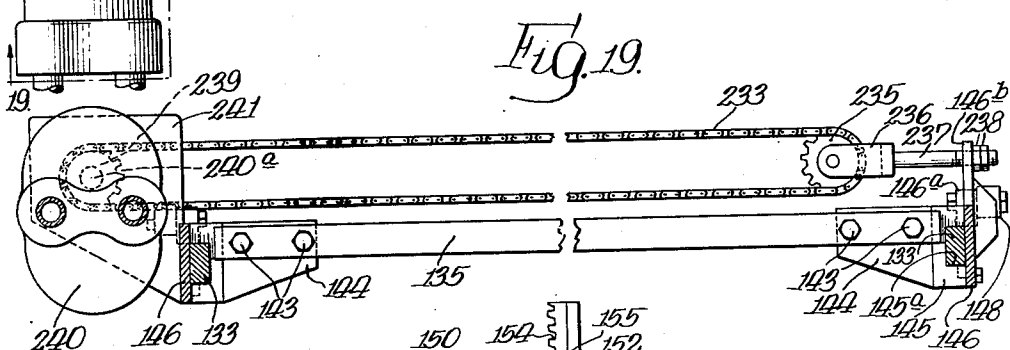
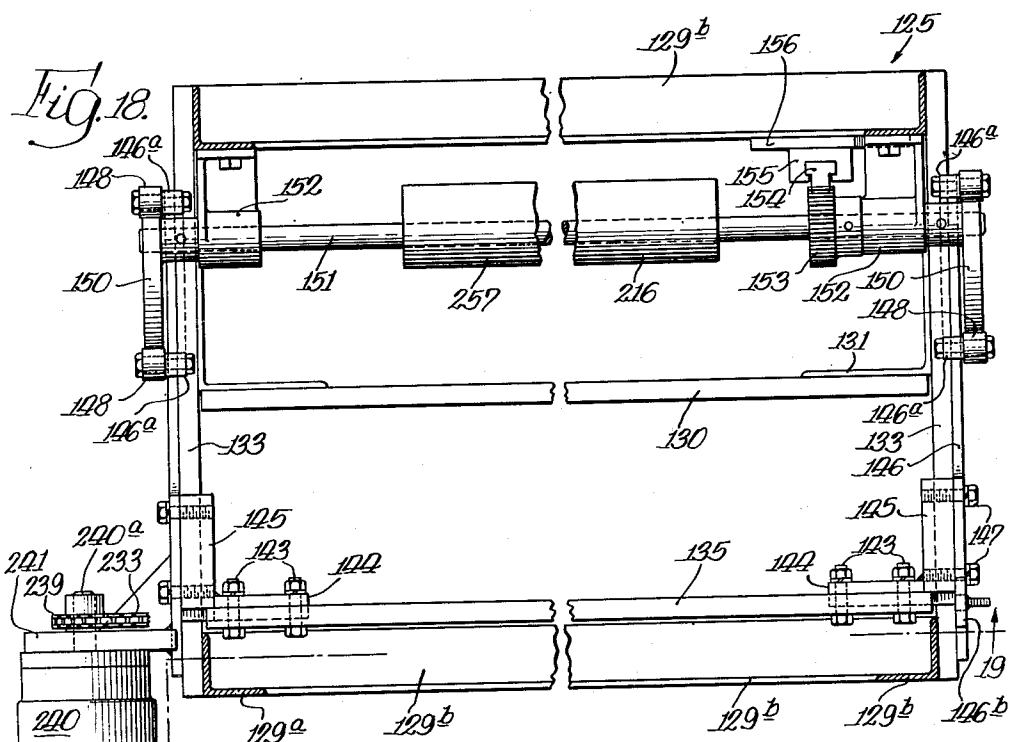
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 5



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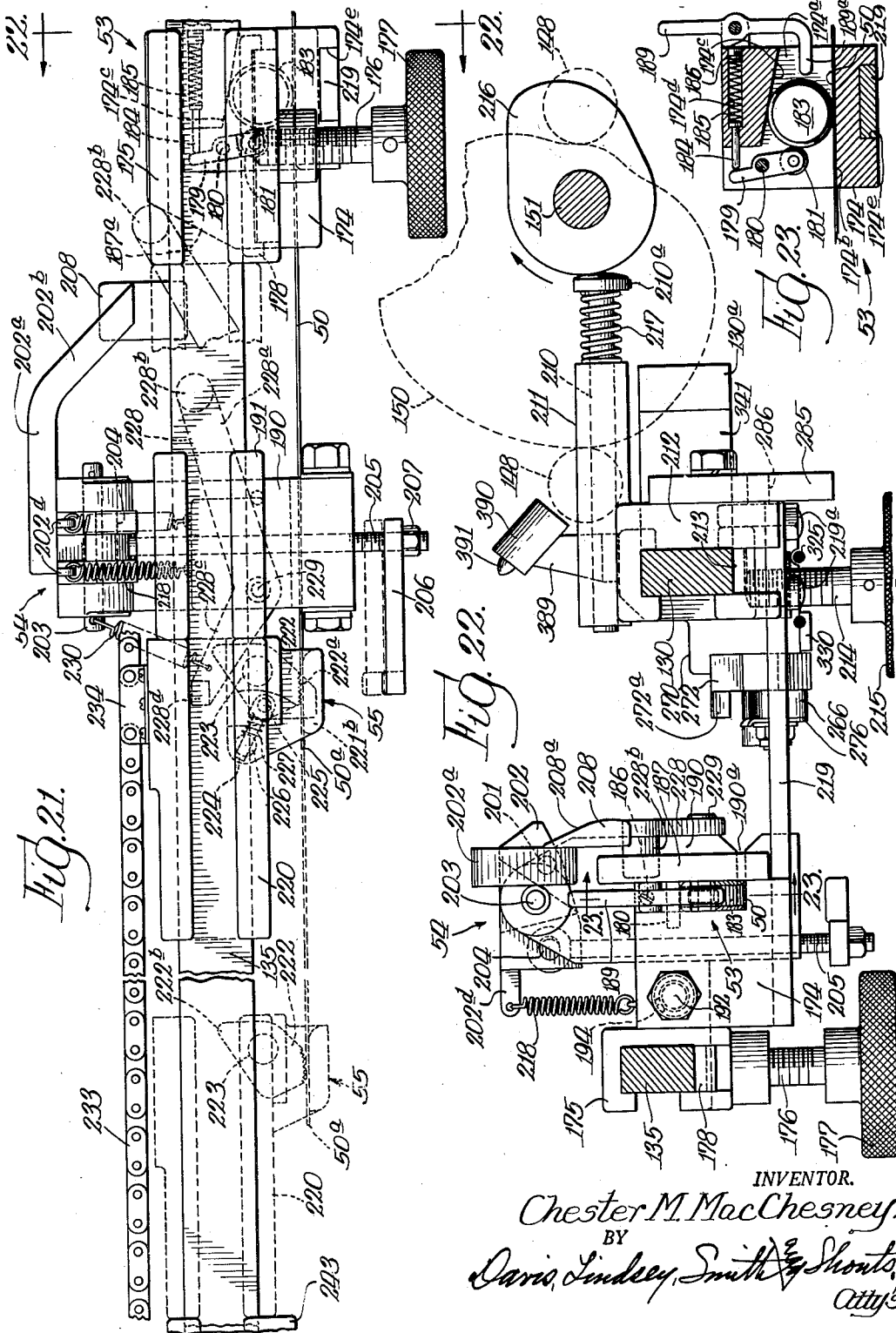
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METHOD OF AND APPARATUS FOR BINDING BOXES

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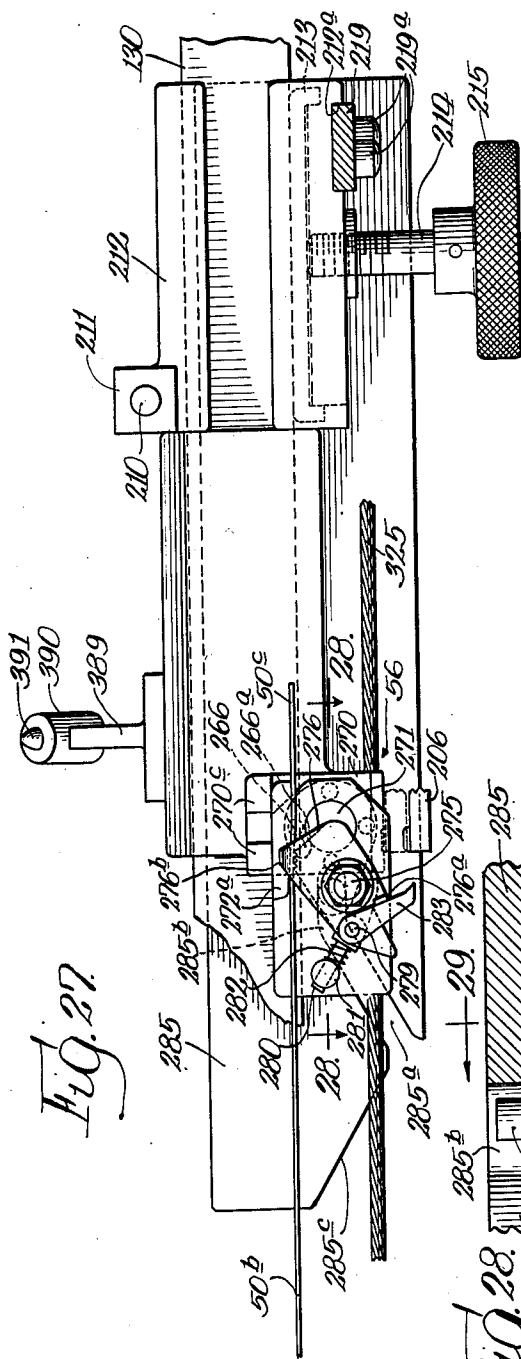
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METHOD OF AND APPARATUS FOR BINDING BOXES

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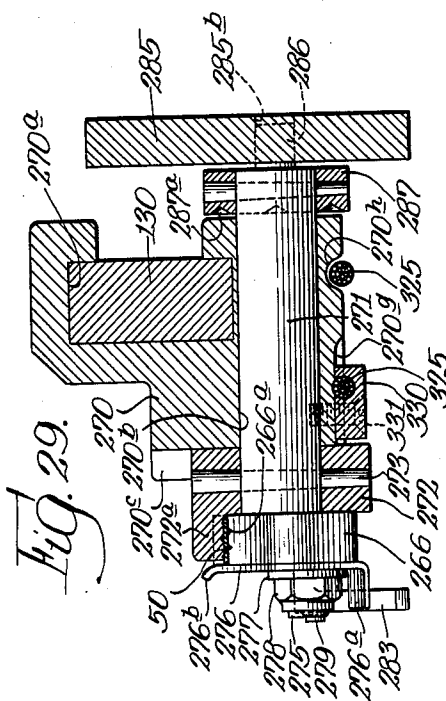
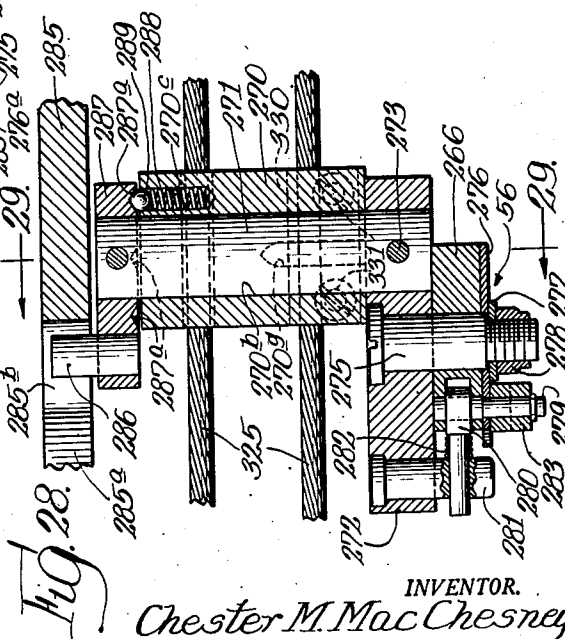


Fig. 29.



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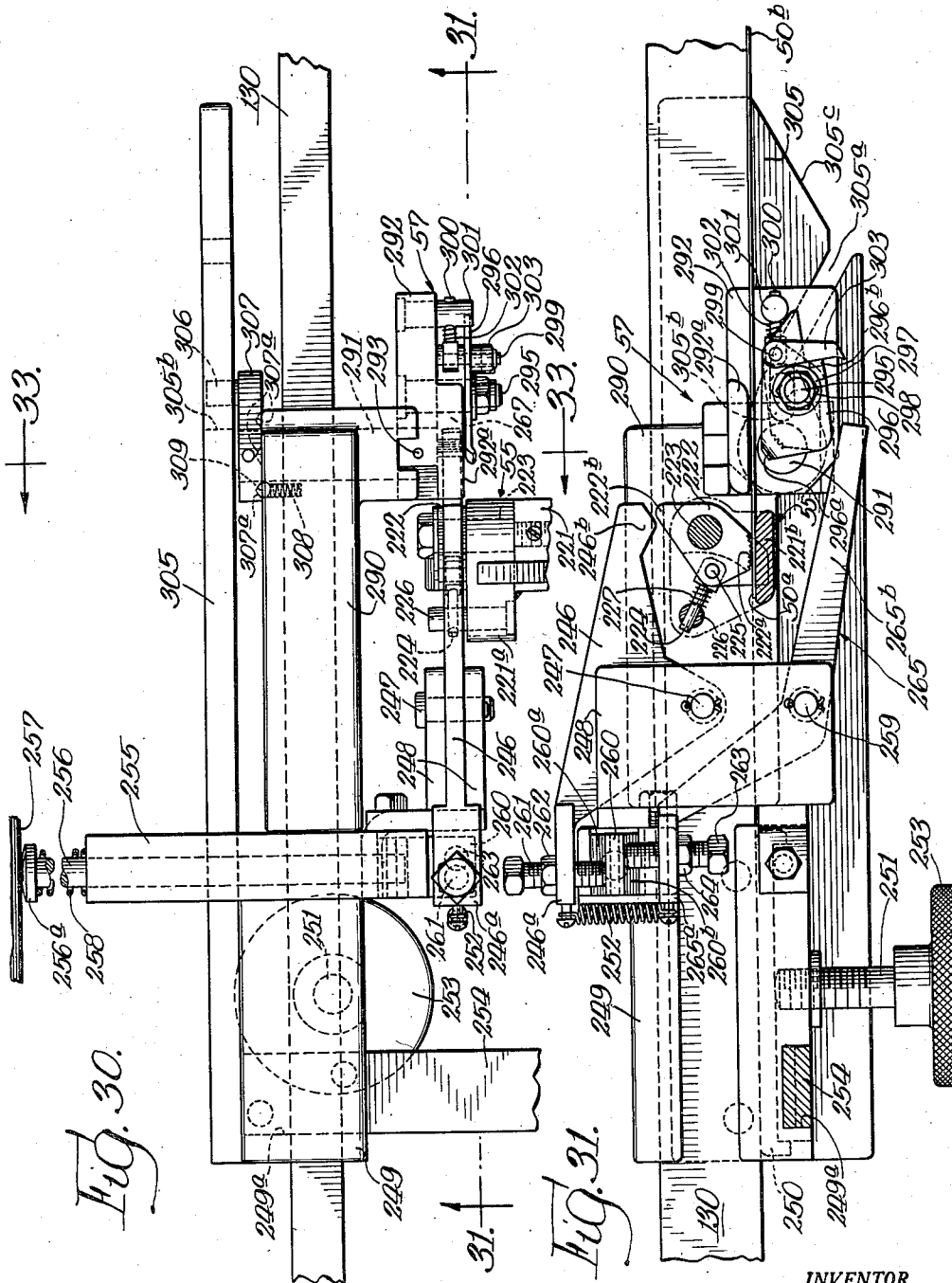
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 9



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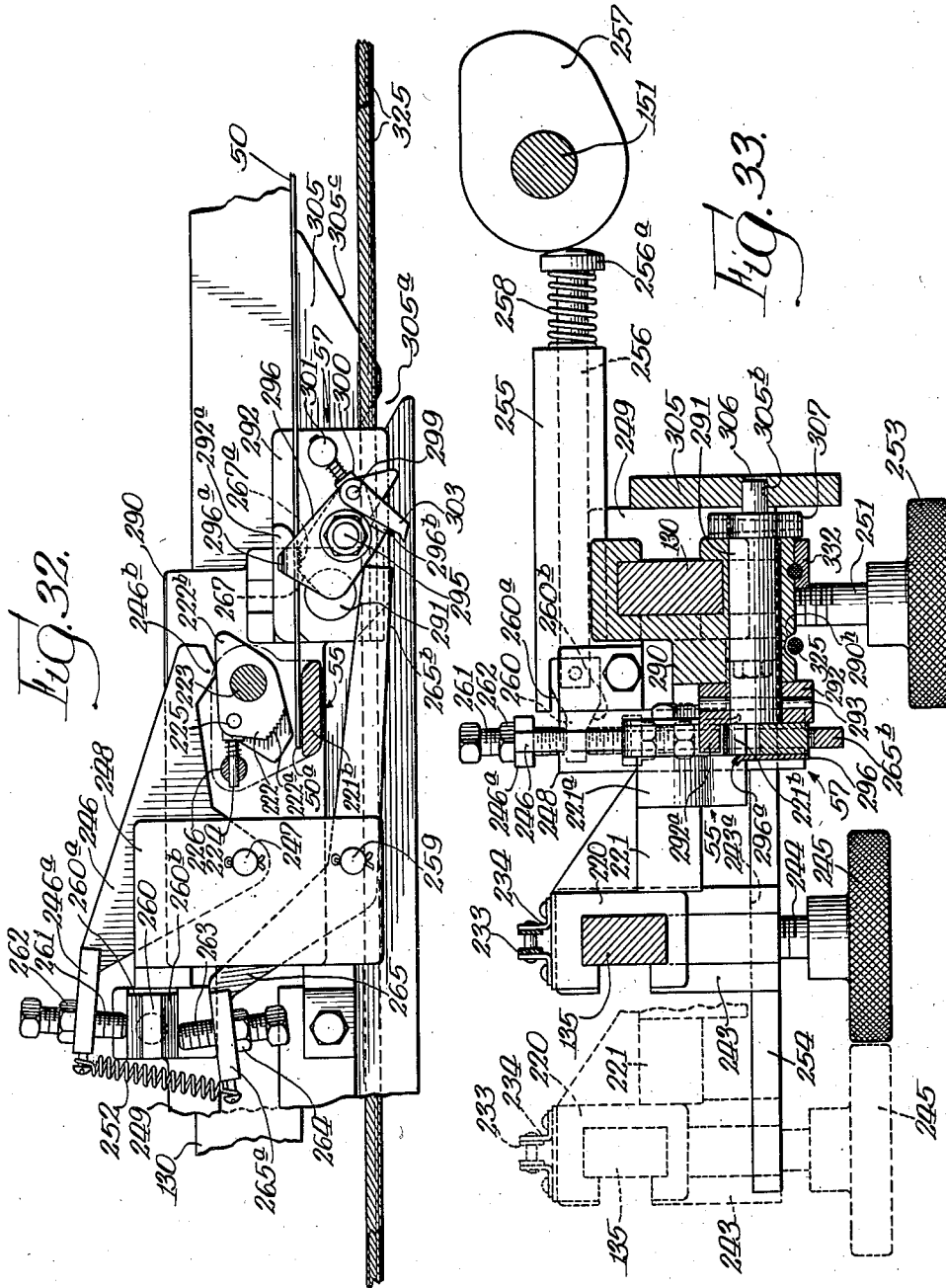
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 10



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METHOD OF AND APPARATUS FOR BINDING BOXES

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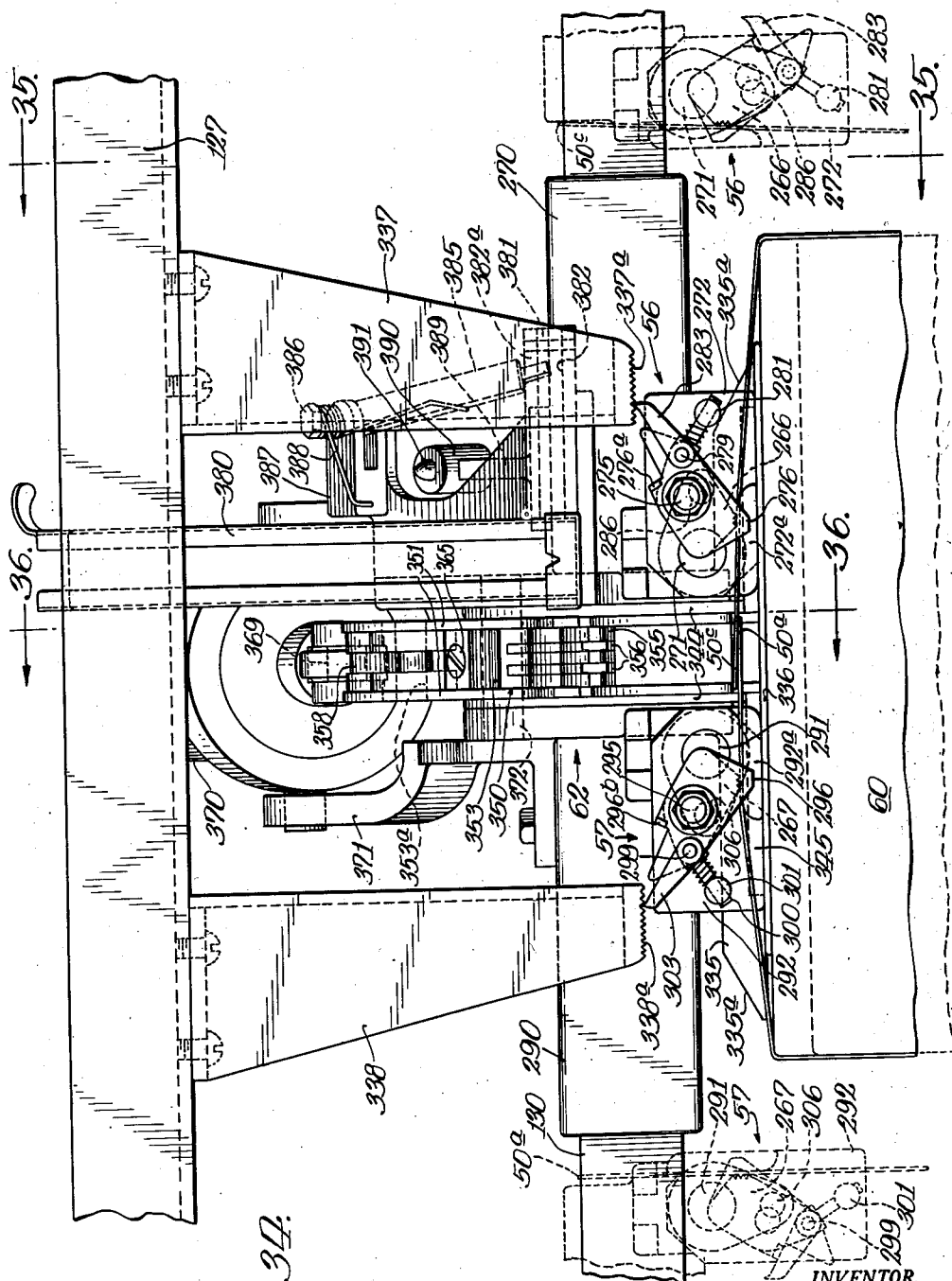


Fig. 37.

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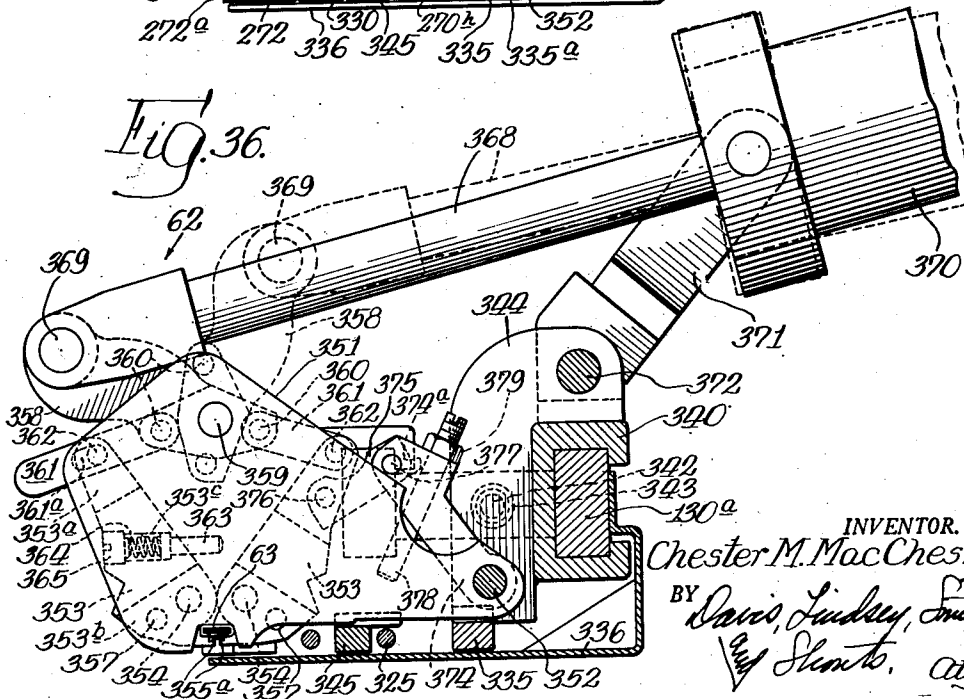
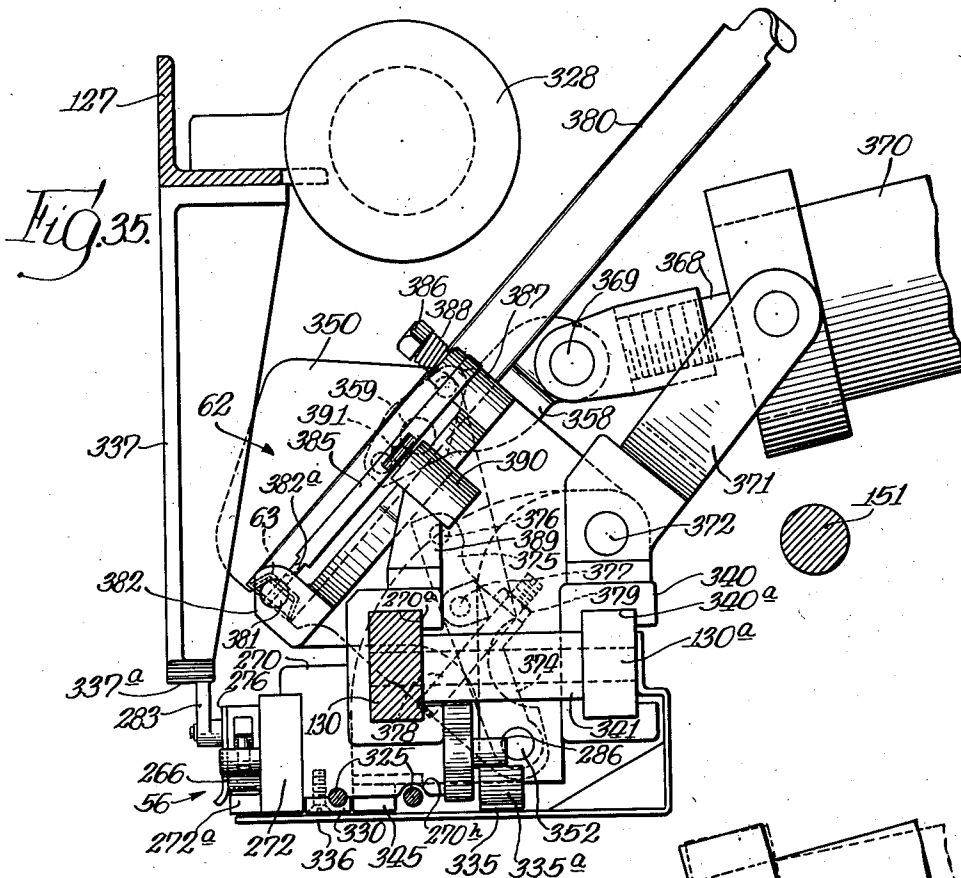
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METHOD OF AND APPARATUS FOR BINDING BOXES

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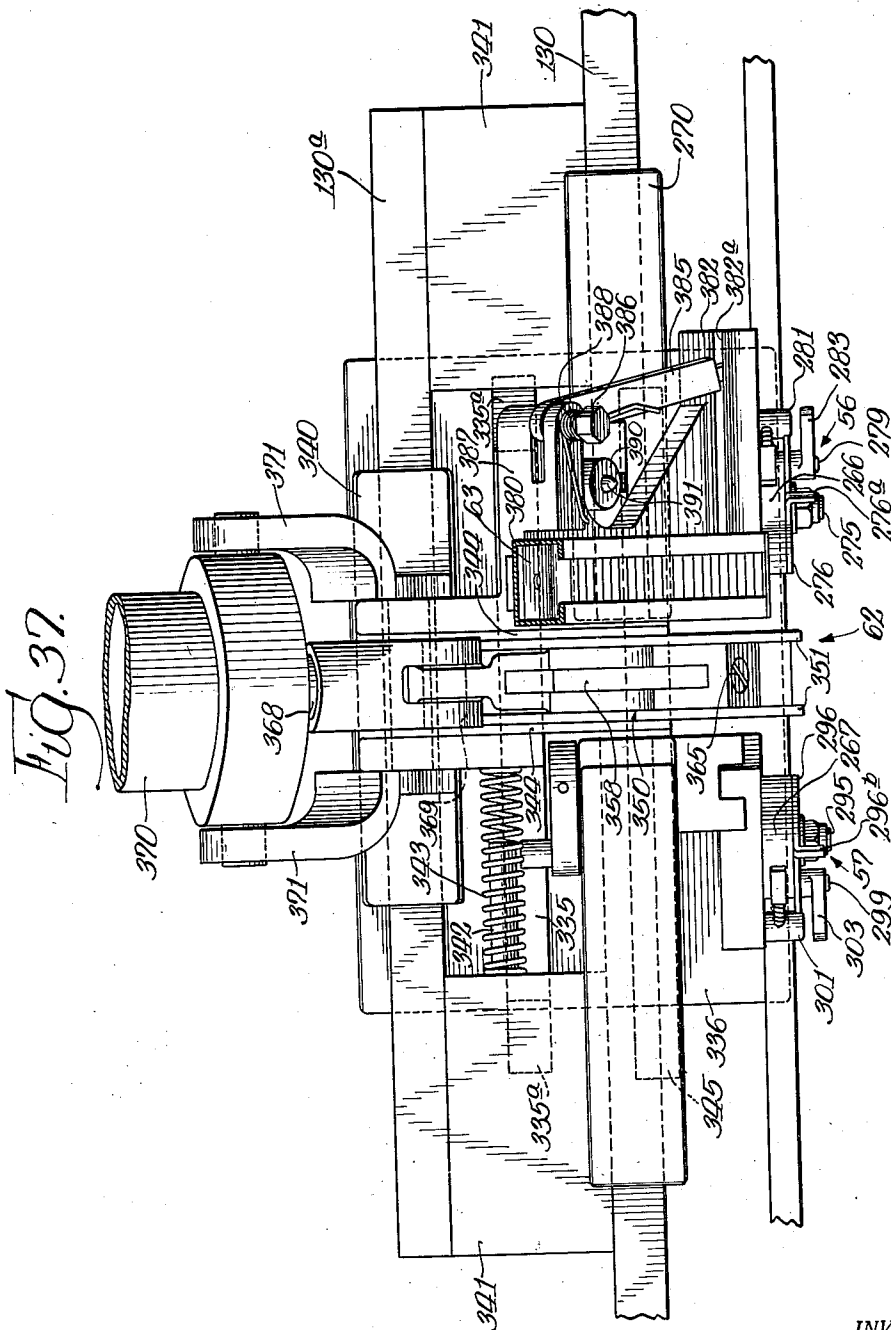
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 13



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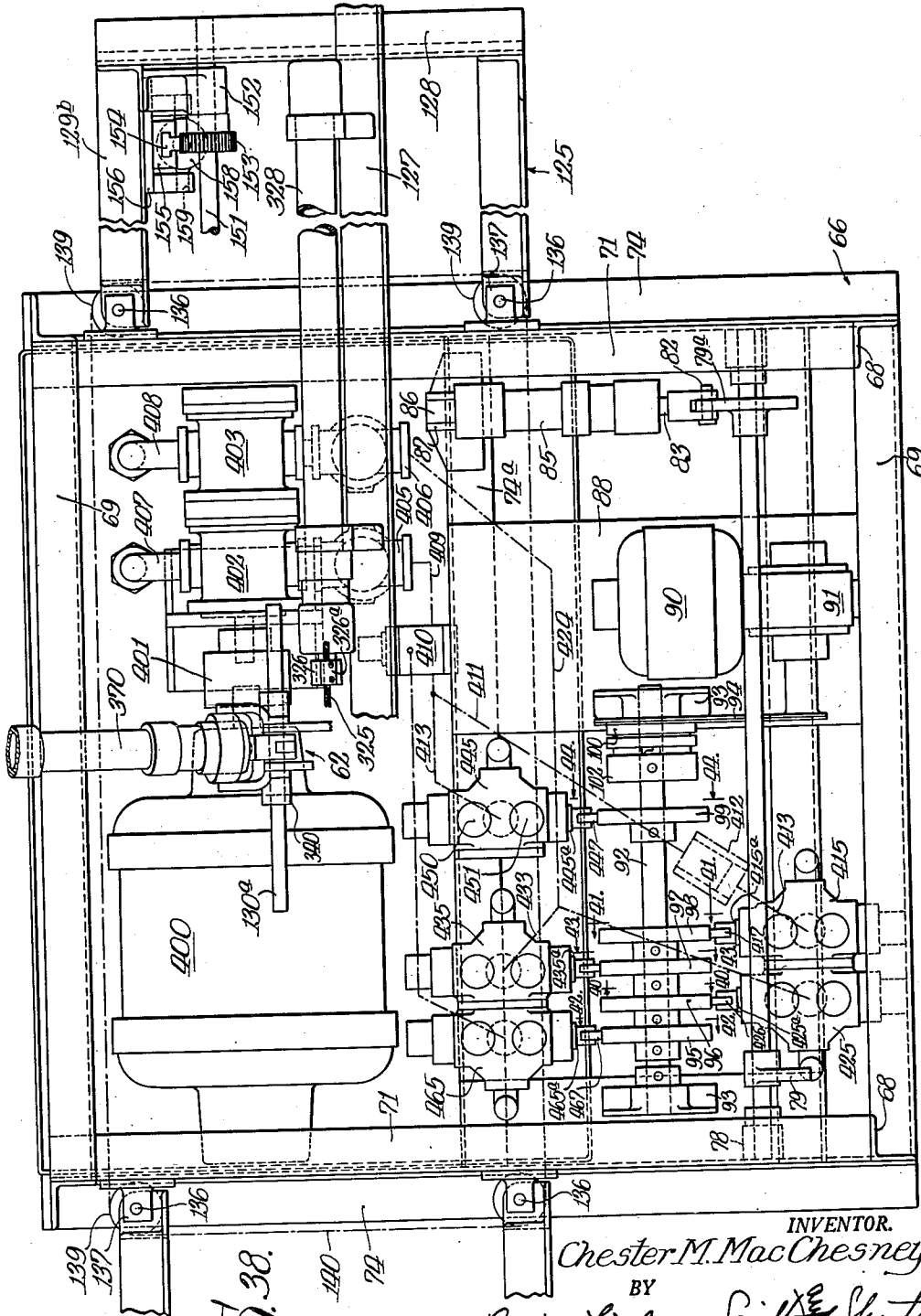
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 14



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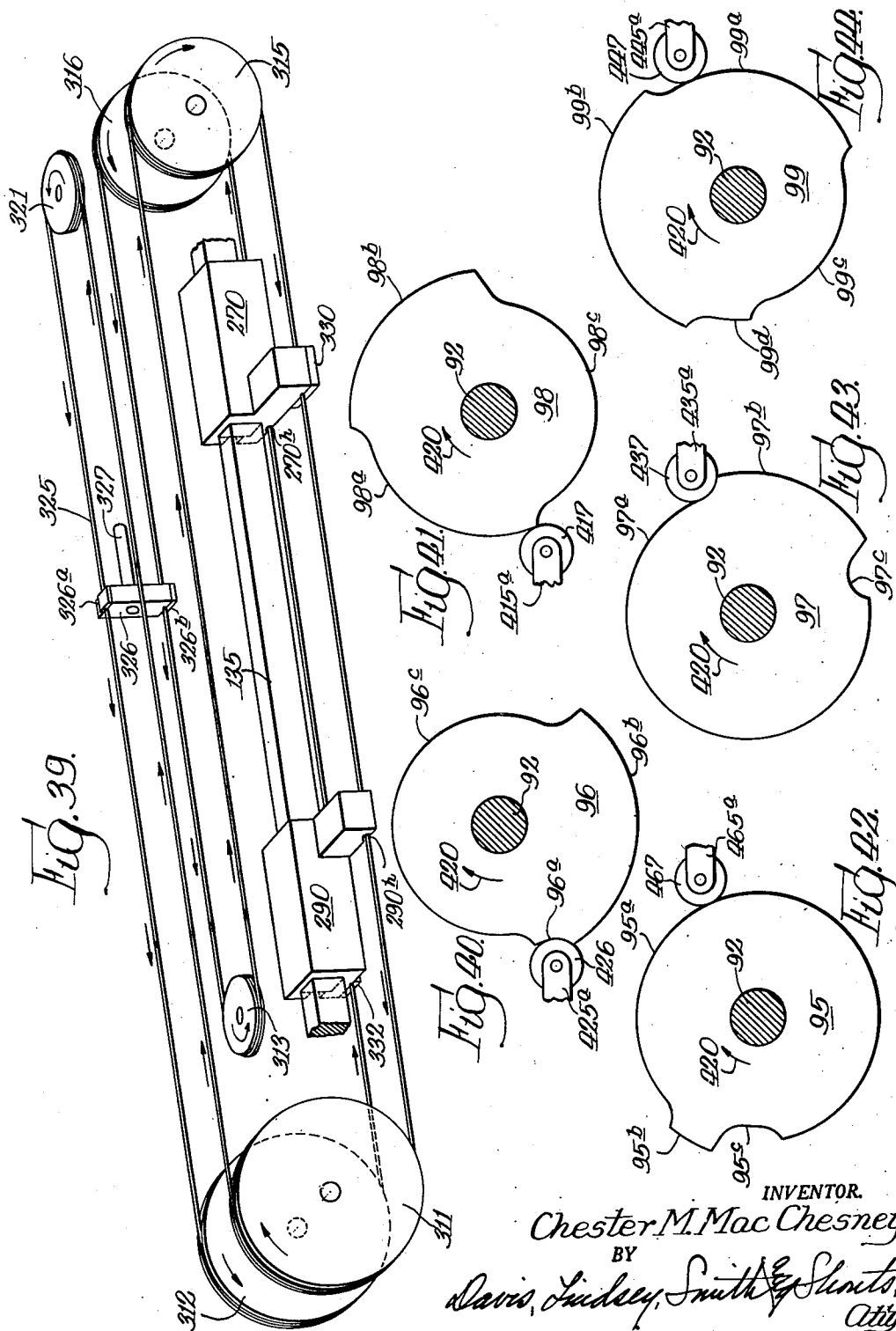
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 15



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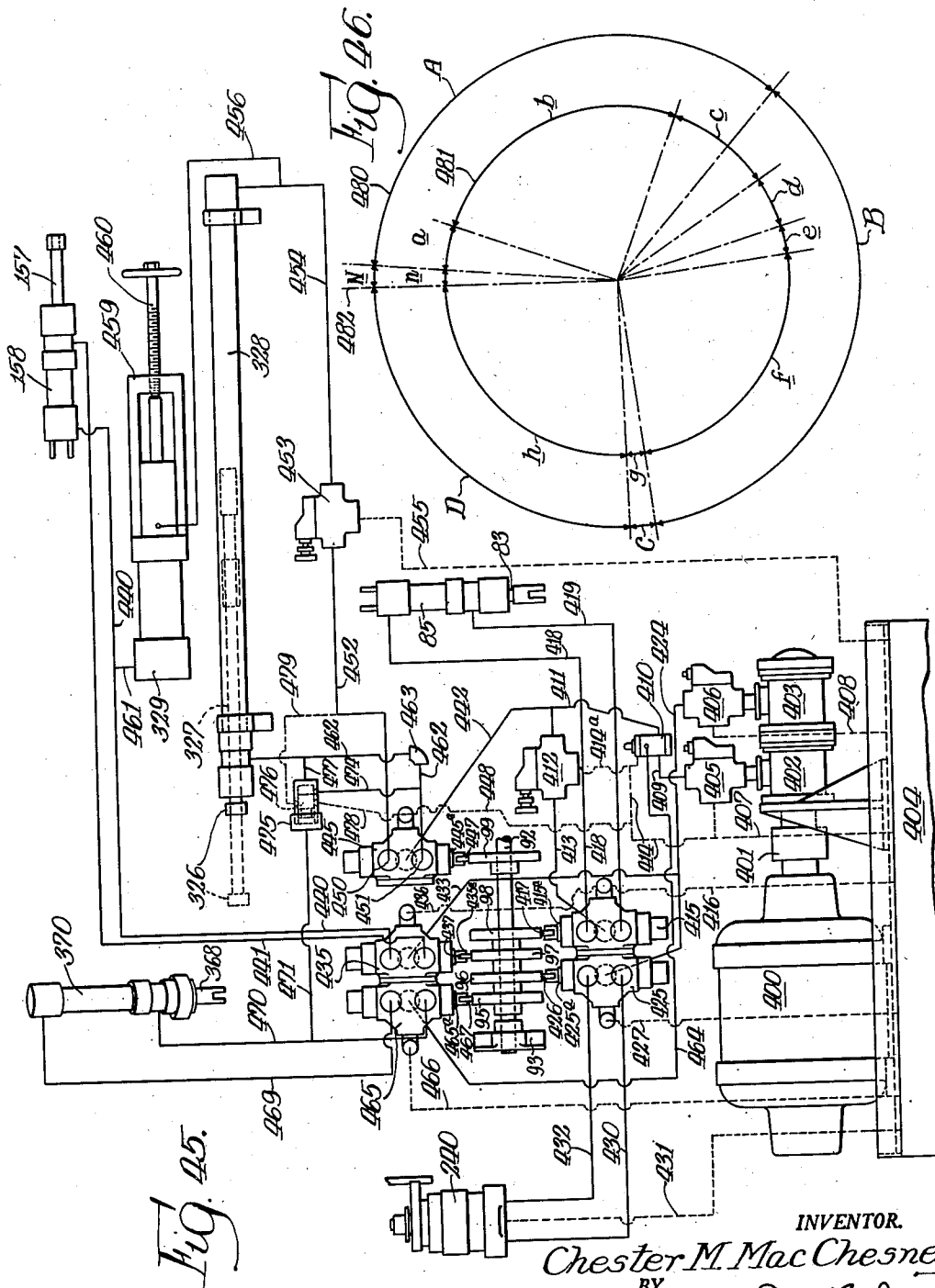
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METHOD OF AND APPARATUS FOR BINDING BOXES

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16 Sheets-Sheet 16



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UNITED STATES PATENT OFFICE

2,612,833

METHOD OF AND APPARATUS FOR
BINDING BOXES

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Application December 22, 1944, Serial No. 569,383

78 Claims. (Cl. 100—2)

1

This invention relates to improvements in methods of and apparatus for binding boxes, packages and the like with flexible metal binders such as flat, transversely curved, or beaded steel strapping, or round wire, commonly used for the purpose.

The principal object of the invention is to provide an improved binding machine capable of carrying on the binding of boxes and packages automatically in a continuous process with no attention on the part of the operator except that required to place the packages successively in the machine and to remove them therefrom as they are bound.

A further important object is to provide an improved method of binding packages and the like in which a measured length of binder is drawn from a source of supply, whereupon the end portions of this length are held and it is cut off from said source, after which the held ends of said length are moved toward each other to cause its intermediate portion to be deflected to form a loop, preferably a suspended loop, into which the package is then moved, preliminary to moving the held ends of said length of binder further toward each other to draw the binder taut around the package and place its ends in position to be united with each other.

Another object is to provide a method of binding in which a measured length of binder is continuously held adjacent its ends during the operations of drawing out said length from a source of supply and measuring it, cutting off said measured length from said source, moving said ends toward each other to form a suspended loop of binder, moving a package into said loop, moving said held ends further toward each other to draw said length of binder taut around the package and uniting the ends of said length of binder.

Still another object of the invention is to provide improved apparatus comprising relatively movable holding devices by which a measured length of binder is drawn out from a source of supply and then moved laterally into engagement with relatively movable stretching devices which seize the binder, whereupon a shearing device cuts off the supply end of the measured length from the supply and said length is released by said holding devices preliminary to relative moving of said stretching devices toward each other which then takes place to cause the portion of said measured length between said dogs to form a suspended loop into which a package is then moved to be bound by said length of binder which is then drawn taut by the move-

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ment of the stretching devices further toward each other during which movement they are automatically reversed in their positions so that, as they draw the length of binder taut about the package, they present the ends of the binder in overlapping relationship to be united by a sealing device which forms a part of the apparatus. A further feature of the invention is the provision of automatic controlling apparatus which causes the operations just referred to to be initiated by the placing of a box or package in the machine in a position to be bound and then to follow each other in the proper order and in the desired timed relationship until the binding is completed, the box or package is automatically ejected from the binding position, and a new loop of binder formed for the reception of another box or package.

Another important object of the invention is to provide a machine of the type referred to in which the successive operations are effected and controlled by power means such as fluid pressure, preferably hydraulic pressure, which is actuated to start the sequence of operations which take place in the machine by the act of placing a package or the like in the machine in position to be bound, the sequence of operations terminating after the package is bound and automatically moved from the binding position and a new length of binder drawn out in readiness for the binding of another package.

A further object of the invention is to provide a machine in which a plurality of cycles of operations are carried on simultaneously, one cycle of operations including the drawing out of a measured length of binder from the source of supply, transferring it to engagement with stretching devices and cutting it off from the supply, while another cycle comprises the operations of moving the ends of the cut length toward each other to form a suspended loop, moving a package into the loop, drawing the loop taut around the package with the ends of the binder overlapping and uniting these overlapping ends. Thus, while a cut length of binder is being applied to a package by one cycle of operations, another length of binder is being drawn out and cut off by the other cycle of operations in preparation for the binding of the next package. Other objects of the invention relate to various features of construction and arrangement of the apparatus, and to other novel features of the improved method, which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the

accompanying drawings in which one embodiment is illustrated. In the drawings,

Figure 1 shows a somewhat diagrammatic front elevation of the holding and measuring devices embodied in the machine for drawing out a predetermined length of binder from a source of supply by the relative movement thereof, these devices being here illustrated in their initial relative positions preliminary to the drawing out of the binder from the source of supply;

Fig. 2 is a diagrammatic front elevation similar to that of Fig. 1, showing the relative positions of the parts after a relative movement of the holding devices has been effected to draw out and measure a predetermined length of binder;

Fig. 3 shows a somewhat diagrammatic top plan and perspective view of the holding devices and the relatively movable gripping dogs, illustrating by dotted lines the positions of the holding devices after a measured length of binder has been drawn from the source of supply as illustrated in Fig. 2, and showing by full lines the positions of the holding and measuring devices after they have been moved rearwardly to transfer the measured length of binder to a position where it is engaged by the relatively movable stretching dogs;

Fig. 4 is a somewhat diagrammatic top plan and perspective view similar to that of Fig. 3, showing the relative positions of the parts after the measuring devices have been returned to their forward positions following the transfer of the measured length of binder to the stretching dogs and showing, by full lines, the relative positions of the stretching dogs after they have been moved toward each other from their initial positions, illustrated by dotted lines, thereby causing the intermediate portion of the binder to descend by gravity and form a U-shaped loop;

Fig. 5 shows a front elevation of the stretching dogs and the U-shaped loop of the binder after a package to be bound has been inserted into the loop on the supporting table in readiness for the operations of elevating the package into operative relation to the sealing device illustrated above it and for the operation of effecting further relative movement of the stretching dogs to draw the binder taut around the package;

Fig. 6 shows a front elevation of the package, stretching dogs, binder and sealing apparatus after the stretching dogs have been moved inwardly toward each other and rotated by engagement with the corners of the package to cause the projecting ends of the binder to project toward each other and to be overlapped when the stretching dogs reach their final positions here illustrated;

Fig. 7 is a diagrammatic front elevation showing the relative positions of the parts after the ends of the binder have been sealed, the supporting table lowered and the stretching dogs separated to their initial positions;

Fig. 8 shows a front elevation of the machine; Fig. 9 shows a top plan view thereof;

Fig. 10 shows a perspective view of a box or package having binding straps applied thereto with their ends united by interlocking joints formed through the use of metal seals;

Fig. 11 is a perspective view of one form of seal which may be used in forming the joint illustrated in Fig. 10;

Fig. 12 shows an enlarged perspective view of the completed strap joint shown in Fig. 10;

Fig. 13 shows a top plan view of the major portion of the supporting table;

Fig. 14 shows an end elevation of the upper part of the machine illustrated in Figs. 1 and 2;

Fig. 15 shows a longitudinal axial section through the clutch which is actuated by the movement of the package on the supporting table to initiate the cycle of operations which occur during the binding of each package after the formation of the U-shaped loop shown in Fig. 5;

Fig. 16 shows a sectional view taken on the line 16—16 of Fig. 15;

Fig. 17 shows a sectional view taken on the line 17—17 of Fig. 15;

Fig. 18 shows a horizontal section taken on the line 18—18 of Fig. 14;

Fig. 19 shows a sectional view taken on the line 19—19 of Fig. 18;

Fig. 20 shows an end elevation of the rear portion of the frame illustrated in Fig. 18, illustrating the cam and the associated mechanism by which a portion of the frame is shifted to transfer the measured length of binder to the position where it is engaged by the stretching dogs as shown in Fig. 3;

Fig. 21 is an enlarged front elevation of portions of the machine shown near the upper right-hand part of Fig. 8, illustrating the holding or gripping devices by which the binder is drawn from the source of supply and measured and also the shearing mechanism by which the binder is cut off from the source of supply;

Fig. 22 shows a sectional view taken on the line 22—22 of Fig. 21;

Fig. 23 shows a detailed sectional view taken on the line 23—23 of Fig. 22;

Fig. 24 shows a top plan view of the right-hand measuring device and stretching dog and the shearing device illustrated in Fig. 8;

Fig. 25 shows a sectional view taken on the line 25—25 of Fig. 24, illustrating the details of the shearing device;

Fig. 26 shows a horizontal section taken on the line 26—26 of Fig. 25;

Fig. 27 shows a sectional view taken on the line 27—27 of Fig. 24, illustrating the right-hand stretching dog when it is in position to engage the measured length of binder transferred thereto by the rearward shifting of the holding and measuring devices;

Fig. 28 shows a sectional view taken on the line 28—28 of Fig. 27;

Fig. 29 shows a sectional view taken on the line 29—29 of Fig. 28;

Fig. 30 shows a top plan view of the left-hand stretching dog and the left-hand measuring device and gripping dog, as viewed in Fig. 8, when the measured length of binder has been shifted to a position where it may be engaged by the stretching dog;

Fig. 31 is a sectional view taken on the line 31—31 of Fig. 30;

Fig. 32 is a sectional view similar to that of Fig. 31, showing the relative positions of the parts after the binder has been released by the movable measuring device and gripped by the adjacent stretching dog;

Fig. 33 shows a sectional view taken on the line 33—33 of Fig. 30, illustrating by dotted lines the forward position of the bar which carries the relatively movable holding or measuring devices and associated parts and illustrating by full lines the positions of these parts after they have been transferred rearwardly for the purpose of moving the measured length of binder to a position where it may be engaged by the relatively movable stretching dogs;

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Fig. 34 shows an enlarged front elevation of the sealing apparatus in operative relation to the package to be bound, illustrating by full lines the positions of the stretching dogs after they have been moved over the top surface of the binder and inverted in their positions to cause the ends of the binder to be directed toward each other and then overlapped, and illustrating by dotted lines the stretching dogs in the positions which they occupy at the time of holding the suspended loop shown in Fig. 5 before they have been moved inwardly toward each other and rotated about their own axes by engagement with the upper corners of the box or package;

Fig. 35 shows a sectional view taken on the line 35—35 of Fig. 34;

Fig. 36 shows a sectional view taken on the line 36—36 of Fig. 34;

Fig. 37 shows an enlarged top plan view of the sealing apparatus illustrated in Fig. 34;

Fig. 38 shows a somewhat diagrammatic top plan view of the hydraulic system and apparatus by which the several operations performed by the machine are automatically effected and caused to occur in the proper timed relation;

Fig. 39 is a perspective view of the endless cable system by which the relatively movable stretching dogs are moved toward and from each other during the operation of the machine;

Fig. 40 is a sectional view taken on the line 40—40 of Fig. 38, showing a side elevation of the cam which controls the operation of the fluid motor by which the strap measuring mechanism is actuated;

Fig. 41 is a sectional view taken on the line 41—41 of Fig. 38, showing a side elevation of the cam for controlling the hydraulic mechanism by which the package supporting table is automatically raised and lowered;

Fig. 42 is a sectional view taken on the line 42—42 of Fig. 38, showing a side elevation of the cam which controls the hydraulic mechanism by which the sealing apparatus is operated;

Fig. 43 is a sectional view taken on the line 43—43 of Fig. 38, showing a side elevation of the cam which controls the hydraulic system by which the measured length of binder is transferred from its forward position to the position wherein it is engaged by the stretching dogs;

Fig. 44 is a sectional view taken on the line 44—44 of Fig. 38, showing a side elevation of the cam which controls the hydraulic mechanism by which the stretching dogs are actuated to cause the formation of the U-shaped suspended loop and then to effect a further actuation of these stretching dogs to draw the binder taut around the package;

Fig. 45 shows a diagrammatic view of the principal parts of the hydraulic system and their connections by which all of the operations of the machine are effected in the proper timed relation to each other; and

Fig. 46 is a diagram showing the duration and timed relation of the operations which occur in each of the two cycles of operations which are carried on simultaneously in the machine.

Before entering upon a detailed description of the mechanical construction of the machine illustrated in the drawings, its general mode of operation will be described with reference to Figs. 1 to 7, inclusive, in which the successive steps of the method of drawing out the binder from the source of supply and applying it to the package to be bound are illustrated. As there is shown, the flexible binder 50, which may preferably be flat metal strapping, is supplied by a

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rotatable reel 51 from which it passes upwardly and over a roller 52 and then to a holding device 53 which is normally adapted to permit the free movement of the binder therethrough toward the left, as viewed in Fig. 1, while preventing the reverse movement thereof. From the stationary holding device 53, the binder passes through a shearing device 54 which operates to cut off a length of strapping from the source of supply after the required length has been drawn out through the stationary holding device 53 and through this shearing device. When the apparatus is first arranged for operation, the free end 50^a of the binder is manually projected into the shearing device 54 so that it occupies a position to be engaged by the relatively movable measuring device 55 which is adapted to be moved toward the right and to force the shearing device toward the right until the binder is projected through the shearing device sufficiently to be gripped by the measuring device 55, whereupon the measuring device is caused to travel toward the left from the position shown by full lines in Fig. 1 to the position shown in Fig. 2, thereby drawing out a predetermined length of binder from the source of supply. The relative positions of the parts, after this predetermined length 50^b has been drawn from the source of supply, are shown in Fig. 2.

Having measured a length of binder by the relative movement of the holding device and the measuring device, these devices, which are mounted upon a bar extending longitudinally of the machine, are moved rearwardly from the position shown by dotted lines in Fig. 3 to the position shown by full lines, and the measured length 50^b of the binder is thereby carried to a position where it may be engaged by the stretching devices 56 and 57 which comprise gripping dogs adapted to engage the binder when it has been so transferred, the stretching devices being spaced apart to grip the measured length of the binder near the ends thereof, leaving projecting portions which are directed away from each other. As soon as the length of binder has been gripped by the stretching devices 56 and 57, the shearing device 54 is operated to cut off the binder from the source of supply.

After cutting off the length of binder 50^b with the ends 50^a and 50^c directed away from each other, the stretching devices 56 and 57 are then automatically moved toward each other to the positions shown in Fig. 4, during which operation the stretching devices are rotated through 90 degrees so that they assume suspended positions, while the intermediate portion of the length of binder descends partly by gravity and partly by the action of the stretching devices and forms a U-shaped loop 50^d, as shown in Fig. 4. While these operations are going on, the bar carrying the holding device 53, the shearing device 54, and the measuring device 55 is returned to its forward position, as shown by full lines in Fig. 4, after which the measuring device 55 is moved toward the right, as viewed in Fig. 4, until it engages the shearing device 54, whereupon it moves the shearing device with it to a limited extent toward the right, against the pressure of a spring, until the projecting end of the supply portion of the binder is again projected through the shearing device to be engaged by the measuring device 55, whereupon the measuring device is automatically operated to engage this free end and to move again toward

the left, to draw out another length of binder in readiness for the next binding operation.

In the meantime, having formed the U-shaped loop 50^d, a package 60 is manually inserted into this loop while resting upon a supporting plate 61. At the time of inserting the package within the loop, the plate 61 is so positioned that the upper surface of the package 60 is slightly below the sealing apparatus 62 which is partially shown in Fig. 5. As the package is moved into the loop, in the manner shown in Fig. 5, it engages a starting lever which operates hydraulic mechanism for swinging the supporting plate 61 upwardly and thereby moving the upper surface of the package into operative relationship to the sealer 62 and also into the path of travel of the suspended stretching devices 56 and 57. The automatic elevation of the supporting plate 61 is followed by the further actuation of the stretching devices 56 and 57 to move them toward each other from the positions shown in Fig. 5, causing them to strike the upper corners of the package 60 and be thereby rotated about their own axes and turned so that the free ends 50^a and 50^c of the measured length of binder are directed toward each other. The movement of the stretching devices 56 and 57 toward each other is continued until the projecting ends of the binder are overlapped, as shown in Fig. 6. The sealing device 62 is then operated to unite the overlapping ends of the binder, this operation being preferably brought about automatically as soon as the binder has been drawn taut with its ends overlapped.

Upon completing the binding of the package 60 and the sealing of the overlapping ends of the binder, the next step in the operation is to effect a slight relative separation of the stretching devices 56 and 57 from the positions shown in Fig. 6, thereby rotating the gripping dogs of these devices about their own pivots so that the binder is released from the gripping dogs. The supporting plate 61 is then again automatically actuated to move downwardly and forwardly so that the binder applied about the package is carried out of engagement with the gripping devices and the package is itself lowered away from the sealing device so that it may then be withdrawn from the machine by the operator. The stretching devices 56 and 57 are then separated and restored to their initial inverted positions, as shown in Fig. 7, so that they are in readiness to engage a new length of binder transferred thereto by the holding device 53 and the measuring device 55. Upon withdrawing the bound package 60, it may be replaced by another unbound package since, by that time, the ends of the second measured length of binder will have been moved toward each other by the relative movement of the stretching devices to form another U-shaped loop adapted to receive a new package to be bound. In this way, a continuous series of operations may be carried on with great rapidity, with no manual operation necessary except that of placing a package upon the supporting table and removing it therefrom and with two cycles of automatic operations being carried on simultaneously, one cycle including the steps of drawing out a measured length of binder from the source of supply, transferring it to the gripping device and cutting it off from the source of supply, while the other cycle of operations includes the steps of moving the stretching devices toward each other to a predetermined extent to form a suspended U-shaped loop and then, when a package is placed upon the supporting

table, elevating the top plate of the table, effecting a further movement of the gripping devices toward each other, drawing the binder taut with its ends overlapping, sealing the overlapping ends, releasing the bound binder from the gripping devices, moving the bound package out of engagement with the sealing device and the gripping devices, and again separating the gripping devices to receive a new measured length of binder. By this method of operation, the binding of packages may be carried on with a speed which has not heretofore been attained.

Various methods may be employed for uniting the overlapping ends of the binder by the use of the sealing device 62 but one convenient method includes the use of U-shaped metal seals 63 of the form shown in Fig. 11. These seals comprise top or back walls 63^a and diverging side walls 63^b which are united integrally therewith, thus giving them a channel form which enables a plurality of them to be arranged in a stack. The sealing apparatus is adapted to bend the side walls of the seal about the overlapping strap ends 50^a and 50^c and then shear the edges of the seal and the enclosed strap ends, as shown in Fig. 12, to provide a plurality of pairs of cuts 64 with the metal between these cuts deflected as shown at 65 so that a plurality of interlocking shoulders are formed which prevent relative endwise movement of the overlapping strap ends. Two binders having their ends united by seals 63 are shown applied to a package 60 in Fig. 10 and it will be apparent that in the practice of this invention two or more binders may be applied to the same package by withdrawing it and reversing its position on the supporting plate 61 after one binder has been applied thereto.

The apparatus for carrying out the binding method described above comprises a base frame 66 which is adapted to be secured to a floor 67 or other support which carries all of the mechanism by which the strapping operations are effected. This frame is of skeleton construction and of rectangular horizontal cross section, being made up of a plurality of frame members including four corner legs 68 of angle bar form which are connected together, as shown in Figs. 8, 9 and 14, by upper frame members 69 and lower frame members 70, at the front and rear sides of the frame, and by upper frame members 71 and lower frame members (not shown) at the ends of the frame. In addition, the corner legs 68 are connected by horizontal intermediate frame members 73 at the front and rear sides of the machine and by horizontal intermediate frame members 74 at the ends of the frame. Diagonal braces 75 extend between the opposite legs 68 at the front and rear sides of the frame. All of these frame members are preferably of angle bar form and they are welded or otherwise secured together at their joints to provide a strong and rigid construction.

The supporting plate 61, upon which the boxes or packages 60 are adapted to be mounted during the binding operations, normally rests at its front and rear edges upon the top horizontal flanges of the top horizontal frame member 69, at the front and rear sides of the frame, as shown in Fig. 9, and the lateral edges of this plate 61 are located in proximity to the edges of the top flanges of the upper end frame members 71. The supporting plate 61 and the frame 66 thus form a supporting table and in order to permit the upward movement of the supporting plate 61 which forms the top of this table, for the purpose of positioning the top of the package in proximity

to the sealing apparatus 62 and in the path of movement of the stretching devices 56 and 57, as above referred to, the supporting plate 61 is mounted upon a pair of shafts 77 which are journaled in bearing brackets 78 carried by the end frame members 71, as shown in Figs. 8, 13 and 14. Crank arms 79 are secured on the shaft 77 adjacent their ends and the free ends of these crank arms are pivotally connected to brackets 80 which are attached to the under side of the top plate 61. One of the crank arms 79 has formed integrally therewith a downwardly directed extension 79^a, shown in Fig. 14, which is pivoted at the point 82 to a piston rod 83 which is connected to a piston mounted to reciprocate in a fluid pressure cylinder 85 so that, upon the admission of fluid under pressure to the end of the cylinder 85 which is remote from the crank arm 79^a, this crank arm is actuated to rock the connected shaft 77 in its bearings and thus transmit motion through the top plate to the crank arms on the other shaft 77 so that the top plate 61 is thereby shifted upwardly and rearwardly in order to raise the box or package 60 to the strapping position.

The cylinder 85 is pivoted at its inner end, as shown at 86, to a supporting bracket 87, which is mounted upon an angle bar 74^a carried by the frame members 74. There is mounted upon a plate 88, carried by the frame members 74, a motor 90, preferably an electric motor, which is adapted to operate at constant speed and which is connected through a speed changing device 91 with a cam shaft 92, journaled in bearing brackets 93 which are mounted upon the plate 88, as shown in Figs. 8, 14 and 38. The cam shaft 92 and the shaft of the speed changing device 91 are connected by sprocket gears and a sprocket chain 94 and the cam shaft has mounted thereon, between the bearing brackets 93, a series of cams 95, 96, 97, 98 and 99, the peripheral configurations of which are shown in Figs. 42, 40, 43, 41 and 44, respectively, and which control the various devices actuated by hydraulic pressure by which the various parts of the binding apparatus are operated and controlled, as hereinafter more fully pointed out.

As shown in Figs. 15, 16 and 17, the sprocket gear which is driven by the chain 94 is formed on a clutch member 100 which is mounted to rotate upon the shaft 92. This clutch member 100 has formed therein a plurality of equally spaced longitudinally extending recesses 100^a of circular cross section which are adapted to be engaged by a clutch pin 101, also of circular cross section, which is mounted to reciprocate in a tubular bore or guideway 102^a formed in another clutch member 102 secured on the shaft 92 by means of a key 103 and a set screw 104. The clutch pin 101 is provided at one end with a rounded surface 101^a and at its other end with an inwardly extending circular recess 101^b which is slotted on its lateral sides, as shown at 101^c, to form a sliding engagement with the set screw 104. A coil spring 105 is mounted in the recess 101^b between the inner end thereof and the set screw 104, and this spring serves normally to force the clutch pin 101 to a position wherein the rounded extremity thereof engages one of the recesses 100^a formed in the clutch member 100. In Figs. 15 and 16, the clutch pin 101 is shown in engagement with one of the recesses 100^a and it will be observed that the rounded surface 101^a is so directed that the clutch member 100 will drive the pin 101 and the clutch member 102 in one direction while permitting free relative movement in the other di-

rection since the rounded surface 101^a on the pin will cause the pin to move out of its recess in the clutch member 102 if the wall of a slot 100^a engages the rounded surface 101^a.

The clutch pin 101 is normally retracted from the clutch member 100 by a latch member 107 which is pivoted at 108 on a stationary bracket 109 carried by the plate 88. A spring 110 is mounted on the pivot pin 108 and engages the latch member 107 so that it normally forces this latch member into engagement with an annular groove 102^b which is formed in the clutch member 102, as shown in Fig. 15. This annular groove intersects the longitudinal bore 102^a in which the clutch pin 101 is mounted and the clutch pin 101 has a notch 101^d in its outer side which is adapted to register with the groove 102^b and which is provided on one of its walls with an inclined wedging surface 101^e adapted to coact with a depending tooth 107^a formed on the latch member 107. Upon engagement of this tooth with the inclined wedging surface 101^e, the clutch pin 101 is withdrawn against the compression of the spring 105 so that the extremity of this pin is moved out of engagement with the clutch member 100, thus permitting the clutch member 100 to be driven by the sprocket chain 94 without rotating the clutch member 102, so that the cam shaft 92 will then remain at rest.

When a package 60 is placed in the proper position upon the supporting plate 61, it engages the upwardly extending arm 111^a of a starting lever 111 which extends through a slot in the supporting plate 61 and is pivoted at the point 112 on a bracket 113 secured to a frame member beneath the supporting plate. Upon movement of the extremity 111^a of the starting lever toward the right, as viewed in Fig. 14, the lower extremity 111^b thereof is elevated, thus bringing a dog 114, pivoted on the lower end of the lever 111, into engagement with the tip 107^b of the latch member 107. The starting lever 111 is normally held in the position shown in Fig. 14, with the extremity 111^a projecting upwardly, by means of a coil spring 115 which extends between the lower part 111^b of the lever and the plate 88. A lug 111^c formed on the starting lever normally holds the dog 114 in alignment with the part 111^b of this lever although permitting free relative upward movement of this dog with respect to the lower part of the lever. When, therefore, the trip lever is actuated by the placing of a package 60 on the supporting plate 61, the dog 114 moves upwardly into the path of the tip 107^b of the latch member 107 and raises this latch member out of engagement with the clutch pin 101 so that the clutch pin is then actuated by its spring 105 to move into engagement with the face of the constantly rotating clutch member 100, whereupon the pin engages one of the recesses 100^a and causes the cam shaft 92 to be rotated.

Upon the rotation of the cam shaft, the hydraulic system is controlled to cause the admission of hydraulic pressure to the cylinder 85 so that the supporting plate 61 is then swung upwardly and rearwardly about the axes of the shafts 77 to move the package into operative position with respect to the sealing apparatus and the path of travel of the stretching dogs. The initiation of this operation, which is controlled by the cam 98, as hereinafter more fully described, also sets in motion the other cams 95, 96, 97 and 99 which control the operation and timed relation of other operations in the method of strapping carried out by this apparatus, also more

fully described hereinafter. At the conclusion of the strapping operation, the cam 98 causes the admission of hydraulic pressure to the opposite end of the cylinder 85 so that the supporting plate 61 of the table is thereby moved downwardly and forwardly to move the bound strap on the package out of engagement with the sealing device and the stretching devices 56 and 57. The starting lever 111 is then returned to its normal position by the action of the spring 115 and the pivoted dog 114 passes by the extremity of the latch member 107. The latch member then moves downwardly under the influence of the spring 110 into renewed engagement with the groove 102^b of the clutch member 102 and, at the end of one revolution of the shaft 92, engages the inclined wedging surface 101^a of the clutch pin to retract the pin and break the driving connection between the clutch members 100 and 102.

In order that the package 60 may be properly positioned on the supporting plate 61 to actuate the trip lever 111, a series of guides or stop members are mounted on the upper surface of the plate, as shown particularly in Figs. 13 and 14. For this purpose, the plate 61 is provided with a slot 61^a extending toward the rear thereof and providing means for securing in adjusted position a stop member 117, shown in Figs. 8, 13 and 14, which has a flange 117^a adapted to be clamped to the plate 61 by a bolt 118 and a nut 119. The plate 61 also has two transversely extending slots 61^b for securing two side guide members 120 in adjusted positions on the table so that the box or package 60 will pass loosely between them. These side guide members are secured to the table by bolts 121 engaging the slots and having nuts 122 thereon. By adjusting the positions of the stop member 117 and the guide members 120 on the plate 61, the package 60 may be caused to come to rest in the required position to receive a binding strap in the desired location, in addition to locating the package laterally so that it will actuate the starting lever 111. In addition to these slots, the plate 61 is provided with a transversely extending slot 61^c which is adapted to receive the lower part of the U-shaped loop 50^a, as shown in Fig. 5, so that the package 60 may be caused to slide over the lower part of the loop when it is moved into the position on the supporting plate wherein it engages the starting lever 111 and the rear stop member 117. When the supporting plate 61 is moved downwardly and forwardly on the crank arms 79, the stop member assists in ejecting the package from its position beneath the sealing apparatus.

The holding and measuring devices, the shearing device and the stretching devices, heretofore referred to, are carried by a strapping frame 125 which is mounted upon the base frame 66 and which is capable of vertical adjustment so that it may be located in various spaced relations with respect to the supporting plate 61 in order to accommodate boxes or packages of various sizes. This strapping frame 125 is considerably longer than the base frame 66 and it comprises a rear longitudinal frame member 126, an intermediate longitudinal frame member 127, end frame members 128 and supporting members 129 of irregular form, all of which are preferably of angle bar cross section. The strapping frame 125 is generally rectangular in horizontal cross section and there are four of the supporting members 129, each including an upper vertical portion 129^a, an intermediate inclined portion 129^b, and a lower vertical portion 129^c which is formed in part as

an internally threaded sleeve. The upright portions 129^a of these supporting members, which are located at the corners of the upper part of the frame 125, are welded or otherwise secured to the end frame members 128 and the ends of the rear frame member 126 are also welded or otherwise secured to the upper ends of the rear supporting members 129. The intermediate longitudinal frame member 127 projects beyond the transverse end frame members 128 and is welded or otherwise secured to the top flanges thereof, as shown in Figs. 8 and 14.

In addition to the parts heretofore mentioned, the strapping frame 125 comprises a longitudinal bar or track member 130, of rectangular cross section, shown in Fig. 18, upon which the stretching devices 56 and 57 are slidably mounted. This bar is secured at its ends, by means of angle brackets 131, to the guide bars 133, of rectangular cross section, which extend between and are secured to the front and rear vertical portions 129^a of the supporting frame members 129. This strapping frame also carries a relatively movable longitudinal bar 135 which carries the holding device 53, the shearing device 54, and the measuring device 55, this bar 135 being part of a transfer frame by which these parts are moved toward and from the guide or trackway 132, as hereinafter more fully described.

The internally threaded sleeve portions which are formed at the lower ends of the supporting frame members 129 are threadedly engaged by adjusting screws 136, shown particularly in Figs. 8 and 14, which are journaled in bearing brackets 137 and 138 attached to the upright members 68 of the base frame 66. The lower ends of these adjusting screws have sprocket gears 139 secured thereon and these sprocket gears are engaged by an endless sprocket chain 140 so that upon movement of the chain all of the adjusting screws 136 are rotated together and the strapping frame is thereby raised or lowered in order to provide the desired space between the supporting plate 61 and the under side of the strapping frame for the size of package being bound, so that, when the plate 61 is elevated as heretofore described, the upper surface of the package 60 will engage the under side of the sealing apparatus 62. In order that this adjustment may be conveniently effected, one of the adjusting screws 136 is extended downwardly beyond its lower bearing and the connected sprocket gear and is connected with the shaft of a reversible motor 141, which may be an electric motor or a fluid pressure motor capable of being rotated in either direction so that the strapping frame may be raised or lowered at the will of the operator.

The previously mentioned bar 135, which forms a part of the transfer frame and acts as a trackway and support for the measuring device, the shearing device and the holding device, has its ends secured by means of bolts 143 to plates 144 which in turn are welded to blocks 145 provided with rectangular guideways 145^a, shown in Fig. 19, arranged to receive the supporting guide members 133. Flat bars or plates 146 are secured to the outer sides of the blocks 145 by studs 147, shown in Fig. 18, and these bars 146 extend rearwardly for connection with the mechanism by which the transfer frame is to be shifted on the guide members 133. Each of the bars 146 is provided adjacent its rear end with a pair of upwardly extending lugs 146^a each having rotatably mounted thereon a roller 148. These rollers of each pair are adapted to coact with

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opposite edges of a transfer cam 150, one of which is secured upon each end of the shaft 151 which extends longitudinally of the strapping frame with its end portions journaled in bearing brackets 152 attached to the upright portion 129^a of one of the supporting frame members 129 at the rear of the frame 125.

For the purpose of effecting rotation of the shaft 151, a pinion 153 is fixed thereon adjacent one of the bearings 152 and this pinion meshes with a rack bar 154 which slides vertically in a guideway 155 mounted upon a plate 156 secured to the rear inclined frame member 129^b. This rack bar 154 is secured to, or formed as an extension of, a piston rod 157 which extends into a fluid pressure cylinder 158 containing a piston adapted to be actuated by hydraulic pressure or the like for the purpose of reciprocating the rack bar 154 and thereby rotating the transfer cams 150 to effect forward and reverse movements of the transfer frame. The cylinder 158 is pivoted at 159 in a bracket 160 carried by the plate 156 and its lower end is pivoted in another bracket 161 carried by the plate 156. The admission of fluid under pressure to the cylinder 158 is controlled by the cam 97, shown in Fig. 43, as more fully described hereinafter.

As shown particularly in Figs. 8 and 14, the flat steel strap or other flexible binder 50 is supplied from a reel 51 which is mounted to revolve on a shaft 163 fixed in a hub 164 carried by laterally diverging arms 165 secured to one of the upper frame members 71 and to one of the lower end frame members of the base frame 66. The reel 51 has its rear disk 51^a secured to a brake drum 166 and a brake shoe 167 engages the surface of this drum for controlling the unwinding of the strap or other binder from the reel. The shoe 167 is held against the brake drum by springs 168, the compression of which may be adjusted by nuts 169 for the purpose of regulating the resistance which is offered to the unwinding of the flexible binder. The cylindrical portion 51^b of the winding reel has lugs 51^c which enter apertures in the forward disk 51^d of the reel for holding these parts against relative rotation. A hand nut 170 engages the threaded forward extremity of the shaft 163 to secure the disk 51^d in place and, upon removal of this nut and of the disk 51^d, a new coil of binding material may be placed upon the drum of the reel after one coil has been exhausted.

As the flexible binder 50 is withdrawn from the reel 51, it extends upwardly and over the grooved roller 52 which is rotatably mounted upon a bracket 173 attached to and suspended from the block 145 at the right-hand end of the machine. After passing over the roller 52, which is thus positioned with its peripheral surface extending slightly beyond the upright portions of the right-hand supporting frame members 129, the binder 50 extends toward the left and into engagement with the holding device 53 which is mounted for longitudinal adjustment on the bar 135 of the transfer frame. This holding device is shown generally in Figs. 8 and 9 but is illustrated in greater detail in Figs. 21, 22 and 23 where it is shown as comprising a block 174 carried by a slotted guide member 175 which is mounted to slide upon a bar 135 and which is secured in adjusted position by an adjusting screw 176 operated by a hand wheel 177 and engaging a shim 178 positioned within the bracket 175 on the under side of the bar. This block 174 is provided on its rear side with an inwardly extending hori-

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zontal chamber 174^a which is adapted to receive the binder 50 extended thereto from the roller 52. The chamber 174^a has an inclined top wall 174^c which is opposed to the surface of the binder 50 which passes through the chamber block in contact with the lower wall 174^b thereof. A lever 179 is pivotally mounted within the chamber 174^a on a pin 180 and the lower end of this lever carries a roller 181 which contacts with the outer surface of a hardened steel roller 183 which is adapted to wedge between the inclined surface 174^c and the surface of the binder 50 to prevent movement of the binder toward the right as viewed in Figs. 8 and 9. The small roller 181 is maintained in contact with the hardened steel roller 183 by a pin 184 which is actuated by a coil spring 185 mounted in a small bore 174^d formed in the block 174 and closed at its end by a plug 186. The chamber 174^a is closed on its rear side by a retainer plate 187 which is positioned by a pin and secured in place by screws entering apertures in the rear face of the block 174. There is thus formed a channel in the block 174 through which the binder 50 passes and, due to the action of the spring pressed roller 183, the binder 50 may normally move only toward the left, as viewed in Figs. 8 and 23, since movement in the reverse direction will tend to wedge the roller 183 between the surface 174^c and the surface of the binder resting on the bottom surface of the channel, while movement in the other direction will cause the roller 183 to move away from the wedging surface. In order to permit the release of the binder 50 from the holding device 53 when desired, a small lever 189 is pivoted on the block 174 and provided with an interned lower extremity 189^a adapted to enter the recess 174^a. By pressing on the upper end of this lever, the roller 183 may be pushed away from the wedging surface 174^b in order to permit the withdrawal of the binder 50 from the holding device toward the right as viewed in Fig. 23.

From the holding device 53, the binder 50 passes toward the left, as viewed in Figs. 1 and 8, to the shearing device 54, the details of which are illustrated in Figs. 21, 22, 24, 25 and 26. This shearing device comprises a block 190 carried by a bracket 191 having a slot of rectangular cross section which is fitted by the guide bar 135 of the transfer frame. This block 190 is engaged by a long bolt 192 which extends through the block 174 of the holding device 53 and which is engaged on its threaded end by a nut 193 seating against the left-hand side of the block 190, as viewed in Fig. 24. A coil spring 194 is mounted on this bolt 192 with one end thereof entering a recess 174^e formed in the block 174 of the holding device so that the spring normally separates the holding device from the shearing device. This normal separation may be varied in extent by regulating the position of the nut 193 on the bolt 192 which will have the effect of varying the extent to which the upper end of the binder overlaps the lower end when they are drawn taut around the package in position to be sealed or otherwise united, as hereinafter described.

The block 190 is provided on its rear side with a transverse horizontal slot 190^a adapted to receive the binder 50 passed thereto from the holding device. This slot is intercepted by a tubular bore 190^b formed in the block and extending in a vertical direction. A stationary die 195 is secured in the bore 190^b below the slot 190^a by means of a bolt 196 and a movable die 198

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is mounted to slide in the upper part of the bore above the slot 198^a. The upper die 198 is provided with two semicircular cutting edges 198^a, as shown in Fig. 26, and these cutting edges are adapted to cooperate with corresponding cutting edges on the lower die 195 to cut off the binder with rounded ends, a segment of the binder being cut out between the two rounded ends which are thus formed.

The upper movable die 198 is slotted to receive a pair of links 199 which are pivotally connected thereto by a pin 200 and which have their upper ends pivoted at 201 to an operating lever 202. This lever 202 is pivoted by a pin 203 on the block 190 and when it is actuated it performs two functions, one of which is to operate the movable shearing die 198, while the other is that of tripping the right-hand stretching device 56 so that it will grip the binder immediately, before the binder is cut off from the source of supply. For the latter purpose, the lever 202 is extended forwardly, as shown in Fig. 25, and is pivoted at 204 to an eyebolt 205 mounted to slide vertically in a small bore 190^c formed in the block 190. An arm 206 is splined on the lower end of the eyebolt 205 and secured in adjusted position by a nut 207 and, when the right-hand stretching dog 56 and the shearing device 54 have been moved into the proper relative positions, as hereinafter described, the elevation of the arm 206 trips the gripping dog of that stretching device and causes it to grip the binder before the shearing die 198 is operated to sever the binder.

The lever 202 has a transversely extending arm 202^a which is inclined downwardly, as shown at 202^b in Fig. 21, terminating in a lug 208 having on its face an inclined wedging surface 208^a which slopes downwardly and rearwardly. This arm of the lever 202 is adapted to be actuated by a plunger 210 which is mounted to slide in a tubular member 211 carried by a block 212 adjustably mounted on the bar 130 of the strapping frame (Fig. 27). This block is provided with a rectangular slot open on one side which slidably engages the bar 130 and a shim 213 is mounted between the lower wall of the slot or guideway and the under face of the bar 130 so that a set screw 214, operated by a hand wheel 215, may be manipulated to secure the block 212 in the desired position on the bar 130. In this way, the block 212 may be adjusted to correspond with the positions of the holding device and the shearing device which, in turn, may be adjusted to accommodate boxes or packages of different heights and widths requiring different lengths of binders. The block 212 is maintained at all times in fixed relationship to the holding device 53 by a guide bar 219 which is secured in a groove 212^a in the under side of this block by studs 219^a, as shown in Fig. 27, and which extends forwardly and slidably engages a groove 174^c in the bottom of the block 174, as shown in Figs. 21, 22 and 23. The hand wheels 177 and 215 may be operated to release the blocks 174 and 212, respectively, at the same time, so that these blocks may be adjusted together longitudinally of the bars 135 and 130, respectively.

The plunger 210 is provided with an enlarged head 210^a at its rear end adapted to be engaged by the peripheral surface of a cam 216 which is mounted upon the shaft 151 by which the transfer cams 150 are operated and which is capable of engaging and operating the plunger 210 only

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when the transfer frame has been shifted rearwardly by the operation of the transfer cams. The cam 216 is of substantial length so that it will engage the head of the pin 210 in any position of the block 212. The configuration of this cam 216 is shown in Fig. 22 where there is also illustrated, in dotted lines, the outline and relative angular position of one of the cams 150. Upon the rotation of the cam 216 through substantially 180 degrees from the position shown in Fig. 22, the pin 210 is pushed forwardly to coact with the inclined wedging surface 208^a on the lug 208 carried at the end of the lever 202 so that this arm is thereby wedged downwardly, causing the upper shearing die 198 to be lowered to cut off the binder while, slightly in advance of that operation, the eyebolt 205 raises the arm 206 to trip the stretching device 56 and cause it to grip the binder which is about to be cut off. Upon the completion of this operation, the pin 210 is restored to its initial position by a coil spring 217 mounted between the head of the pin and the end of the tubular member 211, and the lever 202 is restored to its normal position by a pair of coil springs 218 which connect the part 190^d of the block 190 with two arms 202^d which project forwardly from the upper part of the lever 202, as shown in Fig. 25.

Assuming that the shearing device 54 has been operated and that the cut length of binder has been removed by a preceding operation of the stretching devices, there remains in the shearing device the end 50^a of the supply portion of the binder leading from the reel 51 through the holding device 53. Upon the next operation of the measuring device, this free end of the supply portion of the binder has to be engaged and gripped by the measuring device 55 in order to draw out another measured length. To do this, it is necessary to slide the shearing device 54 toward the right, as viewed in Fig. 24, on the bar 135 to cause this end 50^a of the binder to project through the shearing device as shown in Fig. 3. This movement of the shearing device toward the right is effected by the measuring device 55 during its movement on the bar 135. The measuring device comprises a tubular guide member 220 having an undercut rectangular groove open on its forward side, which is fitted by the bar 135, as shown in Figs. 21 and 24. The member 220 carries a rearwardly extending block 221 terminating in a vertical plate portion 221^a having a rearwardly extending gripping flange 221^b at its lower edge which is adapted to underlie the end of the binder when the binder is gripped. A gripping dog 222 is pivoted on a pin 223 secured in the upright portion of the block and this dog has a serrated gripping surface 222^a adapted to engage the upper side of the binder. A pin 224 is pivotally connected to the dog 222 by a pin 225 at the left of the pivot 223 and the free end of this pin slidably engages an aperture in a pin 226 which is secured to and projects rearwardly from the upright portion 221^a of the block 221. A coil spring 227 is mounted on the pin 224 and, when the pin 225 is below the center line extending between the axes of the pin 223 and the pin 226, this spring will force the serrated gripping surface into engagement with the binder. When the pin 225 is above that center line, the spring 227 will hold the dog out of gripping position.

As the measuring device 55 approaches the end of its travel toward the right, as viewed in Figs. 21 and 24, the dog 222 will have been previously placed in its open position, as hereinafter de-

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scribed, and the guide member 220 will engage the guide member 191 of the shearing device 54, thereby forcing the shearing device toward the right and compressing the spring 194 which is interposed between the shearing device and the holding device 53. This relative movement of the shearing device and the holding device causes the end 50^a of the binder to project through the shearing device and over the flange 221^b of the measuring device where it may be gripped by the measuring dog 222. The extent to which the binder projects is determined by the initial compression of the spring 194, which may be regulated by adjusting the nut 193, and is limited by the engagement of the guide member 191 of the measuring device 54 with the guide member 175 of the holding device 53. At this point, the measuring dog 222 is tripped to engage the binder 50 by the automatic operation of a lever 228 which is pivoted at 229 on the block 190 of the shearing device. This lever has an arm 228^a extending toward the right, as viewed in Fig. 21, and terminating in a forwardly projecting lug 228^b which is adapted to ride up on the inclined cam surface 197^a of the retainer plate 187 of the holding device as the shearing device approaches the limit of its movement toward the right. The left-hand arm 228^c of this lever then moves downwardly and a forwardly projecting lug 228^d on the end thereof strikes the measuring dog 222 at the left of its pivot 223, thereby moving it downwardly until the pin 225 moves below the aforesaid center line and permits the spring 227 to force the dog into gripping engagement with the binder on the flange 221^b. The guide member 220 is then moved toward the left on the bar 135 and the measuring device 55 then pulls the binder through the holding device and the shearing device and draws out a predetermined length from the source of supply. Since the measuring dog 222 is inclined away from the shearing device 54, its movement toward the left, as viewed in Fig. 21, will tend to increase its grip upon the binder. As the shearing device is restored to its normal position by the action of the spring 194, following the movement of the measuring device toward the left, the lever 228 returns to the position shown at the left in Fig. 21 under the influence of a coil spring 230 connected between the arm 228^c of the lever and the end of the previously mentioned pivot pin 203 carried by the block 190, which spring is extended by the downward movement of the arm 228^c of this lever.

The movement of the measuring device 55 on the bar 135 is effected by an endless sprocket chain 233 which is attached by a clip 234 to the top of the guide member 220 of the measuring device, as shown in Figs. 21 and 24. At the right-hand end of the machine, as viewed in Fig. 19, the chain 233 passes around a sprocket gear 235 journaled in the end of a yoke 236 which is carried by a bolt 237. This bolt projects through an aperture in an upward extension 146^b of the adjacent end plate 146 of the transfer frame and the end of the bolt is engaged by a pair of nuts 238 which may be adjusted to regulate the tension in the upper and lower reaches of the chain. At the left end of the machine, as viewed in Figs. 8, 9, 18 and 19, the chain 233 passes around another sprocket gear 229 which is secured on the shaft 240^a of a fluid motor 240. This motor has its casing secured to a plate 241 which is welded or otherwise secured to the adjacent end plate 146 of the transfer frame. In this way, the driving mechanism for moving the measuring device

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is mounted to move with the transfer frame when this frame is shifted on the strapping frame 125 by which it is carried. The motor 240 is operated, for moving the measuring device in either direction, by hydraulic pressure supplied through flexible connections and controlled by the cam 96, shown in Figs. 38 and 40, as more fully described hereinafter.

The measuring device 55 continues its motion toward the left, as viewed in Figs. 1, 2, 8, 21, 30 and 31, until the cam 96 arrests the operation of the fluid motor 240, or until the measuring device engages a stop member 243, at which time the measuring device will occupy the position shown in Fig. 2, and illustrated by dotted lines in Fig. 21, with the end of the binder 50 still being gripped thereby. Since the drawing out of the binder is restricted by the frictional contact therewith of the holding device 53, the binder is drawn out under tension so that a predetermined length of binder is drawn out by the operation of the motor 240. At the conclusion of that operation, the measuring device 55 is brought to rest by the stop member 243 mounted on the bar 135, and is held against that stop member by the continued application of fluid pressure to the motor until the measured length of binder has been transferred to the stretching devices and severed from the source of supply. This stop member 243 is in the form of a block or sleeve open at one side and having an undercut groove therein which is fitted by the bar and which is adapted to be held in adjusted position by a set screw 244 operated by a hand wheel 245, shown in Fig. 8. This stop member may be adjusted in its position on the bar in accordance with the length of binder to be measured and its right-hand end is adapted to be engaged by the end of the block 220 of the measuring device, as shown in Figs. 8, 21 and 24, when a predetermined length of binder has been drawn out.

The parts are then in readiness for the transfer of the measured length of binder to a position where it may be engaged by the stretching devices 56 and 57 and this transfer is then automatically effected by the operation of the transfer cams 150 which carry the transfer frame rearwardly to the point where the measuring device 55 occupies the position shown in Figs. 30 and 31. The gripping dog 222 of this device may then be engaged by a trip lever 246 which is adapted to be automatically operated to release the free end 50^b of the binder from the measuring device after the measured length of binder has been gripped by the stretching devices. This trip lever 246 is pivotally mounted on a pin 247 carried by plates 248 which are secured to a block 249 mounted to slide on the bar 130 of the strapping frame. This block is provided with an undercut rectangular groove or guideway engaged by the bar 130 and having mounted in the bottom thereof a shim 250 with which a set screw 251, mounted in the bottom of the block, is adapted to coact. This set screw is operated by a hand wheel 253 which may be manipulated to secure the block 249 in the desired adjusted position upon the bar 130. A slide bar 254, similar to the bar 219, is secured in a groove 249^a formed in the under side of the block 249 and this bar extends forwardly to engage a groove 243^a formed in the under side of the stop member 243, mounted on the bar 135, so that the members 243 and 249 are caused to move together on their respective bars 135 and 130 and may be adjusted together longitudinally of the machine to cause

the measuring device to draw out the required length of binder.

As shown in Figs. 30 and 33, the block 249 carries a transverse sleeve 255 which has slidably mounted therein a plunger 256 provided with an enlarged head 256^a adapted to be engaged by a cam 257 secured on the cam shaft 151 which also carries the cam 216 and the transfer cams 150. When the transfer frame has been moved rearwardly by the cams 150, the plunger 256 is brought into a position where it may be engaged by the cam 257 which rotates and moves the plunger 256 forwardly against the compression of a spring 258 mounted on the plunger between the head 256^a and the end of the sleeve 255. This plunger 256 is adapted to operate the trip lever 245 previously referred to and also to operate means for causing the stretching device 57 to grip the measured length of binder 50^b at the proper time. For this purpose, the plunger 256 is secured at its forward end to a wedge-shaped block 260 which is provided on its upper side with an inclined cam surface 260^a adapted to engage a stop screw 261 secured by a lock nut 262 in a flange 246^a which is formed at the upper left end of the trip lever 246, as shown in Figs. 31, 32 and 33. When the plunger 256 is moved forwardly by the cam 257, the wedging surface 260^a coacts with the stop screw 261 to tilt the trip lever 246 about its pivot and cause the pointed head 246^b at the right end thereof to press downwardly upon the portion 222^b of the gripping dog which forms a part of the measuring device, thereby turning the measuring dog about its pivot from the position shown in Fig. 31, until the pin 225 has been moved about a center line connecting the pins 223 and 226, whereupon the spring 227 operates automatically to hold the measuring dog 22 in the open position shown in Fig. 32.

The cam block 260 is also provided on its underside with an inclined cam surface 260^b which is adapted to coact with another stop screw 263 secured by a lock nut 264 in a flange 265^a formed on the end of another trip lever 265 which is pivoted on a pin 259 carried by the lower part of the previously mentioned plate 248. When the plunger 256 is moved forwardly by the cam 257, the inclined cam surface 260^b coacts with the stop screw 263 to actuate the trip lever 265 and move the right-hand arm 265^b thereof upwardly, with the result that it engages a gripping dog 267 which forms a part of the stretching device 57 and moves it into engagement with binder 50^b. The stop screws 261 and 263 are normally moved into engagement with the cam block 260, by a coil spring 252 which is attached at its ends to the flanges 246^a and 265^a of the trip levers 246 and 265, respectively, and these screws may be adjusted to regulate the time of operation of each of the trip levers 246 and 265, so that the binder will be gripped by the gripping dog 267, of the stretching device 57 at the proper time and in advance of the release of this binder by the gripping dog 222 of the measuring device.

The stretching dogs 56 and 57 are similar to each other in construction but they are oppositely arranged, so that they are opposed to each other in their relation to the measured length of binder 50^b, and the gripping dog 267 of the stretching device 57 is similar in form to a gripping dog 266, forming a part of the stretching device 56, which is shown particularly in Figs. 27, 28 and 29, where the gripping device is shown in its inverted position. As there shown, this

stretching device 56 comprises a block 270 which is mounted to slide upon the bar 130, being provided with an undercut groove 270^a which is open on one side and engaged by the bar, as shown in Fig. 29. This block is provided with a horizontal rearwardly extending bore 270^b in which there is journaled a pin or shaft 271 having mounted on the forward end thereof a gripping plate 272 which is secured in place by a transverse pin 273. This plate 272 has a gripping flange 272^a extending forwardly from one edge thereof to cooperate with the gripping dog 266 in the gripping of the length of binder 50^b. The gripping plate 272 extends transversely to the shaft 271 and the intermediate part thereof is engaged by a bolt 275 which has its head countersunk in a recess in the inner face of the plate 272 and which has journaled on the forwardly projecting portion thereof the gripping dog 266 and a retaining plate 276, both of which are secured on the bolt by a washer 277 and a nut 278. The gripping dog 266 and the retaining plate 276 are of irregular configuration, as shown in Fig. 27, and both of these members have apertures which are engaged by a pin 279 located at a point which is, in general, on the opposite side of the bolt 275 from the serrated gripping surface 266^a of the gripping dog. The gripping dog is slotted to receive the apertured head of a pin 280 which is also engaged by the pin 279 and which extends from the slot in the gripping dog to form a sliding engagement with an aperture in the end of another pin 281 which extends parallel to the pin 279 and is secured in an aperture formed in the gripping plate 272. A coil spring 282 is mounted on the pin 280 between the head of this pin and the surface of the pin 281, and this spring tends normally to expand and to force the pin 279 away from the pin 281, which action may have the effect of forcing the serrated gripping surface 266^a either toward or away from the gripping flange 272^a of the gripping plate, depending upon whether the pin 279 is on one side or the other of a center line connecting the axes of the bolt 275 and the pin 281. When the pin 279 is below that center line, as shown in Fig. 27, the spring 282 causes the gripping dog to grip the binder 50 seated against the gripping flange 272^a, and the gripping mechanism is adapted to be tripped to move the gripping dog to this gripping position by the previously described arm 206 carried by the eye-bolt 205 which, as previously described, is actuated through the lever 202 by the cam 216 when the transfer frame has been shifted rearwardly by the operation of the transfer cams 150. As shown in Fig. 27, the serrated gripping surface 266^a is located upwardly from and at the right of the axis of the pivot bolt 275 so that tension in the binder between the stretching devices tends to increase the grip of the dog 266 upon the binder.

On the outer end of the pin 279, there is pivotally mounted a detent 283 which is adapted to be actuated, as hereinafter described, by mechanism associated with the sealing device, for actuating the pin 279, after the binder has been drawn taut about the package and sealed, for the purpose of releasing the binder from the stretching device and moving the pin 279 to a point on the other side of a line connecting the axes of the plate 275 and the pin 281, which latter position is the one occupied by the pin 279 when it reaches the position where the gripping dog 266 is engaged by the arm 206. The re-

retaining plate 276 has an outwardly projecting lug 276^a which limits the angular movement of the detent 283 toward the right, as viewed in Fig. 27, and the opposite extremity of this retaining plate extends beyond the serrated gripping surface 266^a of the gripping dog and terminates in an outwardly curled lip 276^b. When the gripping dog 266 is moved to the gripping position shown in Fig. 27, this projecting portion of the retaining plate extends upwardly and overlaps the gripping flange 272^a, as shown in Fig. 29, thus retaining the binder against outward movement on the flange 272^a. Immediately after this gripping of the binder takes place with the gripping dog 266 in the position shown in Fig. 27, the shearing device 54 is operated by the lever 202, in the manner previously described, in order to cut off the binder and leave a projecting end 50^c extending toward the right, as shown in Fig. 27. After these operations have been performed, the transfer frame is then returned by the transfer cams 150 to its forward position and the measured length of binder is then held by the two stretching devices 56 and 57.

For the purpose of rotating the gripping dogs of the stretching devices 56 and 57 about their own axes during movement of the stretching devices from the positions shown in Fig. 6 to the positions shown in Fig. 7, in order to position them to receive the length of binder 50^b with its extremities directed away from each other, means are provided for rotating these gripping devices as they approach the positions shown in Fig. 7, so that they will be in the proper positions to grip the measured length of binder when they are fully separated from each other. This means comprises a stationary cam bar 285 mounted on the block 212 which is adjustably mounted upon the right-hand portion of the bar 130, as previously described. This cam bar 285 is secured to the rear side of the block 212, as shown in Fig. 24, and extends longitudinally therefrom toward the left parallel to the bar 130, being provided adjacent its left-hand end with a cam slot 285^a. This cam slot is inclined upwardly and toward the right from the lower edge of the bar 285 and terminates in a horizontal portion 285^b. The cam bar 285 is provided at its end with an inclined guiding surface 285^c which is directed downwardly and toward the right in the direction of the mouth of the slot 285^a. This cam slot in the cam bar 285 is adapted to be engaged by a pin 286 which is eccentrically mounted upon a plate 287 fixed on the rear end of the shaft 271 of the stretching device, as shown particularly in Figs. 28 and 29. The pin 286 and the plate 287 serve as a crank for rotating the shaft 271 in its bearing and thereby turning the gripping plate 272 and the gripping dog 266. This rotation is limited by lugs 270^c formed on the vertical face of the block 270 which are adapted to be engaged by the plate 272 after a predetermined movement. The block 270 is provided at its rear end with an inwardly extending cylindrical recess 270^c in which there is mounted a coil spring 288 adapted to press a spherical ball 289, mounted in the outer end of the recess, into engagement with the forward face of the plate 287. This face of the plate is provided with four conical depressions 287^a located 90 degrees apart and in concentric relationship to the axis of the shaft 271 so that, when the ball 289 engages any one of these depressions, it will hold the plate 287 and the connected gripping devices 266 and 272 in fixed relationship to the block 270 until

relative movement of these parts is again effected by the application of a force to the gripping plate 272 or to the plate 287 which is sufficient to move the ball 289 into the recess 270^c by the wedging action of the wall of the depression 287^a on the surface of the ball.

As the stretching device 56 is moved toward the right and approaches the cam bar 285, the inclined surface 285^c will engage the pin 286 and direct this pin into the cam slot 285^a which will then operate to turn the shaft 271 and revolve the gripping device about its own axis until the serrated surface 266^a of the gripping dog is directed upwardly in opposition to the opposed overlying flange 272^a of the gripping plate, as shown in Fig. 27. In this way, the gripping device is automatically operated to present the gripping surfaces in proper position to grip the measured length of binder 50^b with the end 50^c thereof directed away from the other gripping dog 267.

The left-hand stretching device 57, which includes the previously mentioned gripping dog 267, is identical in construction with the stretching device 56 except that its parts are directed oppositely so that it forms a left-handed gripping device in contrast with the right-handed gripping device 56. This gripping device 57 is shown particularly in Figs. 30, 31, 32 and 33 and it comprises a block 290 mounted to slide on the bar 130 and having journaled therein a shaft 291 upon the forward end of which a gripping plate 292 is secured by a pin 293. This gripping plate has a gripping flange 292^a arranged to cooperate with the serrated gripping surface 267^a of the gripping dog in gripping the end portion 50^a of the binder 50, and it has secured in the intermediate part thereof a bolt 295 upon which the gripping dog 267 and a retainer plate 296 are journaled, these parts being secured on the bolt by a washer 297 and a nut 298. A pin 299 engages registering apertures in the gripping plate 297 and the retainer plate 296 and this pin also engages the apertured head of a pin 300 which has a sliding engagement with an aperture in another pin 301 secured in the plate 292 near the outer end thereof. A coil spring 302 is mounted on the pin 300 between the head of that pin and the pin 301 so that, as in the construction previously described, this spring serves to retain the gripping dog in either one of two positions depending upon whether the pin 299 is on one side or another of a line connecting the axes of the shaft 295 and the pin 301. The retainer plate 296 has a part which extends beyond the serrated gripping surface 267^a of the gripping dog and terminates in an outwardly curled lip 296^a so that, when the gripping dog is turned to the gripping position shown in Fig. 32, this portion of the retainer plate occupies a position on the outer side of the binder 50 and retains it against movement away from the body of the gripping plate. On the outer end of the pin 299, there is pivotally mounted a detent 303 which is limited in its movement in one direction by a lug 296^b extending outwardly from the retainer plate 296. As in the case of the detent 283, this detent 303 acts in the manner hereinafter described to move the gripping dog 267 out of gripping position after the overlapping ends of the binder have been sealed by the sealing device.

In order that the gripping plate 292 and the gripping dog 267 may be turned about the axis of the shaft 291 at the proper time during the separation of the stretching devices 56 and 57 on the bar 130, there is provided a cam bar 305,

similar to the cam bar 285 previously described, but directed in the opposite direction. This bar 305 is secured on the rear face of the block 249 which carries the mechanism for actuating the trip levers 246 and 265 and which also serves as a stop for limiting the movement of the block 290 of the stretching device 57 toward the left when this block is retracted from the position where the sealing operation takes place. The cam bar 305 is provided on its under side at its right-hand end with a cam slot 305^a which is directed upwardly and toward the left and which then terminates in a horizontal portion 305^b. The bar 305 is also provided on its under side with an inclined wedging surface 305^c which is directed downwardly and toward the left from the end of the bar, terminating at the mouth of the slot 305^a. This cam slot is adapted to be engaged by a pin 306 which is eccentrically mounted on a plate 307 secured on the inner end of the shaft 291. The plate 307 is provided on its forward face with four depressions 307^a which are of conical form and a spring 308, mounted in a recess in the block 290, is adapted to press a ball 309 into engagement with one of the depressions 307^a for the purpose of locking the shaft 291, and the gripping devices mounted on the forward end thereof, against angular movement with respect to the block 290 until such movement is caused by the actuation of the pin 306 or by the engagement of the gripping plate 292 with the package being bound.

When the gripping device 57 reaches the left-hand end of its path of travel, as shown in Figs. 30, 31 and 32, the pin 306 engages the cam slot 305^a and turns the gripping plate 292 and the gripping dog 267 to the positions shown in Fig. 31 where the plate 292 is inverted with its gripping flange 292^a extending above and spaced from the serrated gripping surface 267^a, in readiness to receive the left-hand end portion of the measured length of binder 50. At this point, the transfer frame is shifted rearwardly by the action of the transfer cams 150 and, when the transfer frame is in its rearward position, the plunger 256 is actuated by the cam 257 to cause the operation of the trip lever 265 and then the operation of the lever 246. When the arm 265^b of the lever 265 moves upwardly, it engages the gripping dog 267 on the side thereof beneath the serrated gripping surface 267^a, thus rocking the gripping dog about its pivot and moving the pin 299 below a line connecting the axis of the shaft 295 and the axis of the pin 301, whereupon the spring 302 automatically carries the gripping dog 267 to the gripping position shown in Fig. 32 where the end portion of the binder is gripped and held against the flange 292^a of the gripping plate. In this gripping position, the inclination of the gripping dog is such that tension in the intermediate portion of the binder tends to increase its grip upon the binder. Immediately after the binder is thus gripped by the stretching device 57, the other trip lever 246 engages the tip 222^b of the measuring dog 222 and forces it downwardly and toward the right, thus carrying upwardly the pin 225 beyond a line connecting the axes of the pins 223 and 226, thereby causing the coil spring 227 to snap the measuring dog 222 to its open position, shown in Fig. 32, wherein the end 50^a of the binder is released by the measuring device.

At the same time that the cam 257 is operated to cause the gripping of the binder by the stretching device 57 and the release of the binder by the measuring device 55, the other elongated cam 216

on the shaft 151 is operated to cause the other stretching device 56 to engage the other end of the binder and to actuate the shearing device 54 to cut off the binder from the source of supply.

The parts are then in readiness for the return of the transfer frame, with its holding device, shearing device and measuring device, to its forward position, and for the relative movement of the stretching devices 56 and 57 toward each other from the positions shown in Fig. 3 to the positions shown in Fig. 4 for the purpose of forming a U-shaped loop 50^d which is adapted to receive the package to be bound.

The relative movement of the stretching devices 56 and 57 longitudinally of the bar 130 is effected by means of fluid actuated cable mechanism which is illustrated in Figs. 8, 9, 14 and 39. This mechanism is carried principally by the intermediate longitudinal frame member 127 which projects beyond the end frame members of the strapping frame 125. At the left-hand end of the machine, as viewed in Fig. 8, a bracket 310 is secured to the end of the frame member 127 and this bracket carries fixed shafts upon which are journaled two grooved pulleys 311 and 312. On the underside of the frame member 127, near the left-hand end of the machine, but inwardly from the end frame member 128, there is rotatably mounted another grooved pulley 313 having its axis extending vertically. At the right-hand end of the strapping frame 125, the projecting end of the frame member 127 carries another pulley bracket 314, similar to the bracket 310, which has rotatably mounted thereon two other grooved pulleys 315 and 316. On the upper side of the projecting end of the frame member 127 at the right-hand end of the machine, there is mounted an upstanding bracket 317 which is apertured for engagement by a threaded member 319 attached to a clevis 320 in which there is rotatably mounted another horizontally disposed grooved pulley 321. The threaded member 319 may be adjusted in the bracket 317 and secured in adjusted position by means of a nut 322. The pulleys 312 and 316 are in alignment in a vertical plane and the pulleys 311 and 315 are in alignment in a plane which diverges upwardly from the plane of the pulleys 312 and 316 so that stretches of a cable extending between the pulleys of each of these pairs are in proximity to each other for convenient connection with the blocks of the stretching devices 56 and 57.

The grooved pulleys just referred to are engaged by an endless steel cable 325, the connections of which are best shown in Fig. 39. This cable is extended back and forth around the various pulleys and is attached at two points 326^a and 326^b to a cross head 326 which is actuated by a piston rod 327 extending from a fluid pressure stretcher cylinder 328, shown in Figs. 4, 38 and 39, which is mounted on the side of the horizontal intermediate frame member 127 and which contains a piston adapted to be actuated by compressed liquid supplied thereto from a metering cylinder 329, or directly from a pump, as shown in Figs. 8, 38 and 45. Upon the admission to the cylinder 328 of a definite quantity of liquid supplied by the metering cylinder 329, a predetermined movement of the cross head 326 takes place, thereby effecting a predetermined relative movement of the stretching devices 56 and 57 in forming the U-shaped loop, as described more fully hereinafter.

Starting from the point of attachment 326^b at the bottom of the cross head 326, the cable

325 extends toward the left and around the pulley 313 and thence toward the right and around the pulley 315 from which the cable extends toward the left again and is attached to the block 270 of the stretching device 56 in the manner which is particularly shown in Fig. 29, where the block 270 is shown as being provided on its under side with a transverse groove 270^a. A clamping member 330 is secured to the under side of the block 270 by a screw 331 and this clamping member is provided with a groove which receives the cable 325 so that as the clamping member 330 is moved into engagement with the groove 270^a by the screw 331, the cable is securely interlocked with the groove 270^a and held in fixed relationship to the block 270. From the block 270, the cable 325 continues toward the left and passes beneath the block 290, slidably engaging a groove 290^b which is formed in the under side of this block. The cable then continues toward the left and passes around the pulley 311 at the left-hand end of the machine, from which position it extends toward the right again and is passed around the pulley 321 adjacent the right-hand end of the machine. The cable is then extended toward the left and is secured to the cross head 326 at the point of attachment 326^a. From the point of attachment 326^a on the upper side of the cross head, the cable continues toward the left and passes around the pulley 312 from the under side of which it returns and extends beneath the block 290 of the stretching device 57, being secured to this block in the manner previously referred to by a clamping member 332. From the block 290, the cable continues toward the right and beneath the block 270, slidably engaging a groove 270^b which is formed in the under side of this block, as shown in Figs. 29 and 39. After passing beneath the block 270, through the groove 270^b, the cable is extended around the pulley 316, and is then carried toward the left and attached to the under side of the cross head 326 at the point of attachment 326^b. With these connections of the cable 325, a movement of the cross head 326 toward the left, as viewed in Fig. 39, causes the blocks 270 and 290 and their gripping dogs to move toward each other, while a movement of the cross head 326 toward the right, as viewed in Fig. 39, will cause the movement of the blocks 270 and 290 away from each other. The admission of a liquid under pressure to the cylinder 328 is controlled by the cam 99, except for the liquid received from the metering cylinder 329 under control of the cam 97, as hereinafter more fully described, so that the relative movement of the stretching devices 56 and 57 is of the required magnitude and occurs at the proper intervals during the cycle of operations of the machine.

If the stretching devices 56 and 57 are in their widely separated positions, with the pin 286 of the stretching device 56 in engagement with the portion 285^b of the cam slot 285^a of the bar 285 and with the pin 306 of the stretching device 57 in engagement with the portion 305^b of the cam slot 305^a, the admission of liquid under pressure to the cylinder 328 to cause movement of the cross head 326 toward the left, as viewed in Fig. 39, will move the blocks 270 and 290 of the two stretching devices toward each other, and, in the initial stages of this movement, the pins 286 and 306 will travel downwardly in the inclined slots 285^a and 305^a, respectively, so that each of the gripping plates 272 and 292, and the gripping dogs carried thereby, will be turned through 90

degrees and caused to occupy the positions illustrated by dotted lines in Fig. 34. As the plates 272 and 292 reach these suspended positions upon the disengagement of the stretching devices with the cam bars 285 and 305, the spring actuated balls 289 and 309 will engage depressions 287^a and 307^a, respectively, which are disposed 90 degrees from those previously engaged thereby, so that the gripping plates and their gripping dogs will be held in their suspended positions notwithstanding any tendency of the binding material to rotate them from that position. Upon reaching the position shown by full lines in Fig. 4 and by dotted lines in Fig. 34, the relative movement of the stretching devices 56 and 57 is arrested, leaving the binder 50^b in the form of a suspended U-shaped loop, the lower part of which is located in the slot 61^c in the supporting plate 61.

The operator then places a package 60 on the supporting plate 61 and actuates the starting lever 111 to start a new cycle of operations which is initiated by further movement of the cross head 326 in the same direction and a consequent further movement of the stretching devices 56 and 57 toward each other from the positions shown by dotted lines in Fig. 34. In the initial stages of this further movement, the depending portions of the gripping plates 272 and 292 engage the upper corners of the package 60 and cause the shafts 271 and 291 of these gripping devices to rotate in their bearings in a direction adapted to cause the extremities 50^a and 50^c of the binder to be directed toward each other above the package. As the motion of the stretching devices toward each other continues, the pins 286 and 306 of the two stretching devices engage the inclined end faces 335^a of a cam bar 335 which forms a part of, and is mounted for movement with, the sealing device 62. As these pins ride up these inclined surfaces 335^a, angular movement of the gripping plates 272 and 292 is completed so that, as they reach their final positions, shown by full lines in Fig. 34, they have each been rotated through 180 degrees from the positions which they occupied when they were in engagement with the cam bars 285 and 305, and their gripping flanges 272^a and 292^a occupy horizontal positions parallel to the top surface of the package and resting upon the comparatively thin bottom plate 336 of the sealing device which extends forwardly beyond other parts of the sealing mechanism to provide a flat support for the stretching devices 56 and 57 when these stretching devices reach their final positions, in which positions the gripping plates 272 and 292 are again locked with respect to their supporting blocks 270 and 290, respectively, by the engagement of the balls 289 and 309 with other depressions 287^a and 307^a in the plates 287 and 307. As the stretching devices reach their final positions shown by full lines in Fig. 34, the extremities of the binder are overlapped, in readiness to be sealed, and in order to insure this overlapping of the binder ends in this position, the top surface of the gripping flange 272^a is preferably inclined upwardly and toward the left, as viewed in Fig. 34, so that the extremity 50^c of the binder will be directed slightly upward, causing its tip to extend over the extremity of the binder end 50^a.

As the stretching devices 56 and 57 approach the final positions shown by full lines in Fig. 34, the detents 283 and 303, which are carried by the gripping plates 272 and 292, engage the teeth 337^a and 338^a, respectively, which are formed on the

lower ends of the stationary brackets 337 and 338, respectively, secured to the under side of the longitudinal frame member 127. After the ends of the strap have been sealed, the stretching devices 56 and 57 are moved slightly away from each other by a slight reverse movement of the cross head 326, effected through the admission of liquid under pressure to the cylinder 328, and this action causes the detents 283 and 303 to exert downward thrusts upon the pins 279 and 299, respectively, thereby turning the gripping plates 272 and 292, and the gripping dogs 266 and 267, respectively, carried thereby, about their pivots so that the binder is released by both of the gripping dogs 266 and 267 and the retaining plates 276 and 296 are elevated to permit the disengagement of the sealed binder from the flanges 272^a and 292^a.

This disengagement is then effected by a reverse operation of the piston in the table cylinder 85, controlled by the cam 98, which causes the supporting plate 61 of the table to be lowered by a swinging motion of the supporting links 79, so that the package 60 is moved downwardly and forwardly with a resultant sliding of the sealed binder out of engagement with the flanges 272^a and 292^a of the sealing device and out of engagement with the bottom plate 336. The stretching devices 56 and 57, including the gripping plates 272 and 292, are then separated from each other and restored to their initial positions, shown in Fig. 3, by the admission of liquid under pressure to the cylinder 328 to cause movement of the cross head 326 toward the right as viewed in Fig. 39.

The sealing mechanism 62 is shown particularly in Figs. 34, 35, 36 and 37 and comprises a supporting frame or bracket 340 by which a sliding connection is made with the supporting bar 130^a which is a rearwardly offset portion of the bar 130 upon which the stretching devices 56 and 57 are mounted. As shown in Figs. 9 and 37, the bar 130 has a gap therein at its middle point to accommodate the downwardly moving parts of the sealing apparatus which are brought into engagement with the seal on the overlapping binder ends and, at each side of this gap, a block 341 is secured to the bar 130 and to the rearwardly offset bar 130^a, the bracket 340 being mounted on the bar 130^a between the blocks 341. A pin 342 is mounted in the block 341 at the left of the sealing apparatus, as viewed in Fig. 37, to extend parallel to the bar 130, and a coil spring 343, mounted on this pin, engages the block and the side of the bracket 340 to move the sealing apparatus toward the right to the normal position shown in Fig. 37. The bracket 340 has secured thereto a pair of vertical guide plates 344 which are spaced apart, as shown in Fig. 34, and which have secured to their lower forward edges a longitudinal bar 345 which is located in front of the previously described cam bar 335, secured to the bracket 340, by which the pins of the stretching dogs are turned to their final positions.

The auxiliary supporting bar 130^a has secured thereto the upwardly extending rear portion of the previously mentioned bottom plate 336 which is offset rearwardly to clear the bracket 340 and which extends downwardly and terminates in a flat horizontal portion of such size that it extends longitudinally beyond the ends of the gripping plates 272 and 292 when these plates are in their final positions shown by full lines in Fig. 34, while it also extends forwardly to a sufficient extent to underlie the major portions of the gripping flanges 272^a and 292^a, as illustrated in

Fig. 35, thus forming a partial housing for the sealing apparatus.

The guide plates 344 extend vertically and form a channel between which a sealing head 350 is adapted to move. This sealing head comprises a pair of side plates 351 which lie parallel to each other and which taper rearwardly with their rear extremities pivotally mounted on a pin 352 secured in the supporting bracket 340. Between these side plates 351, there are mounted a pair of sealing jaws 353 which are pivoted on pins 354 carried by the side plates and which are made up of a plurality of laterally spaced bending dies 355 and intervening shearing dies 356. The bending dies of each jaw may be formed as parts of one integral member having slots to receive the shearing dies and these parts are secured together by the pivot pins 354 and by other pins 357 which are held in place by the side plates 351 of the sealing head. The construction of the sealing head and the means for operating it are generally similar to the construction of the corresponding parts of the sealing apparatus disclosed in the United States patent of Ralph H. Norton, No. 1,260,016, dated March 19, 1918. The jaws 353 are provided with upwardly extending arms 353^a by which the jaws are swung between the side plates 351 about their pivots 354. The actuation of these jaws is effected by means of a lever 358 which is pivoted on a pin 359 extending between the side plates and which is provided at its lower end with oppositely directed arms connected by pins 360 with links 361. These links are connected at their ends by pins 362 with the arms 353^a of the sealing jaws and one of the links 361 is longitudinally slotted as shown at 361^a to permit some relative movement of the connected jaw arm 353^a with respect to that link.

The opposed bending dies 355 are provided at their tips with lugs 355^a which are adapted to underlie and support the edges of the side walls 63^b of a channel-shaped metal seal, of the form shown in Fig. 11, when this seal is inserted between the lower portions 353^b of the jaws with these jaw portions separated from each other to the maximum extent. A pin 363 has an enlarged head slidably mounted in a bore 353^c formed in one of the jaws and this head is engaged by a coil spring 364 which is mounted in the bore and retained at its other end by a plug 365, threadedly engaging the bore, so that it may be adjusted to vary the compression of the spring. When a seal is inserted between the jaws, this pin 363 engages the opposite jaw 353 and effects relative movement of the jaws within the limits of the slot 361^a so that the seal is held with resilient pressure between the lower parts of the jaws.

The lever 358 is actuated by a piston rod 368 to which it is pivotally connected at 369. This piston rod extends into a cylinder 370 where it is connected to a piston adapted to be actuated by hydraulic pressure under the control of the cam 95 shown in Figs. 38, 42 and 45. The cylinder 370 is pivoted at its lower end in a yoke 371 which is secured at 372 on the supporting bracket 340 of the sealing apparatus. Upon the admission of liquid under pressure to the upper or rear end of the cylinder 370, the piston rod 368 is actuated to move the sealing head 350 downwardly from the position shown in Fig. 35 to a position wherein a seal 63 held between the jaws is placed on the overlapping binder ends. During this portion of the movement, the lever 358 is held against movement about its pivot 359 by a toggle connection comprising two links 374 and

375. One link 374 is pivoted on the pin 352 about which the sealing head moves and the other link 375 is connected to the jaw member 353 which is nearest the pin 352 by a pin 376. The two links are pivotally connected together by a pin 377. One link 374 is slotted at its upper end, as shown at 374^a, to receive the end of the link 375 and this end of the link 375 is rounded on its lower corner so that the two links may have relative pivotal movement in an upward direction while preventing relative pivotal movement of the two links in the opposite direction beyond a point where the two links are in substantial alignment, due to the engagement of the angular upper corner of the link 375 with the end wall of the slot 374^a. When the two links are thus in substantial alignment, the pin 377 is located slightly below a plane containing the axes of the pins 352 and 376 so that the two links act as a toggle connection between the jaw members and the pivotal axis 352 of the head, thus preventing relative movement of the jaw members during the initial movement of the piston rod 368 which moves the head 350 to the point where the seal between the jaws is positioned on the upper binder end 50^c.

At that point in the movement of the piston rod 368, the toggle is broken by the action of a stop member 378 which threadably engages the link 374 and which is adapted to strike a rearward projection of the bar 345 as the head 350 reaches the limit of its downward swing, thereby raising the pivot pin 377 and permitting relative movement of the links 374 and 375. The stop member is held in adjusted position by a lock nut 379. This relative movement of the connected links allows further downward movement of the piston rod 368 to effect relative movement of the jaws 353, during which the bending dies 355 bend the side walls of the seal downwardly and beneath the overlapping binder ends, as shown in Fig. 36, and the shearing dies 356 shear the lateral edges of the seal and the enclosed binder ends to form an interlocking joint of the type illustrated in Figs. 10 and 12. After the joint has been formed, the piston in the cylinder 370 is operated in the reverse direction by hydraulic pressure to restore the sealing head 350 to the position shown in Fig. 35. The resilient mounting of the sealing mechanism 62 permits this mechanism to move as a unit with the rigid-hand stretching device 56 at the end of the stretching operation so that, when the sealing operation takes place, the seal will always occupy the same position with respect to the upper strap end, while the lower strap end held by the left-hand stretching device 57 may project in varying degrees through the seal when the joint is formed, depending upon variations in the girth and compressibility of different parts of the package being bound or of different packages bound in successive operations. Substantially the same degree of tension is thus obtained in different binders on the same package and on different packages of substantially the same size. After the joint has been formed and upon separation of the stretching devices, the sealing mechanism is returned by the spring 343 to its normal position.

The channel-shaped seals 63 are preferably supplied to the jaws 353 of the sealing head 350 from a magazine 380 which is mounted in an upwardly and rearwardly inclined position at one side of one of the guide plates 344 between which the sealing head moves. The seals are super-

imposed upon each other in nesting relationship in this magazine and they are adapted to be moved successively from the bottom of the magazine to a position between the lower portions 353^b of the jaws when the head 350 is in the elevated position shown in Figs. 34, 35 and 37. For this purpose, the magazine is provided with an opening in one side immediately above its bottom wall and a feeding plunger 381 is mounted for sliding movement in alignment with this opening, in a guideway 382 transversely to the path of travel of the sealing head. The guideway 382 is provided with a longitudinal slot 382^a which receives the end of a feeding lever 385, the extremity of which loosely engages a recess in the plunger 381. The other end of the feeding lever 325 is pivoted by a stud 386 upon a bracket 387 carried by one of the guide plates 344. A coil spring 388 is mounted on the stud 386 with its arms engaging the bracket 387 and the lever 385 to cause the plunger 381 normally to assume a retracted position. When the lever 385 is swung toward the left, as viewed in Fig. 37, the plunger 381 is actuated to cause its left end to engage the edge of the lowermost seal in the stack and move it through the opening to a position between the jaws of the sealing head.

This feeding movement of the plunger 381 is effected by the approach to the sealing device of the right-hand stretching device 56. The block 270 of this device has secured thereto an upstanding arm 389 having formed on the end thereof a barrel 390 in which there is resiliently mounted a projecting actuating pin 391 having a conical point. The upper face of the barrel is inclined to agree with the inclination of the feeding lever 385 which lies in the path of the actuating pin 391 as the block 270 moves to the final position shown by full lines in Fig. 34. The pin then engages the lever 385 and causes a feeding movement of the plunger 381, thereby projecting a seal from the magazine to a position between the jaws. As the lever 385 reaches the limit of its feeding movement, the tapered and resiliently mounted actuating pin 391 snaps under the lever and moves to a position beyond it as shown in Fig. 34. In this way, the seal feeding device is actuated by the stretching mechanism to move a seal into the sealing head each time that a binder is drawn taut around a package.

The hydraulic pressure mechanism by which the parts of the apparatus heretofore described are operated and controlled, comprises an electric motor 400 mounted in the lower part of the base frame 66 and having its shaft connected by a coupling 401 with two rotary pumps 402 and 403 which have a common shaft and which are connected for withdrawing oil or other suitable liquid from a tank 404 and for returning the oil to that tank after it has passed through the various parts of the apparatus. This apparatus is shown somewhat diagrammatically in Figs. 38 and 45, where the circuit connections are illustrated by single lines, full lines being used to indicate the output connections from the pumps while dotted lines are used to indicate the exhaust or return connections to the tank. The pump 403 may be of larger capacity than the pump 402 and they are adapted to be driven in unison at constant speed by the motor 400 so that the pumps deliver the oil at substantially uniform pressure during the operation of the apparatus. The output of the pump 402 is arranged to be delivered through a pressure regulator 405 and the output of the pump 403

is arranged to be delivered through a pressure regulator 406. These pressure regulators 405 and 406 have return connections 407 and 408, respectively, extending to the tank 404 so that when there is an excessive pressure developed by the pumps, the excess oil will be returned to the tank and substantially constant pressures maintained in the outflow lines from the pressure regulators. The flow of oil or other liquid through the outlet connections leading from the pumps is controlled by the cams 95, 96, 97, 98 and 99 which are shown in Figs. 42, 40, 43, 41 and 44, respectively, in the relative angular positions in which they are fixed on the cam shaft 92.

The table cylinder 85 by which the package 60 is raised and lowered with respect to the sealing apparatus 62 and with respect to the path of the stretching devices 56 and 57, is supplied with liquid under pressure from the pump 402 through the valve 405 which has an output line 409 leading to a sequence valve 410 which effects a further regulation of the pressure of the oil delivered therethrough. A line 411 connects the valve 410 with a pressure regulator 412 which is provided to insure against the development of an excess pressure in the table cylinder which might force the box or package 60 with undue pressure against the bottom plate 336 of the sealing apparatus. The sequence valve 410 has an exhaust connection 414 leading to the exhaust pipe 407 and the pressure regulator 412 has an exhaust connection 414^a leading to the connection 414. From the pressure regulator 412 a line 413 extends to the center connection of a valve 415 which is a plunger operated valve of the well-known "open-center" type, having three ports including a center port which is open to the tank 404 through a pipe line 416; when the plunger 415^a of the valve is in its intermediate or neutral position. The valve plunger carries at its upper end a roller 417 which contacts with the peripheral surface of the cam 98^a mounted on the previously described shaft 92 which is rotated at constant speed by the motor 90 when the clutch 100-102 is closed by the placing of a package against the starting lever 111, shown in Fig. 14.

From the upper port of the valve 415, a pipe line 418 extends to the rear end of the table cylinder 85, and from the lower outlet of the valve 415, a pipe line 419 leads to the forward end of the table cylinder 85. The roller 417 is maintained in engagement with the surface of the cam 98^a by a coil spring mounted in the interior of the valve casing and engaging the valve plunger. This cam 98^a is of the configuration shown in Fig. 41 and its peripheral surface comprises three portions 98^a, 98^b and 98^c which have radii of different lengths. When the roller 417 is in contact with the surface 98^a of the cam, the plunger 415^a is in its neutral position so that a return connection is then established through the pipe 416 to the tank 404. When the roller 417 engages the portion 98^c of lesser radius, the plunger 415^a is forced upwardly by the spring to its extended position to establish a connection between the inlet pipe 413 and the outlet pipe 418 so that oil under pressure is then admitted to the rear end of the table cylinder 85 to cause the elevation of the supporting plate 61 in the manner previously described. As the cam 98^a continues to rotate, in the direction of the arrow 420, shown in Fig. 41, the roller 417 passes into engagement with the portion

98^b of larger radius which forces the plunger 415^a downwardly to its retracted position where a connection is established from the line 413 through the pipe 419 to the upper end of the cylinder 85, thus causing the return of the supporting plate 61 to its lower position, during which movement the oil previously supplied to the rear end of the cylinder 85 is exhausted through the pipe 418 and the pipe 416 to the tank 404. After the package supporting plate 61 has been lowered, the roller 417 passes into engagement with the cam surface 98^a and the center connection of the valve 415 is then connected by the exhaust pipe 416 to the tank.

The fluid motor 240 which operates the measuring device 55 is supplied with oil or other liquid under pressure from the pump 403 through a pipe 424 which leads from the upper end of the pressure regulator 406, as shown in Fig. 45, to the intermediate point of an open-center valve 425 which has a plunger 425^a carrying a roller 426 arranged to contact with the peripheral surface of the cam 96, mounted on the shaft 92 and having the configuration shown in Fig. 40. This valve is similar to the valve 415 and is mounted in contact therewith with its central exhaust port connected through a pipe 427 to the tank 404 so that when the plunger 425^a is in its neutral position the central port of the valve casing is connected to the tank. As the cam 96 rotates in the direction of the arrow 420, the roller 426 moves into engagement with the portion 96^b of the cam which is of greater diameter and the plunger 425^a moves downwardly to establish a connection through the valve casing from the pipe 424 through a pipe 430 to the fluid motor 240 which is then rotated in a forward direction to effect the movement of the measuring device 55 toward the left, as viewed in Figs. 1 and 2, thereby drawing out a length of binder from the source of supply. During this operation, the oil delivered to the pump through the pipe 430 is returned to the tank 404 through an exhaust connection 431. After the transfer of the measured length of binder to the stretching devices and after the gripping thereof by the gripping dogs 265 and 267, the roller 426 moves into engagement with the portion 96^c of the cam 55 which is of lesser radius so that the valve plunger 425^a then moves upwardly to establish a connection from the pipe 424 through the valve 425 to a pipe 432 which leads to the fluid motor 240 and effects a reverse rotation thereof for the purpose of restoring the measuring device 55 to its initial position shown in Fig. 1, during which operation the oil is exhausted from the pump casing through the pipe 431 leading to the tank. When the roller 426 engages the surface 96^a of the cam, the valve plunger is moved to its neutral position, thereby establishing an exhaust connection through the pipe 427 to the tank 404.

The oil or other liquid for operating the transfer cylinder 158 is also supplied from the pump 403 through a pipe 433 which is connected to the previously mentioned pipe 424 leading from the pressure regulator 406. This pipe 433 leads to the central part of the valve 435 which is of the closed-center type, that is, when its plunger 435^a is in its neutral position, the exhaust connection 436 leading from its intermediate or center connection through the pipe 416 to the tank 404 is closed. This valve plunger carries a roller 437 which engages the peripheral surface of the cam 97 mounted on the shaft 92 and, when this cam is rotated in the direction of the arrow 420 shown

in Fig. 43, the roller 437, while in engagement with the portion 97^a of the cam surface which is of intermediate radius holds the valve plunger 435^a in its neutral position wherein the exhaust connection to the tank 404 is closed. This condition continues during a major part of one rotation of the cam whereupon the roller 437 is moved into engagement with the depression 97^c of the cam which has a lesser radius and the plunger 435^a of the valve moves downwardly to its extended position to establish a connection through the valve casing to a pipe 441 which leads to the upper end of the transfer cylinder 158 so that the piston rod 157 is then retracted and the cams 150 are rotated to restore the transfer frame to its forward position. The roller 437 then passes out of engagement with the depression 97^c into contact with the cam surface 97^b which has the largest radius so that the valve plunger 435^a is then forced upwardly to its retracted position, thereby establishing a connection through the valve casing from the pipe 433 to the pipe 440 which leads to the lower end of the cylinder 158. The piston rod 157 is thus actuated to rotate the transfer cams 150 and thereby effect movement of the transfer frame and the bar 135 thereof rearwardly to transfer the measured length of binder 50^b to a position where it may be engaged by the stretching devices 56 and 57. The roller 437 then again engages the surfaces 97^a of the cam having an intermediate radius to allow the valve plunger to move to its neutral position, so that the transfer frame remains in its rearward position until the cam roller 437 again drops into the depression 97^c. During each of the forward and reverse strokes of the piston rod 157, the oil which is admitted to the cylinder 158 during the preceding stroke is exhausted through the other supply connection and the exhaust lines 436 and 416 to the tank 404.

The oil or other fluid under pressure for operating the stretcher cylinder 328 is supplied thereto from the pump 402 through a pipe 442 connected to the previously described pipe 411 leading from the sequence valve 410 and extending to a closed-center valve 445 having a plunger 445^a which carries a roller 447 operated by the cam 99 on the shaft 92. The valve 445 is of a special closed-center type wherein, when the plunger is in neutral position, the central connection leading to the exhaust pipes 448, 414 and 407 is closed. At that time, the upper port 450 is also closed and the lower port 451 is open to the exhaust connection 448. When the cam 99 is rotated in the direction of the arrow 420, the roller 447 moves from the cam surface 99^a of intermediate radius into engagement with the portion 99^b of the cam which is of greatest diameter, as shown in Fig. 44, the valve plunger 445^a is moved upwardly to its extended position, thereby establishing a connection from the supply pipe 442 through a pipe 452, a pressure regulator 453, and a pipe 454 to the right-hand end of the stretcher cylinder 328 for the purpose of effecting a stretching stroke of the piston rod 327 and the cross head 326 which actuate the cable 325 to effect a movement toward each other of the blocks 270 and 290 by which the gripping dogs 266 and 267, respectively, are carried. The pressure regulator 453 is provided so that it may be adjusted to prevent the application of excess pressure during the stretching of the binder and this pressure regulator has an exhaust connection 455 through which the excess liquid is returned to the tank 404. A branch pipe

456 leads from the pipe 454 to a metering cylinder 329 and, during the stretching stroke, a part of the oil or other liquid supplied through the pipe 454 is delivered to the metering cylinder 329 to cause a predetermined movement of its piston toward the left, as viewed in Fig. 45, thus storing a predetermined quantity of oil in this cylinder for subsequent use. The initial position of the piston in this cylinder may be regulated by an adjusting screw 460, mounted in a bracket 459, so that the quantity of oil stored in this metering cylinder at the end of the stretching stroke of the piston in the stretcher cylinder 328 may be varied. The piston in the cylinder 329 will be moved to its right-hand position against the adjusting screw 460 during the succeeding operation of the transfer cylinder 158 to transfer the bar 135 rearwardly, there being a branch connection 461 leading from the pipe 440 to the left-hand end of the cylinder 329 so that, during the operation of moving the transfer frame, heretofore described, a portion of the oil supplied through the pipe 440 is conveyed through the branch pipe 461 to the left end of the cylinder 329. When the measured quantity of oil in the right-hand end of the metering cylinder is thus forced from that cylinder during the operation of the transfer cylinder, it passes to the right end of the stretcher cylinder 328, as hereinafter described, and effects a predetermined movement of the stretching devices toward each other from the positions shown in Fig. 3 to the positions shown in Fig. 4, thereby forming the U-shaped loop. During the process of supplying oil to the right-hand end of the metering cylinder 329 through the pipe 456, the oil which has previously been supplied to the left end of the cylinder 329 is exhausted through the pipes 461 and 440 and through the valve 435 and pipes 436 and 416 to the tank.

Upon further rotation of the cam 99 in the direction of the arrow 420 shown in Fig. 44, the roller 447 passes out of engagement with the surface 99^b and into engagement with a cam surface 99^c, having the same radius as the surface 99^a, thus allowing the valve plunger 445^a to move to its neutral position, at which time the connection of the central port of the valve casing through the pipes 448, 414 and 407 to the tank 404 is blocked and also the exhaust connection through the valve from the pipes 452 and 454. The stretching devices 56 and 57, including the gripping dogs 266 and 267, respectively, are thus held in their inner positions for a short interval during which the sealing apparatus is operated by the cam 95 to unite the ends of the binder.

When the cam 99 is rotated further, the roller 447 is moved from the surface 99^c into engagement with the portion 99^a of the cam which is of smallest diameter, and the plunger 445^a of the valve 445 then occupies its lower extended position, as viewed in Fig. 45, so that a connection is then established between the pipe 442 and a pipe 462 which leads through a one-way check valve 463 to the left end of the stretcher cylinder 328. Under these conditions, oil flows under pressure to the left end of the cylinder 328 and restores the piston rod 327 and the cross head 326 to their retracted positions, thereby separating the blocks 270 and 290, and the stretching devices 56 and 57 of which they form a part, to the positions shown in Fig. 7. At the conclusion of this operation, the roller 447 moves into engagement with the surface 99^a of the cam, thereby causing the valve plunger 445^a to be restored to its neutral position so that the stretching devices 56 and 57 are then

held in their fully separated positions for a substantial interval during which the measured length of binder is moved by the transfer table into engagement with the gripping dogs 266 and 267.

During the feeding of oil through the pipe 440 to the transfer cylinder 158 to effect the transfer of the measured length of binder rearwardly, a part of the oil delivered through the pipe 440 passes through the pipe 461 to the metering cylinder 329, as heretofore explained, thereby discharging from that cylinder the measured quantity of oil which has previously been delivered thereto during the stretching stroke of the plunger 327. This measured quantity of oil discharged from the metering cylinder 329 passes through the pipe 456 and, since the exhaust connection through the port 450 of the valve 445 is then blocked, this oil passes from the pipe 456 to the pipe 454 and thence upwardly into the stretcher cylinder 328, as shown in Fig. 45, thereby moving the piston in that cylinder and the plunger 327 from their fully retracted positions to an intermediate position which is illustrated by dotted lines in Fig. 45. This movement of the plunger 327 takes place after the length of binder 50^b has been gripped by the stretching devices 56 and 57 and cut off from the supply and it is effected for the purpose of moving the stretching devices inwardly toward each other from the positions shown in Fig. 3 to the positions shown by full lines in Fig. 4, thereby forming the U-shaped loop 50^d. The piston rod and the cross head 323 then remain in that position until the next time the roller 447 engages the cam surface 95^b, whereupon the flow of liquid under pressure to the pipes 452 and 454 advances the plunger 327 through the remainder of its stroke, which moves the stretching devices to the final positions shown in Fig. 6. During this stretching stroke of the plunger 327, a part of the oil delivered through the pipe 454 is again passed through the pipe 456 to the metering cylinder 329 in readiness for the next operation of the transfer cylinder 158 which moves the transfer frame rearwardly. The amount of oil which is thus stored in the metering cylinder 329 is regulated by the adjusting screw 460 so that when the oil is later delivered to the stretcher cylinder 328 the stretching devices 56 and 57 will be stopped at the desired point to form a U-shaped loop of the proper size for the package being bound.

After the stretching devices have been moved to the positions shown in Fig. 6 with their ends overlapping, the sealing apparatus is operated by the admission of liquid under pressure to the cylinder 370. This liquid is supplied from the pump 402 through the pressure regulator 405 and the sequence valve 410 to a pipe 464 which leads to the intermediate part of an open-center valve 465. A pipe 466 leads from the exhaust port of this valve to the tank 404. This valve comprises a plunger 465^a carrying a roller 467 which contacts with the peripheral surface of the cam 95, as shown in Fig. 42. During the major portion of the rotation of the cam 95 in the direction of the arrow 420, the roller 467 contacts with the portion 95^a of the cam surface which holds the plunger 465^a in its neutral position during which a connection is established from the central port through the exhaust pipe 466 to the tank. When the roller 467 engages the high part 95^b of the cam 95, the plunger 465^a is elevated to its retracted position so that oil under pressure is then caused to flow from the upper port of the valve through the pipe 469 to the rear end of the sealing cylinder 370, thereby actu-

ating the sealing apparatus to apply a seal to the overlapping binder ends and form an interlocking joint. This action takes place through a comparatively brief interval, at the conclusion of which the roller 467 passes into engagement with the low part 95^c of the cam 95, thereby causing the plunger 465^a of the valve to assume its lower extended position, wherein oil under pressure is caused to flow through the pipe 470 to the lower end of the sealing cylinder 370 which has the effect of retracting the sealing apparatus to the position shown in Fig. 35. The roller 467 then moves again into contact with the portion 95^a of the cam 95 and the valve plunger 465^a is restored to its neutral position.

During the retraction of the sealing apparatus by the reverse movement of the piston rod 368 in the sealing cylinder 370, the stretching devices 56 and 57 are "jogged" slightly away from each other in the manner heretofore described, for the purpose of releasing the gripping dogs 266 and 267 from the binder, and this is effected by the delivery of a part of the oil which is supplied under pressure to the pipe 470 through a branch pipe 471 leading to the jogging cylinder 475 in which is mounted a piston 476. The flow of oil to the left-hand end of the cylinder 475, as shown in Fig. 45, causes the flow of oil from the opposite end of the cylinder through a pipe 477 to the previously mentioned pipe 462 by which oil is supplied to the stretcher cylinder 328 to effect the separation of the stretching devices. Since the one-way check valve 463 prevents the flow of oil backward toward the valve 445 through the pipe 462, the small quantity of oil discharged into the pipe 462 through the pipe 477 is compelled to flow to the head end of the stretcher cylinder 328, thereby effecting a slight reverse movement of the plunger 327 and the corresponding limited separation of the gripping devices 56 and 57 heretofore described. During the subsequent completion of the reverse stroke of the plunger 327 which is caused by the flow of oil through the pipe 462 and the check valve 463 to the head end of the cylinder 328, a part of the oil thus delivered flows through the pipe 477, and a part through a branch pipe 474, into the jogging cylinder 475 and returns the piston 476 to its left-hand position, in readiness for the next jogging operation. The intermediate part of the jogging cylinder 475 has an exhaust connection 478 extending to the exhaust pipe 448, previously described, and it has another exhaust connection 479 extending to the pipe 452 which leads from the upper part of the valve 445 so that oil delivered to the jogging cylinder on one stroke of its piston may be exhausted on the reverse stroke. When oil is forced from the jogging cylinder 475 through the pipe 477 into the stretcher cylinder 328, a part of the oil in the other end of the cylinder 328 is forced out through the pipe 454 and check valve 453 into the pipe 452 and, since the port 450 of the valve 445 is then blocked, this oil flows through the pipe 479 to the jogging cylinder, the piston in which is provided with an annular groove, so that this oil then flows through this groove and through the exhaust pipes 478, 448 and 414 back to the tank 404.

The time relation of the various operations carried out by the apparatus heretofore described may best be understood by reference to Fig. 46 which represents diagrammatically the sequence of operations carried out during the

cycles which are controlled by one complete rotation of the cam shaft 92. As heretofore indicated, there are two cycles of operations going on in the machine which are carried out simultaneously so that the time required for binding a package is greatly reduced, as compared with the former practice. In Fig. 46, the outer circle 480 is divided into a series of sectors N, A, B, C and D which represent successive steps in one cycle which includes the operations of moving the measuring device to engage the binder, actuating that device to measure a predetermined length of binder, moving the transfer frame to its rear position to permit the gripping of the measured binder by the stretching devices 56 and 57, and again moving the transfer frame to its forward position in readiness for a succeeding operation. The other cycle of operations represented by the inner circle 481, shown in Fig. 46, include a series of steps designed *n, a, b, c, d, e, f, g* and *h* which take place during the relative periods of time represented by the segments of the circle designated by these characters.

At the beginning of these cycles, which are indicated as beginning at the vertical radius 482 at the tops of the circles, all of the valves 415, 425, 435, 445 and 465 are in neutral positions for intervals which are indicated by the sectors N and *n*, and the corresponding cams 96, 98, 95, 97 and 99, respectively, are stationary, the clutch members 100 and 102 being then declutched by the operation of the trip lever 107. Upon placing a package 60 on the supporting plate 61 of the machine and pushing it rearwardly through a loop 50^a formed by a preceding operation of the machine, the package engages the starting lever 111 which elevates the trip lever 107 and causes the clutch members to engage so that the shaft 92 and all of the cams mounted thereon begin to rotate, thus initiating the two cycles previously referred to. As the shaft 92 rotates, the cam 96 operates the valve 425 to move its plunger 425^a to its retracted position, thereby actuating the fluid motor 240 to move the measuring device 55 toward the right, as viewed in Fig. 1, until it engages the shearing device 54 and moves it a limited distance against the compression of the spring 194 to allow the measuring device to engage and grip the free end of the binder, the lever 223 being operated by engagement with the surface 187^a, shown in Fig. 21, to cause the gripping dog 222 to grip the binder when the measuring device has reached the limit of this movement. During this travel of the measuring device 55, which constitutes operation A of the cycle represented by the circle 480, the plunger of the valve 425 is in its retracted position and the plunger of the valve 435 which actuates the transfer cylinder is in its neutral position so that the transfer frame is stationary in its forward position.

At the conclusion of this operation A, the cam 98 actuates the valve 425 to cause a reverse rotation of the motor 240 so that the measuring device 55 is then moved toward the left to the position shown in Fig. 2, during which time the plunger of the valve 425 is in its extended position and the plunger of the valve 435, which operates the transfer frame, continues in its neutral position so that the transfer frame continues to occupy its forward position. Each of the operations A and B occupies a considerable portion of the complete cycle, each of the sectors A and B,

in the example illustrated, occupying about 131 degrees of the complete circle.

Upon the completion of the operation of drawing out the binder by the movement of the measuring device 55 toward the left, as viewed in Fig. 2, the valve 435 for controlling the transfer cylinder 153 is actuated by the cam 97 to move its plunger to its extended position, thereby actuating the piston in the transfer cylinder to rotate the cams 150 and effect the rearward movement of the transfer frame and the binder and the transfer frame then occupies its rearward position with the measured length of binder in position to be engaged by the stretching devices. During this operation, the plunger of the valve 425 is held by its spring in its extended position against the surface 96^a of the cam 96 so that the fluid pressure applied to the measuring motor 240 maintains the measuring device 55 against the stop 243 and holds the binder 50^b taut during its transfer rearwardly. In the example represented by Fig. 46, the operation of moving the transfer frame rearwardly takes place during a period which represents only 6 degrees on the outer circle 480.

During the next step of the cycle represented by the outer circle 480 which is operation D, the roller 426 still engages the portion 96^c of the cam 96 so that the plunger of the valve 425 continues to be held in its extended position with the measuring device 55 held by the motor 240 fully separated from the holding device 53, and during this period the surface 97^a of the cam 97 operates the valve 435 to move its plunger to its retracted position, which causes the transfer frame to be returned by the transfer cylinder 153 to its forward position. At the conclusion of this period of the cycle, the rollers of these cams engage the surfaces 96^c and 97^a, so that the plungers of both valves 415 and 435 are returned to their neutral positions at the commencement of the idle period N.

While the operations A, B, C and D are taking place, another series of operations occur in the other cycle which is represented by the inner circle 481 in Fig. 46. Upon the engagement of the package with the starting lever 111, shown in Fig. 14, at the end of the idle period *n*, which occupies 5 degrees of the circle, the rotation of the shaft 92 moves all of the cams on that shaft out of their neutral positions and the first operation which then takes place in the cycle represented by the circle 481 is that of elevating the table to raise the package to its operative position with respect to the sealing apparatus. This operation is initiated by the cam 98 which allows movement of the plunger of the valve 415 to its extended position, thereby admitting oil under pressure to the cylinder 85 with the result that the supporting plate 61 is swung upwardly and rearwardly to move the package to the sealing position. During this operation *a*, which is indicated as occupying 20 degrees of the circle 481, the plungers of the valves 445 and 465 are in their neutral positions with their rollers engaging the portions 99^a and 95^a of the cams 99 and 95, respectively.

The second operation *b* of the cycle represented by the inner circle 481 then takes place during a period represented by an arc of 91 degrees on the circle. During this operation, the plunger of the valve 415 which operates the table cylinder 85 remains in its extended position, thus maintaining the supporting plate 61 elevated, and the plunger of the valve 465 which operates the seal-

ing apparatus remains in its neutral position, but the plunger of the valve 445 which controls the operation of the stretcher cylinder 328 is actuated by the surface 99^b of the cam 99 to move the plunger to its retracted position, so that fluid is admitted under pressure from the valve 445 through the pipes 442 and 454, at a rate controlled by the pressure regulator 453, to the cylinder 328, thereby effecting the stretching stroke of the piston rod 327 which moves the stretching devices from the position shown in Fig. 5 to the position shown in Fig. 6. It will be understood that prior to the commencement of this operation *b*, and during operation *D* of a previous cycle, the stretching devices 56 and 57 will have been moved to the positions shown in Figs. 4 and 5 by the admission of fluid from the metering cylinder 329 to the stretcher cylinder 328 at the time when the piston of the transfer cylinder 158 is operated to effect the return in a forward direction of the transfer table.

At the conclusion of this stretching operation *b*, operation *c* of the cycle represented by the inner circle 481 occurs. At this time, the plunger of the valve 415 is maintained in its extended position by the cam 98, thus continuing the elevation of the package on the supporting table 61, and the cam 99 continues to hold the plunger of the valve 445 in its retracted position, thus maintaining the stretching devices 56 and 57 in the positions shown in Fig. 6 where the ends of the binder are overlapped, but the plunger of the valve 465 which controls the sealing cylinder 370 is operated by the surface 95^b of the cam 95 to move it to its retracted position, so that the sealing apparatus is then operated to apply a seal to the overlapping binder ends and form an interlocking joint. It will be observed that this period of the cycle is represented as occupying 35 degrees of the complete circle 481 and that this sealing operation is taking place at the conclusion of and slightly beyond the termination of operation *A* during which the measuring device 55 is being moved to the right for engagement with the end of another binder.

The operation *c* is followed by the operations represented at *d* on the circle 481 during which the sealing apparatus is returned to its upper position and the jogging cylinder 475 is actuated to effect the release of the stretching dogs from the binder which has just been sealed. During this time, the plunger of the valve 415 which controls the elevation of the table is still maintained by its spring in its extended position against the surface 98^c of the cam 98, but the plunger of the valve 465 which controls the sealing apparatus 370 is then moved by its spring to its extended position against the surface 95^c of the cam 95 so that oil under pressure is then admitted by the valve 465 to the cylinder 370 to return the sealing apparatus to its upper position. During this period of the cycle, a portion of the oil discharged through the pipe 470 passes through the pipe 471 to the jogging cylinder 475, thereby operating its piston 476 to force a small quantity of oil under pressure into the head end of the stretcher cylinder 328, thereby slightly separating the stretching devices 56 and 57 and causing the detents 283 and 303 to release the sealed binder from the gripping dogs 266 and 267 of the stretching devices. During this period *d*, the plunger of the valve 445 which controls the stretcher cylinder is maintained in its neutral position by the cam 99, the roller 447 being then in contact with the surface 99^a there-

of. This operation of restoring the sealing apparatus and releasing the binder from the stretching dogs takes place during an arc represented as 17 degrees of the circle 481.

Upon the conclusion of the operations just mentioned, the operation indicated at *e* on the circle 481 takes place, thereby returning the supporting plate 61 to its lower position and discharging the package from its engagement with the stretching devices 56 and 57. This operation takes place during a period represented as 9 degrees on the circle and, at this time, the shaft 92 rotates the cam 98 to cause the roller 417 to engage the portion 98^b of the cam surface so that the plunger of the valve 415 is pushed to its retracted position and oil under pressure is admitted to the cylinder 35 to move the supporting plate 61 to its lower position. At this time, the valves 445 and 465 are held in their neutral positions by their respective cams 99 and 95.

Upon the lowering of the supporting plate 61 of the table, the clutch members 100 and 102 are not immediately disengaged because this disengagement does not occur until the tooth 107^a of the trip lever 107 withdraws the clutch pin 101 upon the completion of a complete revolution of the shaft 92. The shaft therefore continues to rotate and causes the next succeeding operation *f*, indicated on the circle 481, to take place with the result that the stretching devices 56 and 57 are spread apart and restored to the relative positions shown in Fig. 7. At this time, the plunger of the valve 415 is maintained in its retracted position by the surface 98^b of the cam 98 and the plunger of the valve 465 is maintained in its neutral position by the surface 95^a of the cam 95, but the plunger of the valve 445 is permitted by the surface 99^c of the cam 99 to be moved by its spring to its extended position which causes oil under pressure to flow from the valve 445 through the pipe 462 and the one-way check valve 463 to the head end of the stretcher cylinder 328, thereby causing a complete reverse stroke of the piston in that cylinder with a resulting complete separation of the stretching devices 56 and 57. The period during which this operation *f* takes place is represented as occupying a segment of 90 degrees on the circle 481.

Following the restoration of the stretching devices to their initial separated positions the plungers of all of the valves 415, 445 and 465 are moved to their neutral positions by the cams 98, 99 and 95, respectively, so that the table remains lowered and the sealing and stretching apparatus remain idle during the period *g* which is of the same duration as the period *C* during which the transfer table is being moved rearwardly to position the measured length of binder for engagement by the stretching devices.

This period of idleness, during which the transfer takes place, is followed by operation *h*, indicated in Fig. 46 as occupying a segment of 92 degrees on the circle 481. During this period, the plungers of the valves 415, 465 and 445 continue in their neutral positions, as they were during the period *g*, and it is during this time that the piston of the stretcher cylinder 328 is operated by fluid admitted thereto from the metering cylinder 329 for causing a pressure stroke of the piston rod 327 and the cross head 326, thereby moving the stretching devices 56 and 57 inwardly to the positions, shown by full lines in Fig. 4, to form the U-shaped loop 59^d. During the time that this

operation *h* is taking place, thereby forming a loop in readiness for the commencement of a new cycle of operations represented by the circle 431, the transfer table is being restored to its forward position by operation D of the cycle represented by the outer circle 430. At the conclusion of these operations D and *h*, all of the other plungers are again in their neutral positions, as represented by the segments N and *n* of the circles 430 and 431, and the clutch members 100 and 102 are then disengaged by the trip lever 107 so that a period of idleness ensues while another package is being placed on the supporting plate 61 to start new cycles of operation represented by the two circles 430 and 431.

It will thus be apparent that two cycles of operations are being carried on simultaneously and continuously except for the intervening neutral periods N and *n* and that, while one measured length of binder is being engaged by the measuring device, drawn out from the source of supply, transferred rearwardly by the rearward movement of the transfer table, followed by the forward movement of this transfer table, a second cycle of operations is going on with respect to another predetermined length of binder which has been measured and transferred to the stretching devices 56 and 57 by a preceding operation of the steps of the first cycle. During this second cycle of operations, the measured length of binder, which is cut off from a source of supply at the conclusion of operation C, is applied to the package by a series of operations which consist in elevating the supporting plate of the table, drawing the strap taut around the package, sealing its overlapping ends, returning the sealing apparatus to its normal position, and actuating the stretching dogs to release them from the binder, restoring the supporting plate of the table to its lower position, separating the gripping dogs for engagement with the binder transferred thereto by the transfer table, and then moving the gripping devices inwardly to a sufficient extent to form a U-shaped loop. As shown in Fig. 46, the separation of the stretching devices 56 and 57, constituting operation *f*, is completed prior to the idle period *g* during which operation C takes place for transferring the measured length of binder rearwardly into position to be engaged by the stretching devices, so that ample time is allowed for the gripping of the binder by the stretching devices prior to the relative inward movement of the two stretching devices which is effected at the time of the movement of the transfer table to its forward position, by the operation of the metering cylinder 329.

The practice of the improved method of binding and the operation of the apparatus herein described, as set forth above, may be varied by effecting the various adjustments which have been referred to in connection with the foregoing description of the construction of the apparatus in order to adapt the invention to the binding of various sizes and shapes of boxes or packages. Although the invention has been described in connection with the binding of boxes or packages with flat metal strapping, it is apparent that other binding materials, including round wire, paper and flexible plastic binders, may be used. It will be understood that both the method and the apparatus may be modified in various ways without departing from the scope of the appended claims. Where the term "loop" is used in the claims, it is to be interpreted, unless otherwise limited or defined, as including within its scope

portions of binder which only partially surround or encircle the box or package at the time when the box or package is passed into engagement therewith.

I claim:

1. The method of binding a package with a flexible binder, which comprises the steps of drawing out a length of said binder from a source of supply, cutting off said length of binder, moving the ends of said length toward each other with the intermediate part of the binder unsupported to cause said length of binder to form a loop by gravity, passing a package into said loop, then effecting further relative movement of said ends toward each other to draw said binder taut around the package with its ends overlapping, and then securing said overlapping ends together.

2. The method of binding a package with a flexible binder, which comprises the steps of providing a predetermined length of flexible binder, holding the ends of said binder and effecting relative movement of said ends toward each other to cause the intermediate portion of the binder to be deflected from the line of travel of its ends to form a loop, passing a package into said loop, then effecting further relative movement of said ends toward each other to draw said binder taut around the package, and then securing the ends of said binder together.

3. The method of binding a package with a flexible binder, which comprises the steps of providing a predetermined length of flexible binder, holding the ends of said binder and moving said ends toward each other to cause the intermediate portion of said binder to descend by gravity and form a suspended loop, passing a package into said loop, contracting said loop and drawing said binder taut around said package, and securing the ends of said binder together.

4. The method of binding a package with a flexible binder, which comprises the steps of providing a predetermined length of flexible binder, holding said binder near its ends and effecting relative movement of said ends toward each other to cause the intermediate portion of said binder to descend by gravity and form a suspended U-shaped loop, passing a package into said loop, moving said ends toward each other over the top of said package to draw the binder taut around the package with its ends overlapping, and securing said overlapping ends together.

5. The method of binding a package with flexible binder which comprises the steps of drawing out a measured length of binder from a source of supply, cutting off said length of binder, moving the ends of said length toward each other to cause the intermediate portion of said binder to descend by gravity and form a U-shaped loop, passing a package into said loop, effecting movement of said ends over the top of the package to draw said length of binder taut around the package, and uniting the ends of said length of binder.

6. The method of binding a package with a flexible binder, which comprises the steps of drawing out a measured length of binder from a source of supply, gripping the end portions of said length of binder, cutting off said length of binder from said source of supply, moving said end portions toward each other to form a loop transversely to the plane of said loop, moving a package supported only at its ends into said loop, and drawing said loop taut around said package.

7. The method of binding packages with flexible binders, which comprises the steps of draw-

ing out a measured length of flexible binder along a predetermined path from a source of supply, effecting a lateral transfer of said measured length of binder and then gripping the end portions of said length, moving said gripped end portions toward each other to cause the intermediate portion of said length of binder to form a loop, passing a package into said loop, drawing said loop taut around the package, and drawing out another length of binder from said source along said path after said transfer has been made and for use in binding another package.

8. The method of binding packages with flexible binders, which comprises the steps of drawing out a measured length of flexible binder from a source of supply, effecting a lateral transfer of said measured length of binder and then gripping the end portions of said length, moving said gripped end portions toward each other to cause the intermediate portion of said length of binder to form a loop, passing a package into said loop, drawing said loop taut around the package, and drawing out another measured length of binder from said source while said first-mentioned length is being formed into a loop and applied to said package, said other length of binder being for use in binding another package.

9. The method of binding a package with a flexible binder, which comprises the steps of providing a predetermined length of flexible binder, supporting said binder only at its ends and effecting relative movement of said ends toward each other to form a loop, passing a package laterally of said loop into said loop, moving the package within said loop to sealing position, moving said ends further toward each other to draw said binder taut around said package, and sealing the ends of said binder.

10. The method of binding a package with a flexible binder, which comprises the steps of providing a predetermined length of flexible binder, supporting said binder only at its ends and effecting relative movement of said ends toward each other to form a loop, passing a package into said loop, moving the package within said loop to sealing position, moving said ends further toward each other to draw said binder taut around said package, sealing the ends of said binder, and then moving the bound package from said sealing position.

11. The method of binding a package with a flexible binder, which comprises the steps of providing a measured length of flexible binder, holding said length of binder near its ends by gripping devices, moving said gripping devices toward each other until the intermediate portion of said length of binder descends by gravity and forms a suspended loop, passing a package into said loop, then inverting said gripping devices and moving them over the top of said package until said length of binder is drawn taut about said package with its ends overlapping between said gripping devices, and then uniting said overlapping ends.

12. The method of binding a package with a flexible binder, which comprises the steps of providing a measured length of flexible binder, holding said binder by gripping devices positioned near its ends with said ends projecting in opposite directions from said gripping devices, moving said gripping devices toward each other along linear paths to cause the intermediate portion of said binder to form a loop, passing a package into said loop, then continuing the movement of said gripping devices toward each other and inverting them by engagement with

said package to draw the binder taut around said package with its ends overlapping between said gripping devices, and then uniting said overlapping ends.

13. The method of binding a package with a flexible binder, which comprises the steps of providing a measured length of flexible binder, holding said binder by gripping devices positioned near its ends with said ends projecting in opposite directions from said gripping devices, moving said gripping devices toward each other along linear paths to cause the intermediate portion of said binder to form a loop, passing a package into said loop, then rotating said gripping devices about their own axes to invert them and cause said ends to project toward each other and moving said gripping devices toward each other until said binder is drawn taut about said package and said ends overlap above said package, and then securing said overlapping ends together.

14. The method of binding a package with a flexible binder, which comprises the steps of providing a measured length of flexible binder, holding said binder by gripping devices positioned near its ends with said ends projecting away from each other, moving said gripping devices toward each other along linear paths to cause the intermediate portion of said binder to form a suspended U-shaped loop, moving a package into said loop, raising said package to a sealing position, then moving said gripping devices further toward each other along linear paths to cause them to be inverted by engagement with the lateral portions of the package and thereby direct said ends of the binder toward each other and continuing said relative movement of said gripping devices until said binder is drawn taut around said package with said ends overlapping, and then sealing said overlapping ends.

15. Apparatus for binding a package with a flexible binder comprising, means for measuring a length of binder drawn from a supply, means for gripping the end portions of said length, means for cutting off said length of binder from said supply, means for effecting relative movement of said gripping means toward each other along a linear path to cause the intermediate portion of said length of binder to form a loop, means for supporting a package passed into said loop, said means for actuating said gripping means being capable of further actuation to draw said length of binder taut around said package, and means for uniting the ends of said binder.

16. Apparatus for binding a package with a flexible binder comprising, means for measuring a length of binder drawn from a supply, means for gripping the end portions of said length, means for cutting off said length of binder from said supply, means for effecting relative movement of said gripping means toward each other along a linear path to cause the intermediate portion of said length of binder to form a loop, means for supporting a package passed into said loop, means for further actuating said gripping means to draw said length of binder taut around said package with its ends overlapping, and means for sealing the overlapping ends of said binder.

17. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other

until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means for further actuating said moving means and turning said gripping devices to direct the ends of said binder toward each other and thereby drawing said binder taut around the package with its ends overlapping, and means for uniting said overlapping ends.

18. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means for then further actuating said moving means to move said gripping devices further toward each other to cause said gripping devices to engage said package and thereby turn about their own axes and reverse their positions to direct said ends toward each other and then continue the relative movement of said gripping devices to positions wherein said ends overlap, and means for uniting said overlapping ends.

19. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means for then further actuating said moving means to move said gripping devices further toward each other to cause said gripping devices to engage said package and thereby turn about their own axes and reverse their positions to direct said ends toward each other and then continue the relative movement of said gripping devices to positions wherein said ends overlap, means additional to said package for insuring said turning of said gripping devices as they approach each other, and means for uniting said overlapping ends.

20. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means actuated by the placing of a package in said loop for elevating said supporting means until the upper surface of said package is in the path of movement of said gripping devices and for causing further relative movement of said gripping devices whereby said gripping devices are turned by engagement with said package and then moved over the upper surface of said package with said binder ends directed toward each other until the binder is drawn taut around the package with its ends overlapping, and means for uniting said overlapping ends.

21. Apparatus for binding a package with a flexible binder comprising, means for providing a predetermined length of said binder, gripping means for engaging the end portions of said length of binder, means for moving said gripping means toward each other to cause the intermediate portion of said length of binder to form

a loop, means for supporting a package passed into said loop, said moving means being capable of further actuation to draw said length of binder taut around said package, sealing means for uniting the ends of said binder, and means for moving said supporting means to place said package in operative relation to said sealing means.

22. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means for further actuating said moving means and turning said gripping devices to direct the ends of said binder toward each other and thereby drawing said binder taut around the package with its ends overlapping, sealing means for uniting the ends of said binder, and means actuated by the placing of said package on said supporting means within said loop for raising said supporting means to place said package in operative relation to said sealing means.

23. Apparatus for binding a package with a flexible binder comprising, gripping devices for holding a length of binder near its ends with said ends directed away from each other, means for moving said gripping devices toward each other until the intermediate portion of said binder descends by gravity and forms a suspended U-shaped loop, means for supporting a package passed into said loop, means for further actuating said moving means and turning said gripping devices to direct the ends of said binder toward each other and thereby drawing said binder taut around the package with its ends overlapping, sealing means for uniting the ends of said binder, means actuated by the movement of said package onto said supporting means for moving said supporting means to place said package in operative relation to said sealing means, and means actuated when said sealing means has been operated for moving said supporting means to move said package away from said sealing means.

24. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a holding device mounted on said bar for holding a binder extending from a source of supply, a measuring device slidably mounted on said bar and having means for gripping the end of said binder, an endless driving member connected to said measuring device, and means including a motor for actuating said driving member to move said measuring device and thereby drawing out a length of binder through said holding device.

25. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a holding device mounted on said bar for holding a binder extending from a source of supply, a measuring device slidably mounted on said bar and having means for gripping the end of said binder, an endless driving member connected to said measuring device, a fluid pressure motor for actuating said driving member, and a cam for controlling the operation of said motor.

26. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a holding device for holding a binder extending from a source of supply, a measuring device slidably mounted on said bar and including a spring actuated gripping dog adapted to be tripped to a gripping position, power operated means for

moving said measuring device on said bar toward and from said holding device, and means for tripping said dog to grip said binder when said measuring device is in proximity to said holding device.

27. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a holding device for holding a binder extending from a source of supply, a measuring device slidably mounted on said bar and including a spring actuated gripping dog adapted to be tripped to a gripping position, means for moving said measuring device on said bar toward and from said holding device, a lever adapted to trip said dog to its retracted position when said measuring device has been moved to a predetermined extent away from said holding device, cam actuated means for operating said lever, fluid pressure operated means for actuating said cam actuated means, and means including cams for controlling the time relation of the operation of said moving means and said cam actuated means.

28. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device toward and away from said holding device and said shearing device, said shearing device being movable with said measuring device from its normal position at the end of the movement of said measuring device toward said holding device to cause the end of said binder to project through said shearing device for engagement by said measuring device.

29. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device toward and away from said holding device and said shearing device, said shearing device being movable with said measuring device from its normal position at the end of the movement of said measuring device toward said holding device to cause the end of said binder to project through said shearing device for engagement by said measuring device, and resilient means for returning said shearing device to its normal position upon movement of said measuring device away from said holding device.

30. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device toward and away from said holding device and said shearing device, said shearing device being movable with said measuring device from its normal position at the end of the movement of said measuring device toward said holding device to cause the end of said binder to project through said shearing device for engagement by said measuring device, resilient means for returning said shearing device to its normal position upon movement of said measuring device away from

said holding device, and means for adjusting the normal position of said shearing device to vary the point on said binder at which said binder is gripped by said measuring device after said shearing device has been moved by said measuring device.

31. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a supporting bar, a holding device secured on said bar and having means for engaging said binder leading from said supply, a shearing device slidably mounted on said bar and occupying normally a position spaced from said holding device, means for adjusting the normal spaced relation of said holding device and said shearing device on said bar, and a spring for maintaining said shearing device normally in said position spaced from said holding device.

32. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a supporting bar, a holding device secured on said bar and having means for engaging said binder leading from said supply, a shearing device slidably mounted on said bar and occupying normally a position spaced from said holding device, means for adjusting the normal spaced relation of said holding device and said shearing device on said bar, a spring for maintaining said shearing device normally in said position spaced from said holding device, a measuring device slidably mounted on said bar and having means for gripping the end of said binder after it has passed through said holding device and said shearing device, and means for moving said measuring device toward and from said holding device on said bar, said measuring device being adapted to move said shearing device toward said holding device to cause the end portion of said binder to project through said shearing device and having means for gripping said end portion which is so projected.

33. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device a predetermined distance to draw out a measured length of binder from said supply through said holding device and said shearing device, means for gripping the end portions of said length, and means for then actuating said shearing device to cut off said length from the source of supply.

34. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device a predetermined distance to draw out a measured length of binder from said supply through said holding device and said shearing device, a pair of stretching devices having means for gripping the end portions of said length of binder, and means for automatically actuating said stretching devices to grip said length of binder and then actuating said shearing device to cut off said length from said source of supply.

35. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for en-

gaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device a predetermined distance to draw out a measured length of binder from said supply through said holding device and said shearing device, a pair of stretching devices having means for gripping the end portions of said length of binder, and cam operated means for actuating said stretching devices to grip said length of binder and then actuating said shearing device to cut off said length of binder from said source of supply.

36. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a shearing device for cutting off the binder after it has passed through said holding device, a measuring device for gripping the end portion of said binder, means for moving said measuring device a predetermined distance to draw out a measured length of binder from said supply through said holding device and said shearing device, a pair of stretching devices having means for gripping the end portions of said length of binder, cam operated means for actuating said stretching devices to grip said length of binder and then actuating said shearing device to cut off said length of binder from said source of supply, and fluid pressure means for actuating said cam operated means.

37. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a measuring device for gripping the end portion of said binder, means for moving said measuring device a predetermined distance to draw out a measured length of binder from said supply, a pair of stretching devices having gripping dogs for gripping the end portions of said length of binder, and means for automatically actuating said gripping dogs to grip the end portions of said length of binder after it has been drawn from said source of supply.

38. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a supporting bar, a holding device secured on said bar and having means for engaging said binder leading from said supply, a measuring device slidably mounted on said bar and having means for gripping the end portion of the binder held by said holding device, means for moving said measuring device away from said holding device to draw out a length of binder gripped thereby through said holding device, a pair of stretching devices having means for gripping said length of binder drawn out by said measuring device, and means for moving said bar to transfer said length of binder held by said holding device and said measuring device to a position wherein it may be gripped by said stretching devices.

39. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a supporting bar, a holding device adjustably secured on said bar and having means for engaging said binder leading from said supply, a shearing device mounted on said bar and adapted to receive the binder passed through said holding device, a measuring device slidably mounted on said bar and having means for gripping the end portion of the binder in said shearing device, means for moving said

measuring device away from said holding device to draw out a length of binder gripped thereby through said holding device and said shearing device, a pair of stretching devices having means for gripping said length of binder drawn out by said measuring device, means for moving said measuring device and said holding device with said shearing device to a position which permits said length of binder to be gripped by said stretching devices, and means for then actuating said stretching devices to grip said length of binder and thereafter actuating said shearing device to sever said length of binder from said source of supply.

40. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a measuring device having means for gripping the end of said binder and movable along a linear path away from said holding device for drawing out a length of binder from said supply through said holding device, a pair of stretching devices mounted for relative movement along a linear path extending parallel to the path of movement of said measuring device and having means for gripping a binder, and means for moving said holding device and said measuring device to transfer said length of binder to a position wherein it may be gripped by said stretching devices.

41. Apparatus for binding a package with a flexible binder comprising, means for supporting a supply of said binder, a holding device for engaging said binder leading from said supply, a measuring device having means for gripping the end of said binder and movable along a linear path away from said holding device for drawing out a length of binder from said supply through said holding device, a pair of stretching devices mounted for relative movement along a linear path extending parallel to the path of movement of said measuring device and having means for gripping a binder, means for moving said holding device and said measuring device to transfer said length of binder to a position wherein it may be gripped by said stretching devices, means for actuating said stretching devices to cause them to grip said length of binder, and means for then effecting relative movement of said stretching devices.

42. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame movable on said supporting frame, stretching devices carried by said supporting frame, measuring means carried by said transfer frame for drawing out a length of binder from a source of supply, and means for moving said transfer frame to transfer said length of binder to a position where it may be engaged by said stretching devices.

43. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame movable on said supporting frame, stretching devices carried by said supporting frame, measuring means carried by said transfer frame for drawing out a length of binder from a source of supply, means for moving said transfer frame to transfer said length of binder to a position where it may be engaged by said stretching devices, and means for effecting relative movement of said stretching devices on said supporting frame to form a package receiving loop and then to draw the looped binder taut around a package.

44. Apparatus for binding a package with a

flexible binder comprising: a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, and means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position wherein said length of binder may be engaged by said stretching devices.

45. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position wherein said length of binder may be engaged by said stretching devices, means for then causing said stretching devices to grip said length of binder, and means for thereafter operating said shearing device to sever said length of binder from said supply.

46. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices having gripping dogs adapted to grip said binder, means for shifting said transfer frame on said supporting frame to transfer said length of binder to said stretching devices, and means for then automatically causing said gripping dogs to grip said length of binder.

47. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from

said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices having gripping dogs adapted to grip said binder, cam actuated means for shifting said transfer frame on said supporting frame to transfer said length of binder to said stretching devices, and cam actuated means operative when said transfer frame has been so shifted for causing said gripping dogs to grip said binder and then effecting the operation of said shearing device to sever said length of binder from said supply.

48. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices having gripping dogs adapted to grip said binder, a cam shaft, cam means actuated by said shaft for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, cam means operated by said cam shaft and operative when said transfer has been effected for causing said gripping dogs to grip said length of binder and then operating said shearing device to sever said binder from said supply, and means for rotating said cam shaft.

49. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices having gripping dogs adapted to grip said binder, a cam shaft, cam means actuated by said shaft for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, cam means operated by said cam shaft and operative when said transfer has been effected for causing said gripping dogs to grip said length of binder and then operating said shearing device to sever said binder from said supply, and fluid pressure operated means for actuating said cam shaft.

50. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source

of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, tripping means for operating said gripping dogs to grip said length of binder and for actuating said measuring device to release said length of binder, and means operative when said transfer frame has been so shifted for effecting the operation of said tripping means.

51. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position wherein said length of binder may be engaged by said stretching devices, means for then causing said gripping dogs to grip said length of binder, and means for thereafter releasing said length of binder from said measuring device and causing said shearing device to sever said length of binder from said supply.

52. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, and means operative when said transfer frame has been so shifted for tripping said gripping dogs to cause them to grip said length of binder and for releasing said length of binder from said gripping means of said measuring device.

53. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame,

a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, means operative when said transfer frame has been so shifted for tripping said gripping dogs to cause them to grip said length of binder and for releasing said length of binder from said gripping means of said measuring device, and means operative after said length of binder has been gripped by said gripping dogs for actuating said shearing device to sever said binder from said supply.

54. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions and to retracted positions, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, means operative when said transfer frame has been so shifted to trip said gripping dogs to their gripping positions and to release said length of binder from said gripping means of said measuring device, and means for then moving said stretching devices toward each other to form a suspended loop.

55. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions and to retracted positions, means for shifting said transfer frame on said supporting frame to transfer said length of

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binder to a position lying in said path of movement of said stretching devices, means operative when said transfer frame has been so shifted to trip said gripping dogs to their gripping positions and to release said length of binder from said gripping means of said measuring device, means for then moving said stretching devices toward each other to form a suspended loop, and means operative when a package has been inserted into said loop for effecting further movement of said stretching devices toward each other for drawing said length of binder taut around the package.

56. Apparatus for binding a package with a flexible binder comprising, a supporting frame, a transfer frame mounted on said supporting frame, a holding device on said transfer frame for holding a binder extending from a source of supply, a measuring device having means for gripping the end of said binder and mounted for movement longitudinally of said transfer frame, a shearing device mounted on said transfer frame in position to engage the binder passing from said holding device, means for moving said measuring device to draw out a length of binder from said supply through said holding device, stretching devices mounted for movement on said supporting frame parallel to the path of movement of said measuring device, said stretching devices comprising spring actuated gripping dogs adapted to be tripped to gripping positions and to retracted positions, means for shifting said transfer frame on said supporting frame to transfer said length of binder to a position lying in said path of movement of said stretching devices, means operative when said transfer frame has been so shifted to trip said gripping dogs to their gripping positions and to release said length of binder from said gripping means of said measuring device, means for then moving said stretching devices toward each other to form a suspended loop, means operative when a package has been inserted into said loop for effecting further movement of said stretching devices toward each other for drawing said length of binder taut around the package, means operative when said binder has been drawn taut for uniting the ends thereof, and means operative when said ends have been so united for tripping said gripping dogs to their retracted positions.

57. Apparatus for binding a package with a flexible binder comprising, a supporting bar, stretching devices slidably mounted for relative movement on said bar, actuating mechanism including an endless cable connected to said stretching devices for effecting simultaneous movement of said devices in either direction toward and from each other, and means for effecting movement of said cable.

58. Apparatus for binding a package with a flexible binder comprising, a supporting bar, stretching devices slidably mounted for relative movement on said bar, actuating mechanism including an endless cable connected to said stretching devices for effecting relative movement of said devices, fluid pressure operated means for effecting the movement of said cable in either direction, and cam actuated means for controlling the operation of said fluid pressure means.

59. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices slidably mounted on said bar for relative movement in either direction, each stretching device comprising a gripping flange and an opposed gripping dog, said gripping

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flanges and gripping dogs being rotatable on the remaining portions of said stretching devices, means operative when said stretching devices are separated from each other for rotating said gripping flanges and gripping dogs to permit the gripping of a length of binder with the binder ends projecting from said stretching devices away from each other, means operative as said stretching devices are moved toward each other on said bar for rotating said gripping flanges and gripping dogs to right-angular positions which permit a length of binder held thereby to form a suspended U-shaped loop, and means operative when said stretching devices are moved further toward each other from said last-named positions for effecting further rotation of said gripping flanges and gripping dogs to cause the ends of said binder to project toward each other and to be overlapped when said stretching devices reach the limits of their movement.

60. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, and means actuated as said stretching devices approach the limit of their separation for rotating said parts of said devices to positions adapted to grip a length of binder with its ends extending away from each other, and means for then actuating said gripping parts to cause them to grip said binder.

61. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, and means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other.

62. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, and means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other, said last-named means being operative upon reverse relative movement of said stretching devices for reversely rotating said gripping parts to permit the binder extending between said stretching devices to form a U-shaped loop.

63. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other, said last-named means being operative upon reverse relative movement

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of said stretching devices for reversely rotating said gripping parts to permit the binder extending between said stretching devices to form a U-shaped loop, means for supporting a package inserted into said loop, and means operative by the engagement of said rotatable parts of said stretching devices with said package upon further movement of said stretching devices toward each other for further rotating said rotatable parts of said stretching devices to cause the ends of said binder to project toward each other.

64. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other, said last-named means being operative upon reverse relative movement of said stretching devices for reversely rotating said gripping parts to permit the binder extending between said stretching devices to form a U-shaped loop, means for supporting a package inserted into said loop, means operative by the engagement of said rotatable parts of said stretching devices with said package upon further movement of said stretching devices toward each other for further rotating said rotatable parts of said stretching devices to cause the ends of said binder to project toward each other, and means operative as said stretching devices approach the limit of their movement toward each other for insuring the completion of said last-mentioned rotation of said gripping parts to a position where said ends of said binder are overlapped.

65. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other, said last-named means being operative upon reverse relative movement of said stretching devices for reversely rotating said gripping parts to permit the binder extending between said stretching devices to form a U-shaped loop, means for supporting a package inserted into said loop, means operative by the engagement of said rotatable parts of said stretching devices with said package upon further movement of said stretching devices toward each other for further rotating said rotatable parts of said stretching devices to cause the ends of said binder to project toward each other, means operative as said stretching devices approach the limit of their movement toward each other for insuring the completion of said last-mentioned rotation of said gripping parts to a position where said ends of said binder are overlapped, and means for then sealing the overlapping ends of said binder and releasing said binder from said gripping devices.

66. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a

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pair of stretching devices mounted for sliding relative movement on said bar, said stretching devices having rotatable gripping parts, means for moving said stretching devices away from each other, means including stationary cam bars adapted to be engaged as said stretching devices approach the limit of their separation for rotating said gripping parts to positions adapted to receive a length of binder with its ends extending away from each other, said last-named means being operative upon reverse relative movement of said stretching devices for reversely rotating said gripping parts to permit the binder extending between said stretching devices to form a U-shaped loop, means for supporting a package inserted into said loop, means operative by the engagement of said rotatable parts of said stretching devices with said package upon further movement of said stretching devices toward each other for further rotating said rotatable parts of said stretching devices to cause the ends of said binder to project toward each other, means operative as said stretching devices approach the limit of their movement toward each other for insuring the completion of said last-mentioned rotation of said gripping parts to a position where said ends of said binder are overlapped, means for then sealing the overlapping ends of said binder, and means operative by a limited relative separation of said stretching devices for releasing the sealed binder from said gripping devices.

67. Apparatus for binding a package with a flexible binder comprising a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping plate secured on said shaft and having a gripping flange extending parallel to the axis of said shaft, a gripping dog pivoted on said plate and arranged to cooperate with said flange in gripping a flexible binder, and means operatively connected with said shaft for rotating said shaft and said plate.

68. Apparatus for binding a package with a flexible binder comprising a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping plate secured on said shaft and having a gripping flange extending parallel to the axis of said shaft, a gripping dog pivoted on said plate and arranged to cooperate with said flange in gripping a flexible binder, a crank pin connected to said shaft, and a cam bar adapted to engage said crank pin to effect the rotation of said shaft and said plate.

69. Apparatus for binding a package with a flexible binder comprising a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping plate secured on said shaft and having a gripping flange extending parallel to the axis of said shaft, a gripping dog pivoted on said plate and arranged to cooperate with said flange in gripping a flexible binder, means for rotating said shaft with respect to said block, and means for resiliently holding said shaft in any one of a plurality of positions with respect to said block.

70. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a block slidably mounted on said bar, a gripping device rotatably mounted on said block, means actuated during the travel of said block on said bar for rotating said shaft in said block, a member secured on said shaft, and means carried by said block and resiliently engaging said member for holding said shaft in any one of a plurality of positions to which it may be rotated.

71. Apparatus for binding a package with a

flexible binder comprising a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping device mounted upon one end of said shaft, a crank arm mounted on the other end of said shaft, and cam means engaged by said crank arm during the travel of said block on said bar for rotating said shaft in said block.

72. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping device mounted upon one end of said shaft, a crank arm mounted on the other end of said shaft, cam means engaged by said crank arm during the travel of said block on said bar for rotating said shaft in said block, and means for resiliently holding said shaft in any one of a plurality of positions which are displaced 90 degrees apart.

73. Apparatus for binding a package with a flexible binder comprising, a supporting bar, a block slidably mounted on said bar, a shaft journaled in said block, a gripping plate fixed on said shaft and having a gripping flange extending parallel to said shaft, a gripping dog pivotally mounted on said gripping plate and having a gripping surface adapted to cooperate with said flange in gripping a binder, a retaining plate movable with said gripping dog on its pivot and adapted to overlap said gripping flange when said gripping dog is in gripping position, a pin carried by said gripping dog, and means including a resilient part associated with said pin for holding said dog in gripping position when said pin has been moved to one position and for holding said dog in a retracted position when said pin has been moved to another position.

74. Apparatus for binding a package with a flexible binder comprising, sealing apparatus, means for gripping a binder at points displaced from the ends thereof, means for moving said gripping means toward each other to draw said binder taut around a package with its ends overlapping adjacent said sealing apparatus, and means for causing the binder end adjacent the same one of said gripping means always to extend on the outer side of the other binder end.

75. Apparatus for binding a package with a flexible binder comprising, a pair of stretching devices each having a gripping flange and a cooperating gripping dog, said devices being adapted to grip a length of binder at points displaced from the opposite ends thereof, and means for moving said gripping devices toward each other to draw said binder taut around a package and to overlap said ends, one of said gripping flanges being shaped to cause the binder end held thereon to extend on the outer side of the binder end held on the other gripping flange.

76. Apparatus for binding a package with a flexible binder comprising, a package support, sealing apparatus mounted to occupy a position adjacent a package on said support, a pair of gripping devices adapted to grip a length of binder near the ends thereof with the binder projecting to a predetermined extent beyond the gripping devices, and means for effecting relative movement of said gripping devices to draw said length of binder taut about said package with

its ends extending in opposite directions in overlapping relationship, said sealing apparatus being mounted to permit a limited movement thereof by one of said gripping devices at the end of said relative movement.

77. Apparatus for binding a package with a flexible binder comprising, a package support, sealing apparatus mounted to occupy a position adjacent a package on said support, a pair of gripping devices adapted to grip a length of binder near the ends thereof with the binder projecting to a predetermined extent beyond the gripping devices, and means for effecting relative movement of said gripping devices to draw said length of binder taut about said package with its ends extending in opposite directions in overlapping relationship, said gripping devices being formed to insure that the binder end held by a certain one of said gripping devices will always extend on the outer side of the other binder end, said sealing apparatus being mounted to permit a limited movement thereof by one of said gripping devices at the end of said relative movement.

78. Apparatus for binding a package with a flexible binder comprising, a package support, sealing apparatus adapted to occupy a position adjacent a package on said support, a pair of gripping devices adapted to grip a length of binder near the ends thereof with the binder projecting to a predetermined extent beyond one of said gripping devices, means for effecting relative movement of said gripping devices to draw said binder taut about said package with its ends extending in opposite directions in overlapping relationship, means for mounting said sealing apparatus to permit a limited movement thereof from its normal position in the direction of movement of said one gripping device, said one gripping device being arranged to effect said limited movement of said sealing apparatus as said one gripping device nears the end of said relative movement, and resilient means for returning said sealing apparatus to said normal position.

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