

July 31, 1962

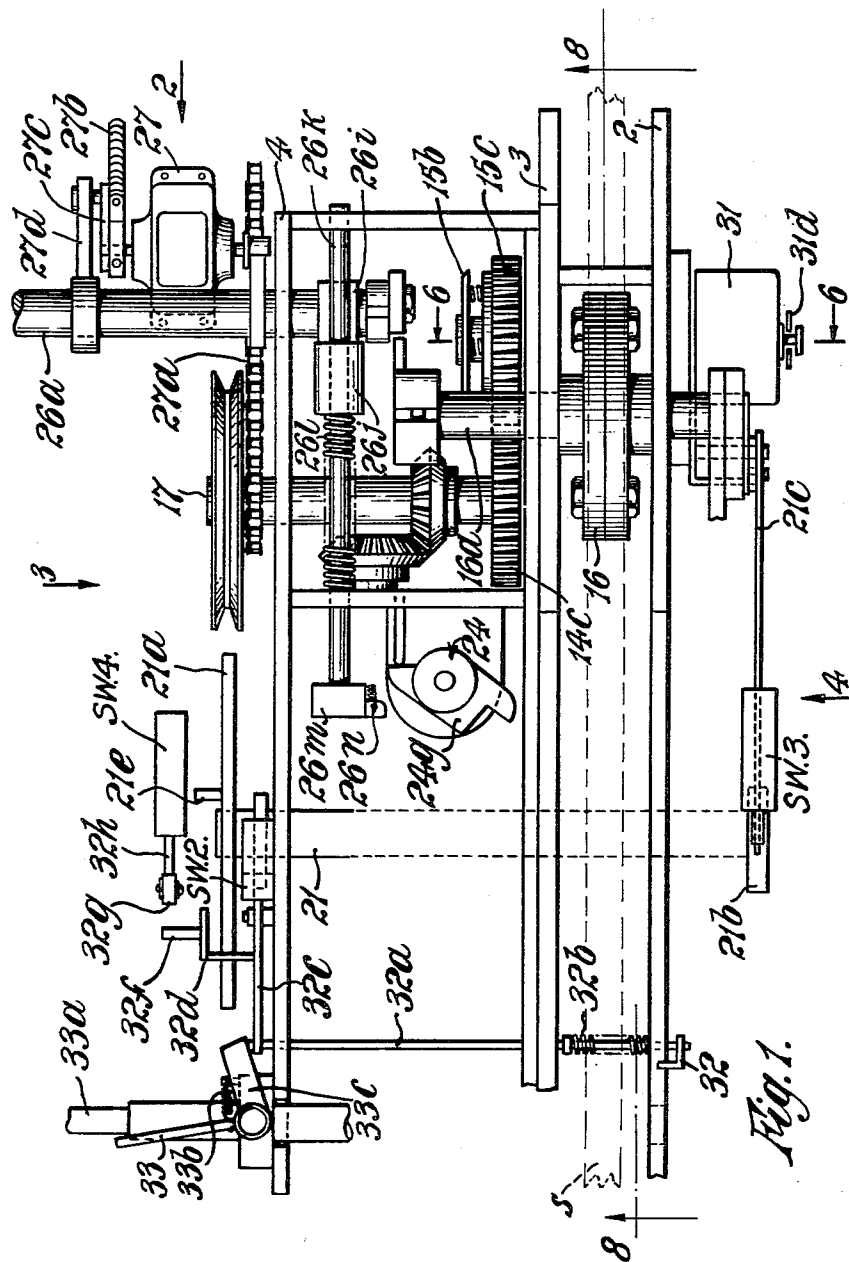
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3,046,871

PACKAGE AND LIKE BINDING MECHANISM

Filed Jan. 16, 1958

7 Sheets-Sheet 1



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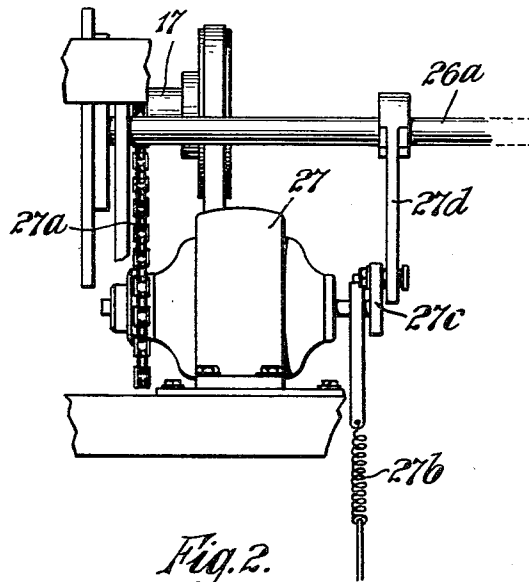


Fig. 2.

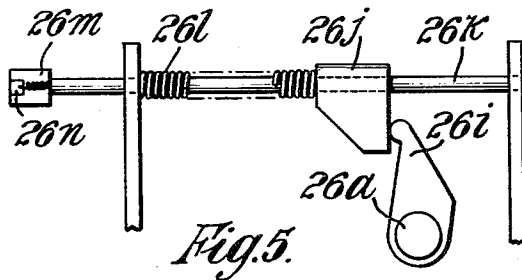


Fig. 5.

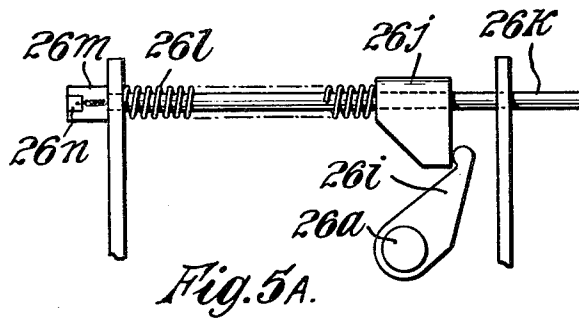


Fig. 5A.

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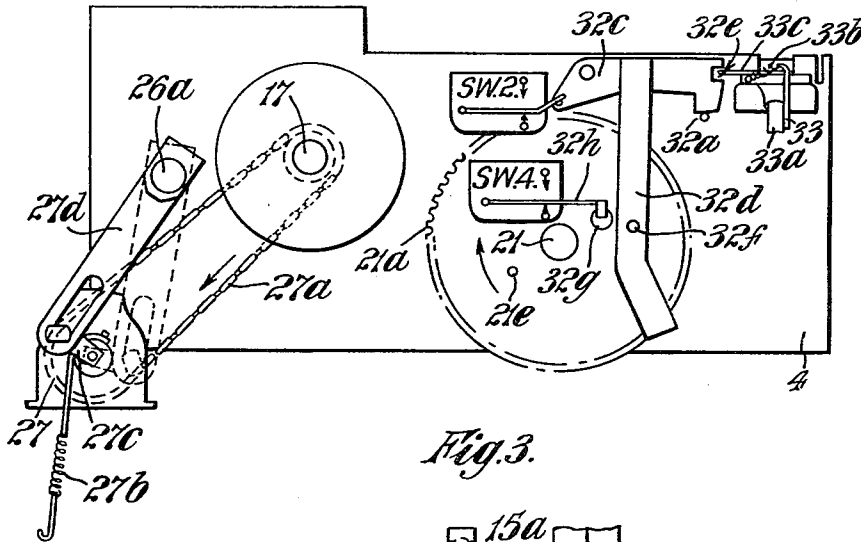


Fig. 3.

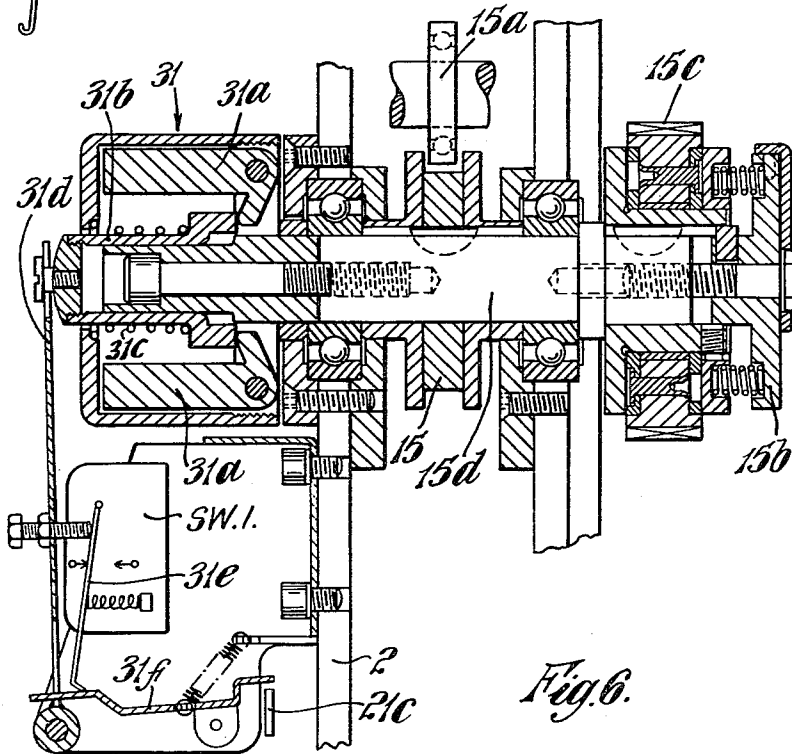


Fig. 6.

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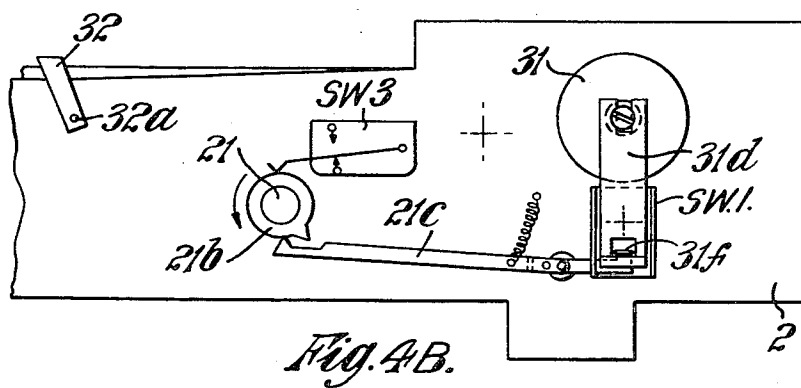
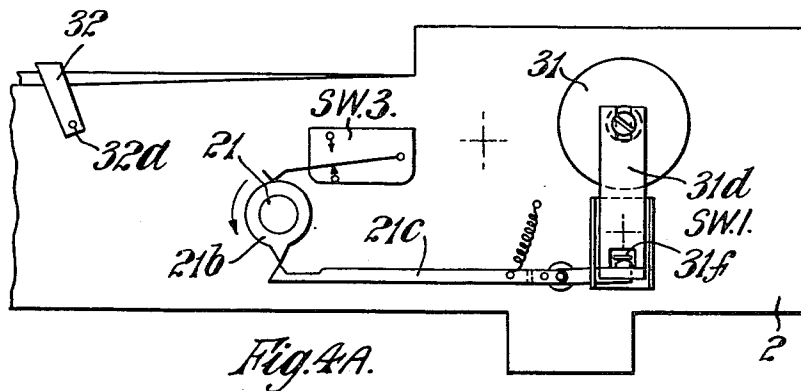
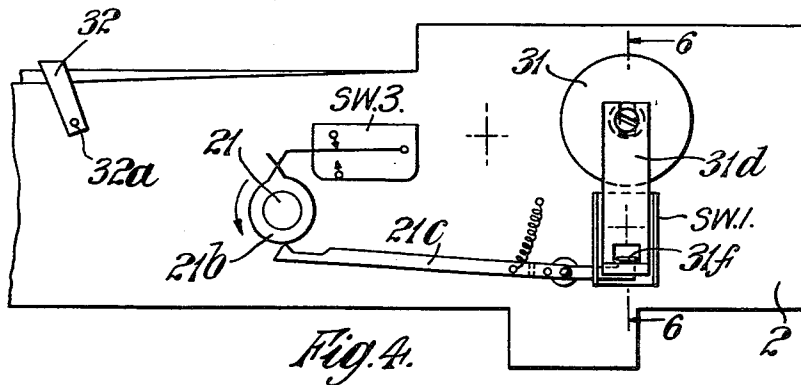
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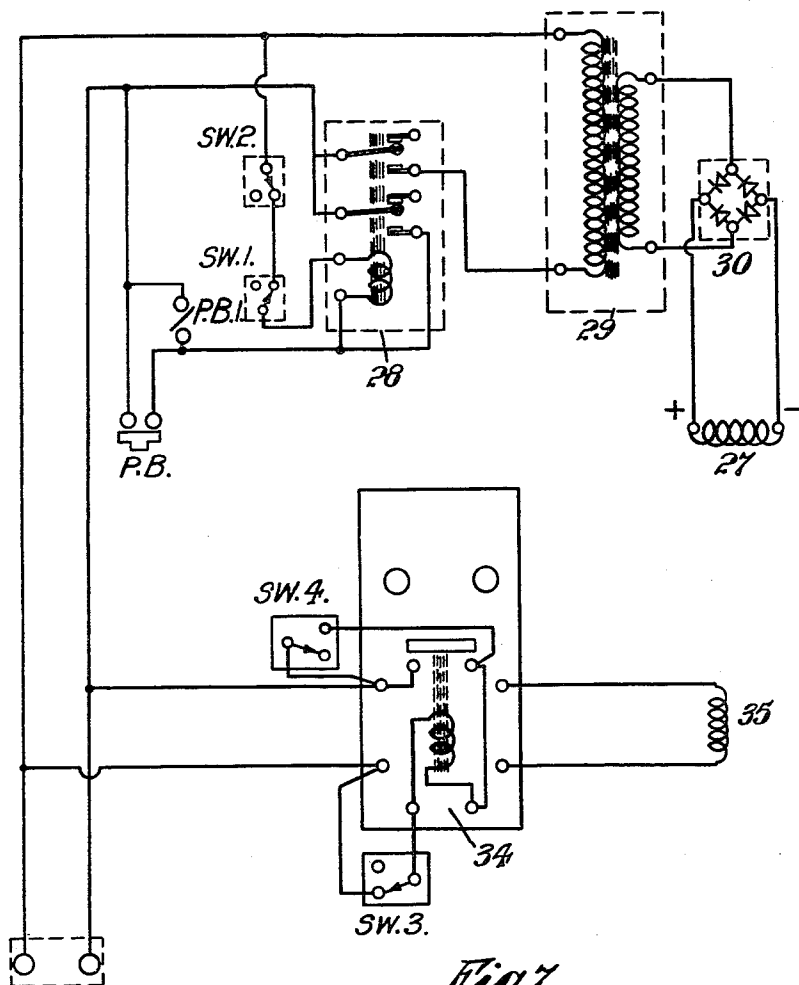


Fig. 7.

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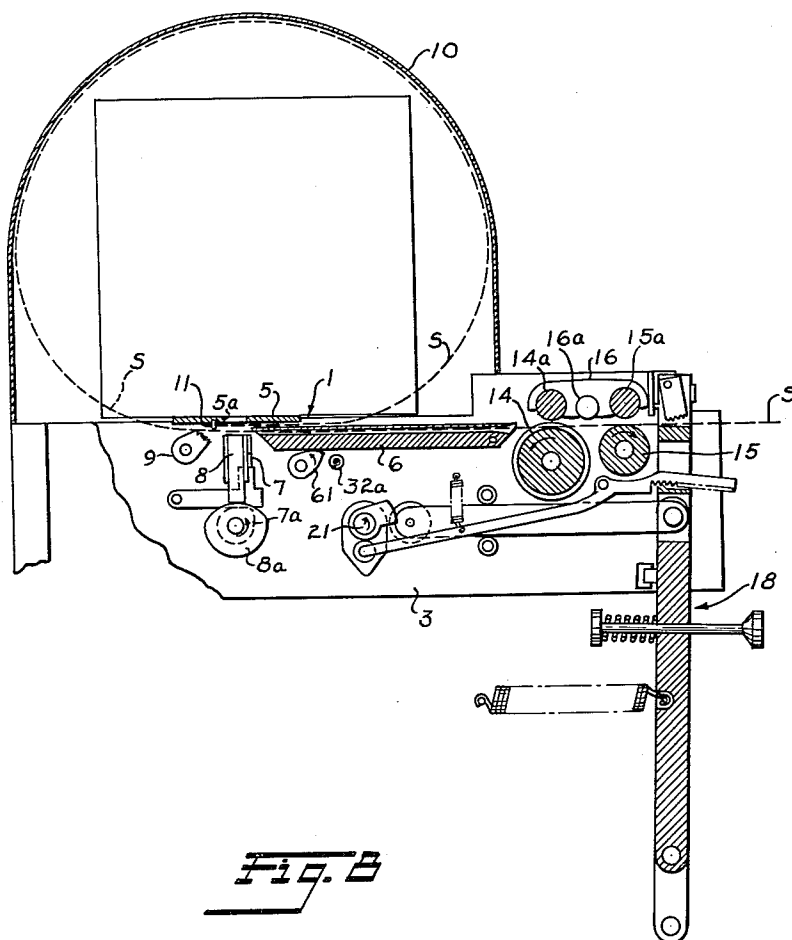


FIG. B

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PACKAGE AND LIKE BINDING MECHANISM
John James Cheesman and Maurice Robert Mills, London, England, assignors to Automatic Strapping Machines Limited, London, England, a British company
Filed Jan. 16, 1958, Ser. No. 709,247
Claims priority, application Great Britain Jan. 21, 1957
19 Claims. (Cl. 100—26)

This invention is concerned with mechanism for tying packages or the like with flexible binding material, of the type essentially comprising a connecting device and on the near side thereof a reversible feed, a holding gripper and severing means operable on the flexible material in the binding plane so that the material, having been fed out from a supply through the connecting device for insertion, after training to form a loop around the package or the like, into the gripper with the free end of the material projecting into the connecting device and held by closing the gripper, is drawn in and the loop closed onto the package or the like by reversing the feed, following which the parts of the material within the connecting device are joined together by actuating the latter and the looped part of the material is separated from the supply by actuating the severing means and the tied package or the like is released by reopening the gripper.

According to the invention from one of its aspects, the duration of the reverse feeding in a mechanism of this type is adjusted automatically in the sense that the conclusion of said reverse feeding is caused by the change in the tension of the flexible material which takes place when the loop has been closed onto the package to a predetermined degree of tightness. Thus, for example, when using a guide around the package or the like adapted to be filled by a constant length of the flexible material on forward feeding, the reverse feeding is determined by the extent of the required withdrawal of the material precisely by and in accordance with the size of each individual package.

According to the invention from another of its aspects, in a mechanism of said type, the actuation of the next step after conclusion of the reverse feeding or the initiation of a subsequent sequence of steps is effected automatically, and preferably immediately, by said change in tension.

Where the reverse feed comprises a continuously rotating roller with which the flexible material is brought into frictional engagement as required, such engagement may be terminated by said change in tension. For this purpose, the drive to said roller may be through a clutch which is adapted to slip preferentially with respect to the frictional engagement of the roller with the material, when this change in tension takes place, and the consequent retardation of the roller may be adapted to slow down a governor associated with said roller, which slowing down may be used to open an electric switch associated with said governor.

Governor control under the influence of the closing of the loop of the flexible material onto the package as now proposed enables the operational cycle of the mechanism to be continued without any appreciable break, so that besides the speeding up of the whole operation which is thus made possible, the frictional engagement of the reverse feed roller with the material and the consequent slip of its associated clutch following such closing can be terminated almost immediately and wear of the clutch reduced therefore to a minimum.

These characteristics make the invention particularly valuable in application to the fully automatic operation of a mechanism of the stated type at maximum speed for each package, regardless of its size within the capacity of the machine, and in rendering such operation entirely

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flexible in this respect without any individual adjustment or control.

The mechanism may be operated by an electric power device which in one direction of its movement effects the required reverse feeding (after closing of the holding gripper where that step starts the full operational cycle) and in the opposite direction initiates the remainder of the cycle and this power device may be included in a basic circuit together with a push-button relay and the aforementioned governor-controlled switch. Closure of this push-button relay then causes energization of said power device in the first direction until said circuit is opened by said governor-controlled switch, thereby causing the power device to act in the opposite direction both to terminate the reverse feeding and simultaneously to initiate a remaining automatic sequence.

Further effective operation by means of the push-button relay and risk of thereby causing reverse feeding during said remaining sequence may be avoided by provision of means for holding the governor-controlled switch open until as near the end of that sequence as possible, which holding means may be operated mechanically as part of the sequence.

The mechanism may also include means for preventing the initiation of a further operational cycle until the previously connected loop has been removed from the binding plane. This means may comprise a further switch in the basic circuit, which switch is left open at the end of each such cycle to prevent further effective operation of the push-button relay and is closed by the removal of the loop. The reopening of this additional switch can take place any time after the opening and before the reclosing of the governor-controlled switch, so that both switches together keep the circuit open from the coming into action of the governor until such removal.

If the push-button relay switch is held permanently closed or is short-circuited or just omitted, leaving the governor-controlled switch and the switch actuated by removal of the loop in sole control of the relay, it follows that the closure of this last mentioned switch consequent on such removal can itself be relied on for completing the basic circuit. It is thus made possible according to the invention from this further aspect to initiate a fully automatic operational cycle of a mechanism of the stated type by means actuated by removal of the previously connected loop and which becomes reset for further actuation as part of that cycle.

Where the flexible material for the next loop is forwardly fed to fill a guide around the package or the like in the aforementioned manner as part of the remaining automatic sequence after the reverse feeding, for example the final step thereof, provision may also be made for interrupting that sequence before the completion of such forward feeding, in order to avoid fouling the joint or seal of the previously connected loop, if still in position in the binding plane, by the end of the material which is thus projected along said guide. The means for this purpose may furthermore be such that removal of said previous loop causes resumption of said forward feeding and completion of said sequence. In this case it is the motor by which the mechanism is powered and from which the aforementioned continuous drive to the feed is derived which can most conveniently be stopped and restarted when required as by including in the control circuit of said motor further switching means for opening and closing that circuit. Thus, where the motor has an associated magnetic starter, one switch may be opened momentarily to de-energize said starter and thereby stop the motor after the commencement of the forward feeding, as part of said remaining sequence, and another switch may be closed momentarily to re-energize said starter and thereby restart the motor on

said loop removal, which closing can be effected by the same means already mentioned for preventing initiation of a further operational cycle until then, as an independent function of that means.

The invention will now be further described by way of example with reference to the accompanying drawings as applied to the conversion of a mechanism for operating with strip metal or band according to the specification of prior Patent No. 2,730,036 of J. J. Cheesman (hereinafter called "the prior specification") to automatic control, very closely simulating the direct manual control of the form of the mechanism shown in and described with reference to FIGURES 1 to 9 of that specification, in conjunction with which disclosure the following is intended to be read. In the present drawings:

FIGURE 1 is a plan view of the mechanism, corresponding to FIGURE 3 of the prior specification, showing the parts in neutral position.

FIGURE 2 is a partial side elevation in the direction of arrow 2 of FIGURE 1;

FIGURE 3 is a rear elevation in the direction of arrow 3 of FIGURE 1, with the parts positioned following connection of a loop but before removal thereof from the binding plane,

FIGURE 3A being a similar view to FIGURE 3, showing the parts after such removal and in neutral;

FIGURE 4 is a front elevation in the direction of arrow 4 of FIGURE 1, with the parts in the position they occupy at the start of forward feeding of the strip when the motor is stopped,

FIGURE 4A being a similar view to FIGURE 4, showing the parts (after restarting of the motor by removal of the connected loop) near the end of the operational cycle when the governor-controlled switch becomes re-closed, and

FIGURE 4B another similar view showing the parts in neutral at the end of the cycle;

FIGURE 5 is a view generally corresponding to part of FIGURE 6 of the prior specification showing the modified single operation clutch control with the parts in neutral,

FIGURE 5A being a similar view to FIGURE 5, with the parts positioned during reverse feeding of the strip;

FIGURE 6 is a section along the line 6-6 of both FIGURES 1 and 4, showing in detail the means for this reverse feeding, including the associated governor and switch controlled by the latter, with the parts in the position in which they rotate freely and with the switch closed, as in neutral and during unrestrained reverse feeding up to the closing of the loop onto the package,

FIGURE 6A being a similar view to FIGURE 6, with the parts in the position they assume when the reverse feed becomes retarded due to this closing of the loop and the governor consequently acts to open said switch;

FIGURE 7 is a circuit diagram; and

FIGURE 8 is a vertical cross sectional view taken substantially on the line 8-8 of FIGURE 1.

The same reference numerals as in the prior specification are used herein as far as possible to denote the same or equivalent parts, the basic mechanism being essentially unchanged. As shown in FIGURE 8 the machine comprises the usual supporting table and platform 1 near the front edge of which extends, in the binding plane a guideway 10 for the strip, S, of flexible binding material. Beneath this table three main vertical plates 2, 3, and 4 for supporting the mechanism are arranged in planes parallel with the binding plane, the front plate 2 just forwardly and the middle plate 3 just rearwardly thereof.

In a central section of this guideway beneath a reaction plate 5 at table level are disposed the first or near side holding gripper 6, the cutter 7, the connecting device tool 8 in register with a hole 5a of the plate 5 and the second or far side holding gripper 9, the strip being adapted to emerge from the guideway 10 beyond the grippers to

pass around the package. The strip S is adapted to be fed out longitudinally from the near side of the machine under the first gripper 6, across the connecting device 7 and through the second gripper 9, then around guide 10 back through the first gripper and again across the connecting device up to a stop 11 a little short of the second gripper. Gripping, connecting and severing are controlled respectively by cams 6l, 8a and 7a all of which are driven in timed relationship in response to the rotation of a shaft 21 which is driven through one revolution during a binding cycle all explained in Patent No. 2,730,036.

The strip S is fed inwardly and outwardly through the medium of a pair of oppositely rotating rollers 14, 15 with which the strip S may be brought alternatively into frictional engagement by the rocking of a frame 16 mounted on a shaft 16a and carrying a pair of idler rollers 14a, 15a.

In addition to the foregoing the machine may be equipped with tensioning means broadly indicated by the numeral 18 and more particularly described in the aforementioned patent.

As in the machine of the patent, control of the present machine is effected by the rocking of a shaft 26a in FIGURE 1 in one direction for causing the reverse actuation of the feed after closing of the holding gripper and in the opposite direction for initiating the remaining automatic operational sequence concluding with the forward feeding of the strip required for the next loop (hereinafter called "the existing automatic operation"). Instead of this shaft being thus rocked as previously by a handle, a magnetic clutch 27 is here used as the aforementioned electric power device for this purpose and may be of the type in which one element is rotated continuously, as by the chain drive 27a from the machine driving shaft 17, to apply torque to the other element only whilst the clutch is energized by the closing of its control circuit. Said other element is thereby moved through a part revolution against a tension spring 27b whereby this element is returned to its original position when said control circuit is broken. This part revolution is sufficient to rock shaft 26a as required through a crank 27c having a pin and slot connection with a lever 27d on said shaft by the consequent movement of the parts as shown in FIGURE 3 from the neutral position (in full line) to the energized position (in broken line). It is unnecessary, when the shaft is thus rocked automatically, for it to be capable of assuming the intermediate neutral position, found advisable with the direct manual control, between its operative positions in which it actuates the reverse feed and in which it trips the existing automatic operation respectively. Consequently the engagement of arm 26i on the shaft with block 26j of the push rod 26k against the action of spring 26l for this last mentioned purpose is here modified so as to permit said arm to be thus in neutral in one end position (see FIGURES 1 and 5) from which it is rocked on energization of clutch 27 to its other end position (see FIGURE 5A, corresponding to the broken line position of lever 27d in FIGURE 3), during the course of which movement the rod 26k becomes retracted by spring 26l together with head 26m on said rod, so that the latch 26n on said head passes the head part 24g of the existing automatic operation clutch control member 24 ready to engage the latter during the return of the parts to neutral. In all other respects the rocking of shaft 26a serves to operate the mechanism exactly as described in the prior specification.

The control circuit of clutch 27 (see FIGURE 7) includes the push button switch PB, the governor-controlled switch SW1, relay 28, transformer 29 and rectifier 30, being initially closed by said switch PB and reopened by said switch SW1 under the influence of the governor 31 arranged forwardly of the front supporting plate 2 of the machine (see FIGURES 1 and 4). The feed again con-

sists of a pair of intergeared rollers continuously rotating in opposite directions, against which the strip is alternatively gripped by idler rollers mounted in frame 16 on the rockable shaft 16a. The roller 15 for effecting the reverse feed in conjunction with idler roller 15a (see FIGURES 6 and 6A) when clutch 27 is energized is thus continuously rotated from shaft 17 through gearing 14c, 15c and the adjustable friction clutch 15b, which is set to slip as soon as the tightening of the loop onto the package holds the strip sufficiently to cause retardation of the roller 15 and consequently of the shaft 15d of the latter, on which shaft the pivotally mounted centrifugal weights 31a of the governor are mounted. This retardation causes these weights to move in from their normal position as shown in FIGURE 6 to that of FIGURE 6A, thus permitting the sleeve 31b to retract under the influence of spring 31c and rocking the switching arm 31d inwardly and causing switch SW1 to open as clearly shown in these figures. The contact arm 31e of the switch thereupon becomes held in this open position by the upwardly sprung latch plate 31f, independently of the governor and of the resumption of full speed rotation of roller 15 when roller 15a lifts therefrom as a result of the de-energization of clutch 27 directly switch SW1 opens.

This latching open of switch SW1 constitutes the first of the aforementioned optional safety precautions, being for the purpose of preventing re-energization of said clutch 27 by the push button switch PB until as near the end of the existing automatic operation as possible, when the latch plate 31f is adapted to be tripped mechanically by a cam 21b on the forward end of the shaft 21 by which that operation is controlled. This cam releases said latch plate from its engagement with the switch contact arm 31e through the lever 21c (see FIGURES 4, 4A and 4B), thus permitting the switch to reclose and returning all the parts to their FIGURE 6 positions.

The control circuit of clutch 27 may also include another switch SW2 as part of the second of the aforementioned optional precautionary means, in this case for preventing further closure of said circuit by the push button switch PB until the previously connected loop has been removed from the binding plane. For this purpose a catch 32 is provided adapted to be engaged and drawn forwardly by part of said loop during such removal and to be subsequently freed by detachment from the loop to permit said catch to reset itself, this forward movement of the catch causing said switch SW2 to close following previous opening thereof by the existing automatic operation between the opening and delayed reclosing of the governor-controlled switch SW1, so that both switches in conjunction make it impossible to re-energize clutch 27 between the coming into action of the governor right up to the withdrawal of the loop. This catch may be mounted adjacent and forwardly of the connecting device on the front end of a rod 32a extending to the back of the machine where it projects through the rear supporting plate 4 thereof, said rod being urged by the spring 32b rearwardly to retract the catch. The rear end of this rod cooperates with a lever 32c pivoted transversely with respect thereto on plate 4 in such a way that when this lever is raised and the catch is fully retracted (see FIGURE 3) the lever is able to rest on the rod and to be supported thereby but that, when the catch is drawn forward, thereby permitting the lever to drop (see FIGURE 3A), the end of the rod then abuts against it resiliently when the catch becomes detached from the loop, until the raising of the lever permits the rod to pass beneath it again. The catch itself thus plays no part in the raising of the lever, but is adapted just to hold it raised. Lever 32c when thus raised is adapted to open switch SW2 arranged adjacent thereto also on plate 4 and when lowered to let this switch close, the required raising being effected by engagement of a pin 21e on the rear sprocket wheel 21a of shaft 21 with an arm 32d depend-

ing from the lever. Exact timing in this respect is unimportant providing the lever is left supported solely by the catch rod 32a on completion of the operational cycle and then quite free to drop and close the switch on removal of that support.

It will be clear that if the push button switch PB is held closed or is short-circuited by closing of the supplementary switch PB1 or is just omitted, the closing of switch SW2 on actuation of catch 32 will result in the immediate energization of clutch 27 and therefore provides a convenient alternative way of initiating a further operational cycle.

Where, as according to the prior specification, the connecting device is of a type adapted to form a sleeve involving the feeding in of continuous strip for this purpose, the catch means just described may be used additionally to prevent initiation of a further operational cycle when the supply of such sleeve strip is about to run out. Thus a feeler 33 (see FIGURES 1 and 3) may be used to engage said strip 33a laterally under the influence of a spring 33b and, when not thus engaged, is adapted to prevent lever 32c from dropping by reason of the engagement of an arm 33c of said feeler in a slot 32e of said lever, so that the switch SW2 is thus held open independently of the catch 32. This latching of the lever allows the latter to be raised even when the feeler has become released from strip 33a besides allowing the feeler to engage the lever directly when already raised, thereby avoiding the necessity for any special timing.

The third of the aforementioned optional precautionary measures, i.e. that for preventing fouling of the joint or seal of the previously connected loop, if still in position in the binding plane, by the forwardly projected end of the strip, now remains to be described. The means for this purpose comprises the two additional switches SW3 and SW4 in the separate circuit of the magnetic starter 34 of the motor 35 by which the machine is powered as shown in FIGURE 7. Switch SW3 is arranged (see FIGURES 1 and 4) forwardly of plate 2 adjacent cam 21b so as to be opened momentarily thereby during the course of the existing automatic operation, just after the forward feed of the strip has started, thereby de-energizing starter 34 and stopping the motor. Switch SW4, on the other hand, is arranged behind plate 4 (see FIGURES 1 and 3) adjacent lever arm 32d, so that a striker pin 32f on the latter can engage a roller 32g on the contact arm 32h of said switch. Thus, when catch 32 is actuated by removal of the loop and lever 32c consequently drops, this has the additional effect of raising said contact arm 32h momentarily as said striker pin passes beneath said roller (see the broken line position of the arm in FIGURE 3A), thereby momentarily closing switch SW4 to cause re-energization of the starter and restarting of the motor to complete the forward feeding and finish the operational cycle. In spite of this provision the motor, because of its inertia, will not come fully to rest providing the loop is removed quickly. It is to be remembered that as switch SW4 will also be similarly closed momentarily during the raising of lever 32c, it is necessary for switch SW3 to be opened after the lever has thus been raised in order to prevent premature restarting of the motor thereby, the closing of switch SW4 before the opening of switch SW3 being of course without effect. Where switch SW4 is thus required to be actuated as an independent function of the catch means the engagement of pin 21c with arm 32d does therefore require to be timed more critically, i.e. to take place nearer the start of the existing automatic operation.

It will be understood that the invention makes possible a standard basic mechanism of the type set forth which can alternatively as required either be either fitted with a direct manual control in accordance with the prior specification or adapted for automatic operation as now proposed.

We claim:

1. Mechanism for binding packages or the like of the

type having means for feeding flexible material from a supply in a binding plane to form a loop around the package, a holding gripper for said material adjacent the free end of said loop, means for reversing said feeding means for thereby closing the loop onto said package, means for connecting the parts of the material defining the ends of the loop and means for severing the loop from the supply, said reverse feed including a roller, means for continuously rotating said roller reversely and means for moving the material into frictional engagement therewith, in combination with a governor responsive to retardation of the reverse rotation of the roller consequent on the change in tension of the material as the loop closes onto the package to a predetermined degree of tightness and means responsive to the consequent actuation of said governor for thereby automatically effecting a remaining operation of the mechanism.

2. Mechanism according to claim 1, wherein said means responsive to the consequent actuation of the governor includes means for concluding the reverse operation of the feeding means.

3. Mechanism according to claim 1, wherein said means responsive to the consequent actuation of the governor includes means for terminating the frictional engagement of the roller with the flexible material.

4. Mechanism according to claim 1, wherein said means for continuously rotating said roller includes a clutch which slips to permit the retardation of the reverse rotation of the roller.

5. Mechanism according to claim 1, including means for preventing initiation of a subsequent operational cycle of the mechanism until the previously connected loop has been removed from the binding plane.

6. Mechanism according to claim 1, including means responsive to removal of a previously connected loop from the binding plane for thereby initiating a subsequent operational cycle of the mechanism so that said means becomes re-set for further actuation as part of that cycle.

7. Mechanism according to claim 1, including a guide encircling the package or the like, said guide being filled by said forward feeding of the material as a step in said remaining operation, and means responsive to the presence of a previously connected loop in the binding plane for interrupting said remaining operation before completion of said forward feeding.

8. Mechanism according to claim 7, including means responsive to the removal of said previously connected loop from said plane to cause completion of the forward feeding.

9. Mechanism according to claim 8, wherein said means for causing completion of the forward feeding includes means for preventing initiation of a subsequent operational cycle of the mechanism until the previously connected loop has been removed from the binding plane.

10. Mechanism according to claim 1, wherein said connecting means comprises means for feeding continuous flexible material to said connecting device to form a sleeve around said end parts and means for preventing initiation of a subsequent operational cycle of the mechanism when said sleeve material is substantially exhausted.

11. Mechanism according to claim 1, wherein said means responsive to the consequent actuation of the governor comprises an electric switch controlled by said governor so as to be opened thereby upon said consequent actuation.

12. Mechanism according to claim 11, wherein said control of the remaining operation is effected by the opening of said governor-controlled switch, and including means for holding said switch open substantially to the end of that operation.

13. Mechanism according to claim 12, including means for operating said holding means mechanically as part of said remaining operation.

14. Mechanism according to claim 11, including an electric power device operable in one direction for effecting said reverse operation of the feeding means and operable in the other direction for effecting said remaining operation and a basic electrical circuit containing said governor-controlled switch, said power device and a push button relay, so arranged that closure of said relay causes energization of said power device in said first direction until said circuit is opened by said switch causing said power device to act in said opposite direction.

15. Mechanism according to claim 14, including means for preventing initiation of a subsequent operational cycle of the mechanism, said means comprising a second switch in the basic circuit and means for holding said second switch open at the end of each cycle to prevent further effective operation, of said relay, and means for closing said second switch by removal of the loop from the binding plane.

16. Mechanism according to claim 15, including means for re-opening said second switch after the opening and before the re-closing of said governor-controlled switch.

17. Mechanism according to claim 16, wherein said governor-controlled switch and said second switch are in sole control of said relay whereby closure of said second switch upon the removal of said loop completes said basic circuit.

18. Mechanism according to claim 15, wherein said basic circuit includes a third switching means responsive to the presence of a previously connected loop in the binding plane for opening said circuit before completion of said forward feeding and responsive to the removal of said previously connected loop from said plane to re-close said circuit.

19. Mechanism according to claim 18, wherein said basic circuit includes a magnetic starter associated with said motor, and said third switching means comprises one switch part responsive to said forward feeding for momentarily opening said circuit to de-energize said starter and thereby stop said motor, and another switch part responsive to the removal of the loop so as to be closed momentarily to re-energize said starter and thereby restart said motor.

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