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3,101,493

BOOK COVER-APPLYING MACHINE

Filed May 23, 1961

2 Sheets-Sheet 1

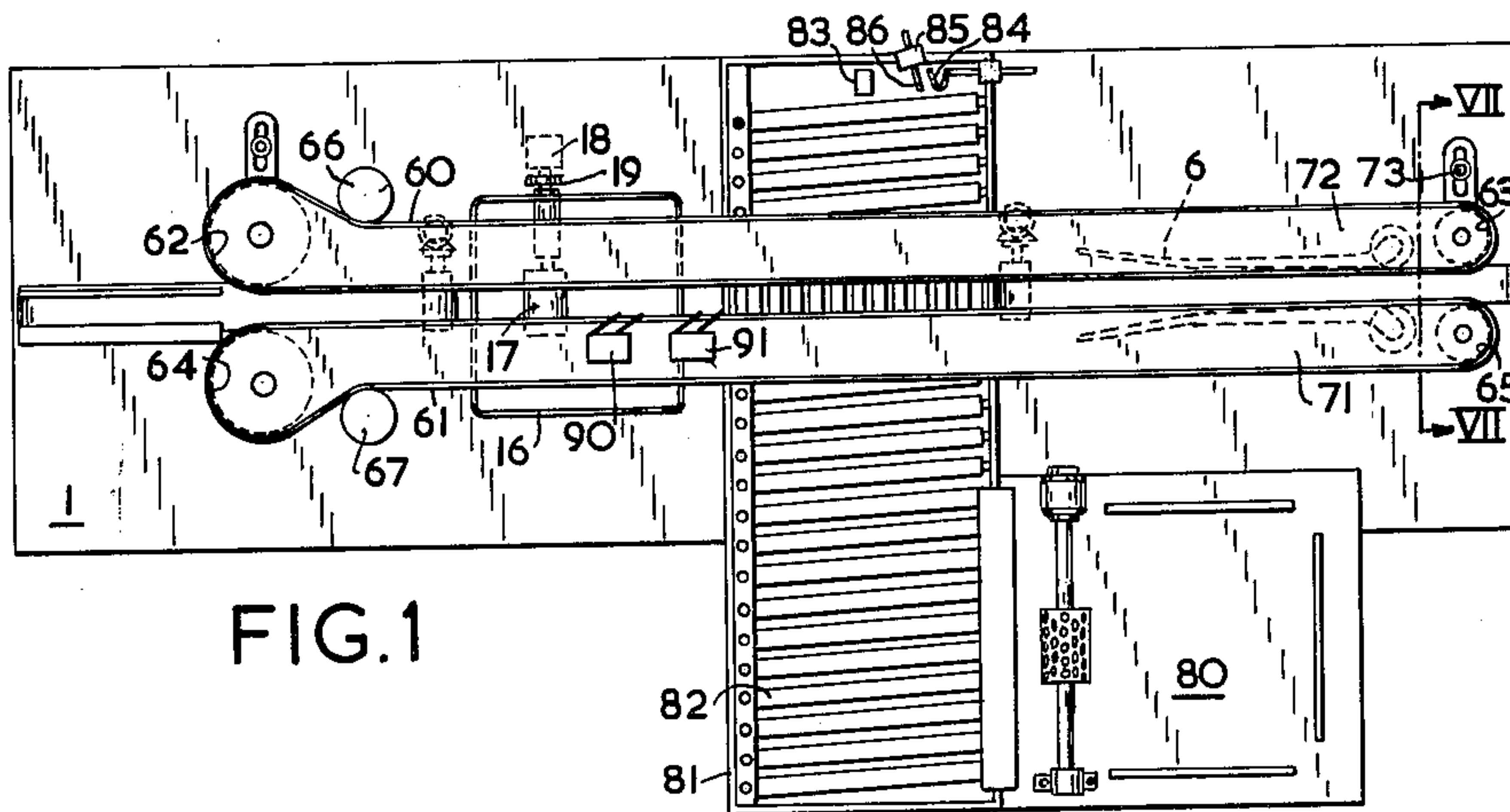


FIG. 1

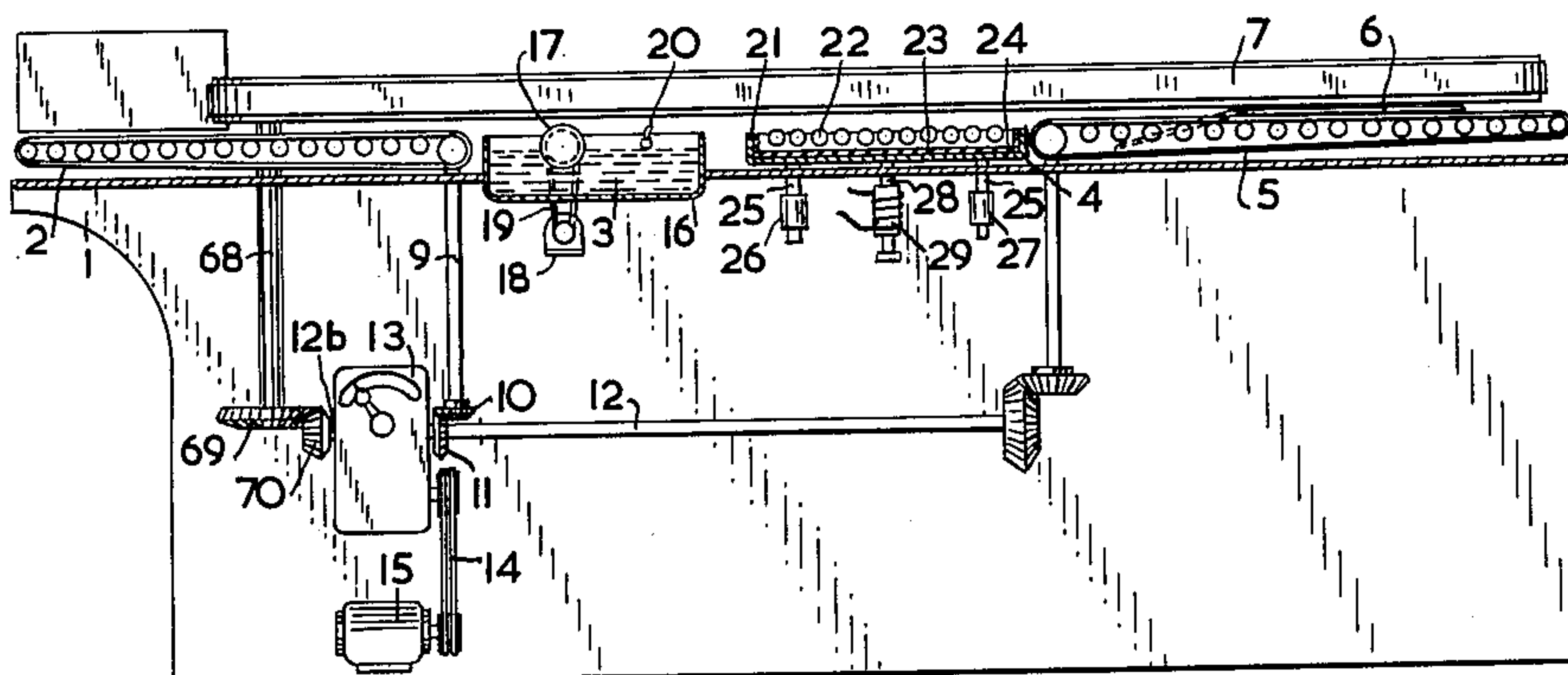


FIG. 2

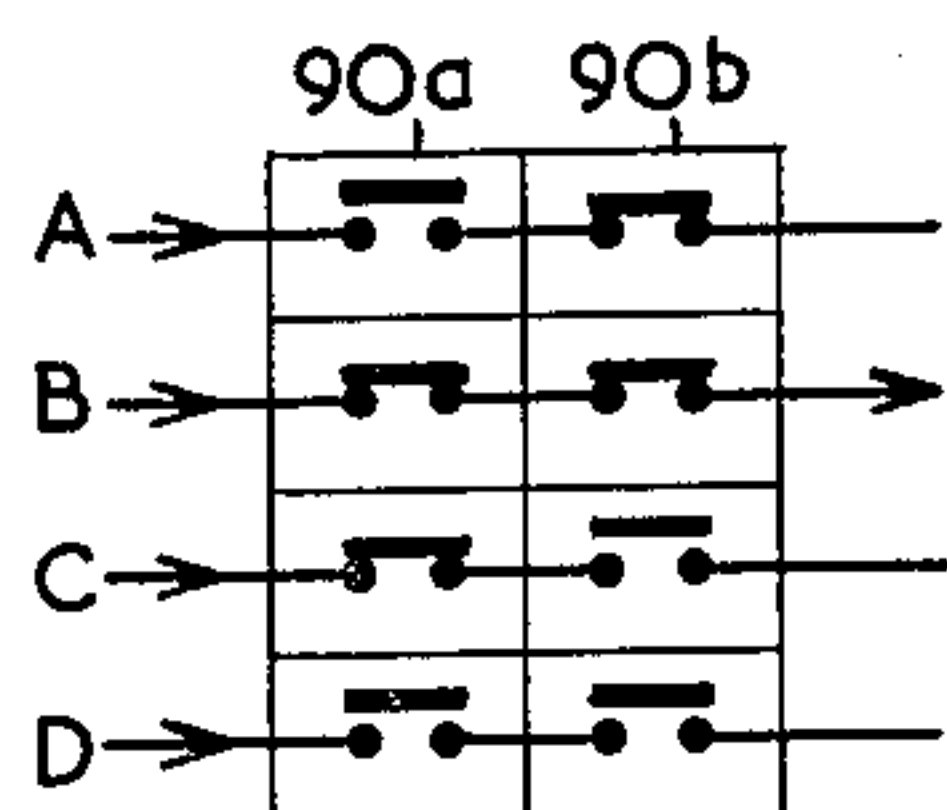


FIG. 3

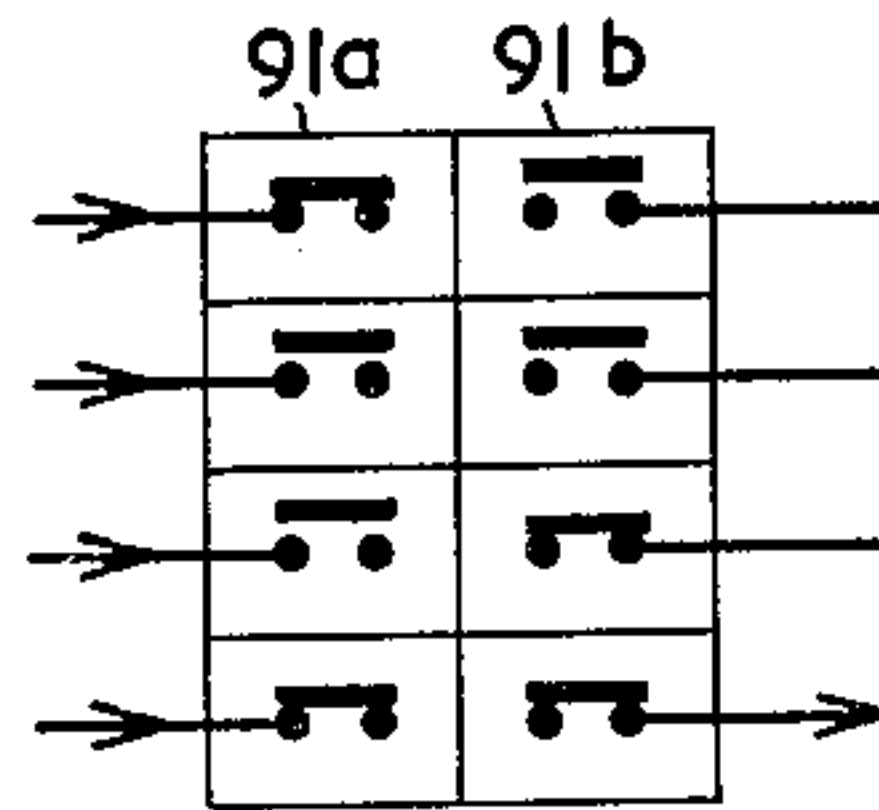


FIG. 4

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2 Sheets-Sheet 2

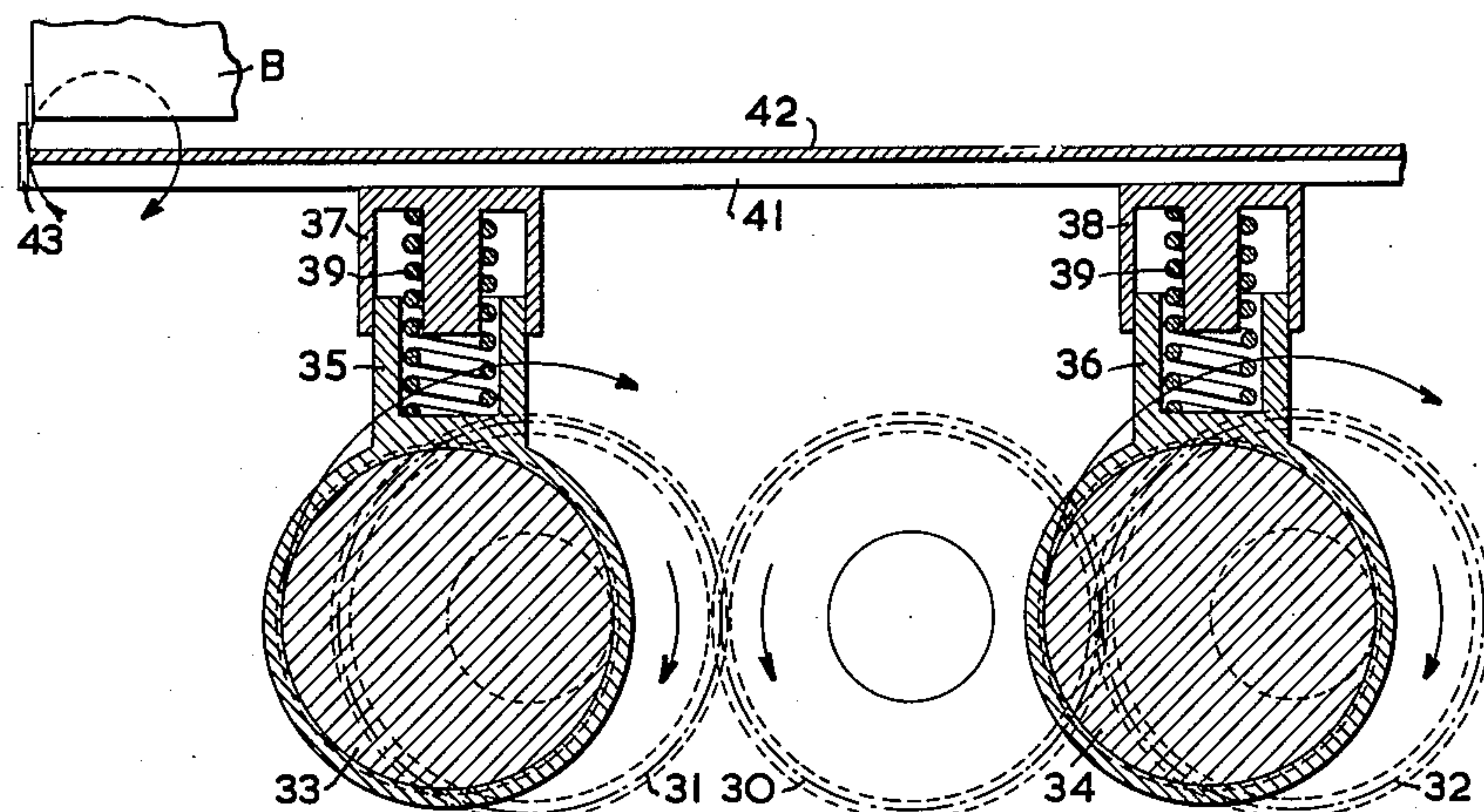


FIG. 5

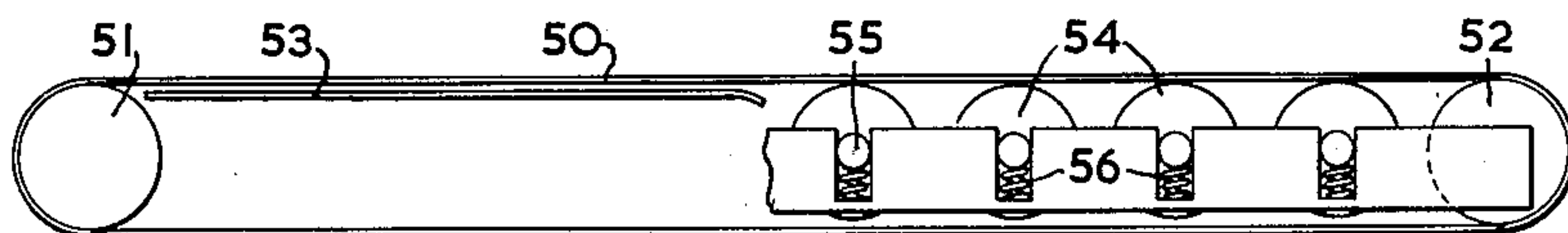


FIG. 6

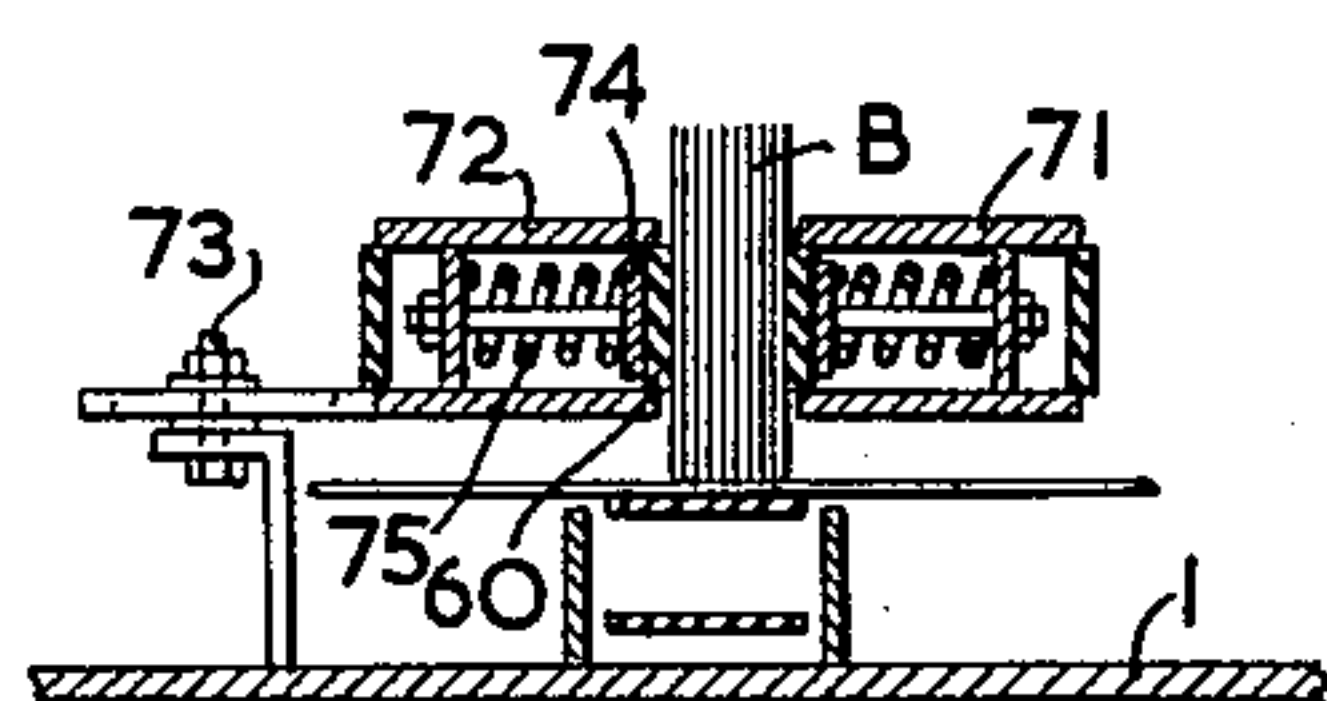


FIG. 7

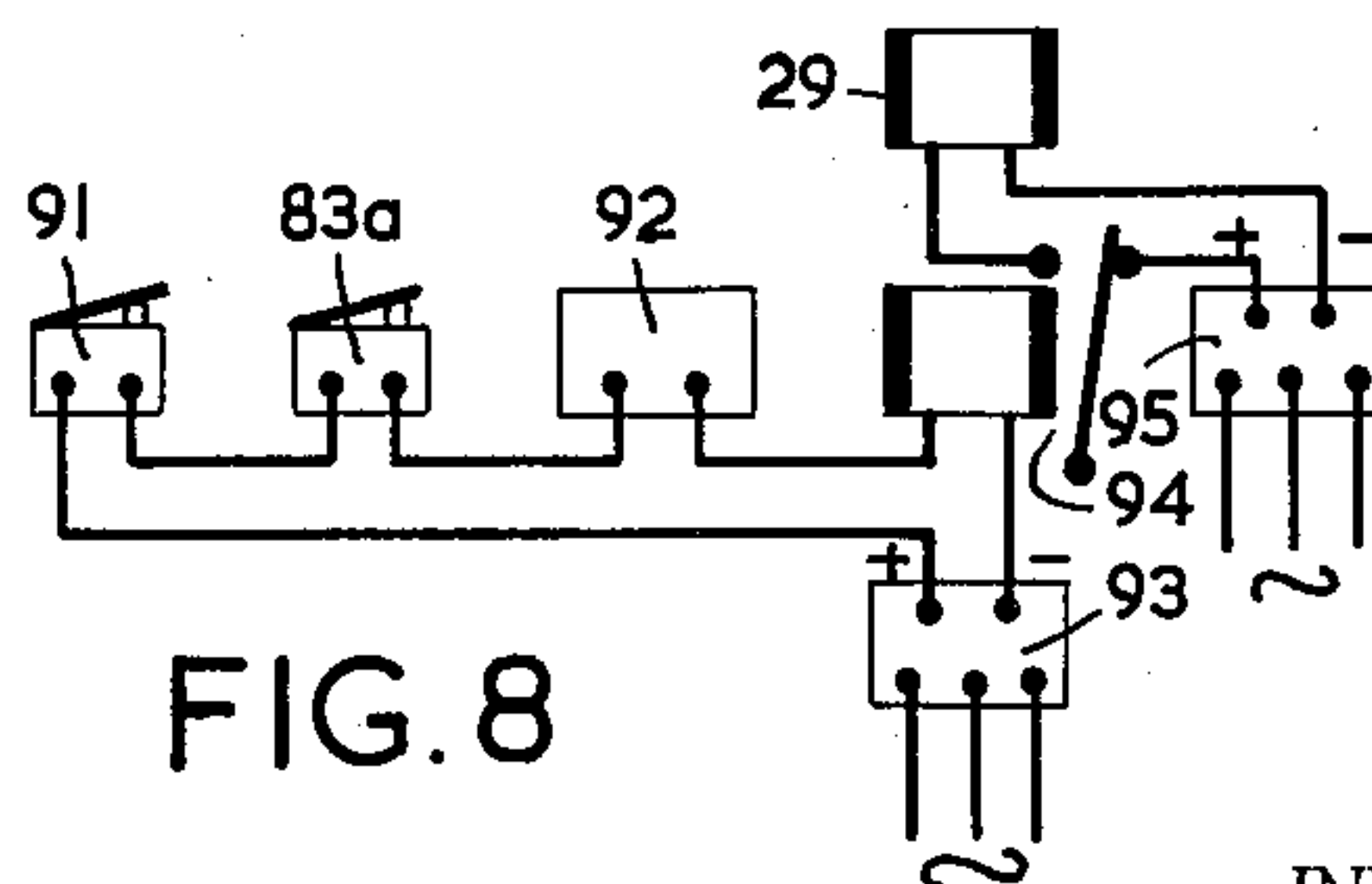


FIG. 8

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## BOOK COVER-APPLYING MACHINE

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12 Claims. (Cl. 11-4)

This invention relates to a machine for applying covers to books, which machine comprises a continuously working book feeding device for vertically positioned books, and a cover feeding device for horizontally supplied plane covers which one by one are passed beneath a book and by means of a presser mechanism pressed against the spine of the book by a relative movement between book and cover at a time when these two parts are located in a pre-determined mutual position at the pressure station of the machine.

In a known machine of this type, the book feeding device performs a stepwise movement. When the mechanism is at rest, different functions, for example, the insertion of a new book and the removal of a finished book, and application of the cover by means of the presser mechanism are performed, the book and, if desired, also the cover having been provided with glue during movement from the station where the insertion of the book takes place to the station where the presser mechanism is located.

In another machine of the said type the books, their spines facing downwards, are fed between two conveyor belts, and when a book arrives at the cover-applying station it is gripped and arrested during the cover-applying operation, while the conveyor belts continue their travel and carry the subsequent book nearer to the arrested book. In this machine is, therefore, required a rather considerable and preferably regular spacing between books fed in succession, which restricts the capacity of the machine. It is further inexpedient that the conveyor belts are to rub against the retained book as this involves the risk of damage and, consequently, an increase of the percentage of waste.

It is an object of the present invention to provide a machine which is simple and, consequently, cheaper both in the cost of production and in cost of operation and which may be combined with other book working machines without any form of synchronizing.

The invention is based on the recognition that the timed function with regular feeding of books, which has hitherto been considered necessary in connection with machines of the said type, is not an inevitable condition and that by waiving the timed function it is possible to obtain a substantial increase of the production speed.

In view of the above mentioned object the invention resides in the features that the book feeding device is arranged for uninterrupted feeding of books at a constant speed but with optional interspacing, and that provision is made of controlling means located in succession in the direction of travel of the books and being mutually independent and actuatable by the books, for controlling both the cover feeding device and the presser mechanism. Hereby a saving of time is obtained both in relation to the known type of machines where all books in the machine are subjected to a timed movement with alternating stoppings and startings and in relation to the known type of machines, where only the book located opposite the cover applying mechanism is stopped.

Further, by the machine according to the invention, viewed in relation to first mentioned known type of machine, an economy as to operators or mechanical aids is obtained since it is not necessary for each cycle to insert manually or mechanically a book in a holder. Viewed in relation to the last-mentioned type of known machines

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the particular mechanism is saved, which in regular timing stops and releases an arriving book with a view to supplying the books at the side of introduction of the book feeding device, with regular spacings so as to avoid that the book immediately following the book retained for the moment above the cover applying mechanism, pushes against said retained book.

Over a machine of the last mentioned type where the conveyor belts are to slide along the book momentarily retained, the machine according to the invention affords the advantage that the adjustment of the mutual distance and tension of the conveyor belts are uncritical, because the books are continuously to be clamped by, and kept in pace with, the book feeding members. Consequently there is no risk of tearing the extreme pages of the book, resulting in waste.

In the following the invention will be explained in detail with reference to the accompanying purely diagrammatical drawings where

FIG. 1 shows a top view of an embodiment of a cover applying machine according to the invention,

FIG. 2 shows a side elevation and partial section of the machine shown in FIG. 1,

FIGS. 3 and 4 show circuit diagrams for different positions of electrical switches included in an embodiment of the control means for controlling the cover feeding device and the cover pressure mechanism, respectively,

FIG. 5 shows a partially vertical section through another embodiment of a presser mechanism for a machine according to the invention,

FIG. 6 shows a side-elevation of a close-pressing device for a machine according to the invention,

FIG. 7 shows a cross-sectional view of the machine according to FIGS. 1 and 2, and

FIG. 8 shows a circuit diagram for an embodiment of a controlling circuit for the cover-pressure.

In FIGS. 1 and 2, 1 designates the bed of the cover-applying machine in which viewed from the left to the right is mounted a book conveyor 2, a glue-applying device 3, a cover presser mechanism 4, a close-pressing mechanism 5, means 6 for folding a cover around a book, and a book feeding device 7 which is situated above said parts of the machine, and which serves for feeding books from the insertion end to the delivery end of the machine, viz. from left to right in the figure. Between the glue applying device 3 and the cover presser mechanism 4, provision may be made of a drying arrangement, not shown, for example a heating element and/or a blower.

The conveyor 2 is a horizontal belt conveyor of the type known per se, comprising a belt passing around two end rollers with intermediate supporting rollers. One of said end rollers is via a vertical shaft 9 which at top has a conical gear wheel, not shown, in engagement with a conical gear wheel, not shown, on the driving roller of the belt conveyor, and which at its other end has conical gear wheels 10 and 11 connected with an output shaft 12 in a gear box 13 which via a belt drive 14 is in connection with a driving motor 15.

The gluing arrangement 13 comprises a receptacle 16 holding a supply of glue wherein there is a gluing roller 17 driven by a driving motor 18 via a belt drive 19. Further there is a brush 20 for striking off excess glue.

The cover applying presser mechanism 4 which is explained in more detail in my co-pending application Serial No. 112,011 of May 23, 1961, contains a vertically movable presser frame 21 comprising a number of freely rotatable journaled rollers 22. The rollers may for example be hollow and closed at their ends by a circular disc having a bearing pin supported in corresponding bearings in the frame side. The axial direction of the rollers is at right angles to the direction of travel of the book



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feeding device. The frame 21 is supported by the plate 23 of elastic material, for example, foam rubber carried by a supporting plate 24 rigidly connected with carrying rods 25 located in bearings 26 and 27 secured to the bed 1 of the machine. Provision may be made of return springs, not shown, to urge the presser frame back to its lowermost position. In rigid connection with the supporting plate 24 there is a push rod 28 of which part constitutes or carries the core of an electromagnet 29. The said part is ferromagnetic and is sucked into the electromagnet when a current is supplied to the coil thereof, whereby the push rod 28 is moved upwards in the figure. With a view to the accuracy in the movement of the presser frame there is expediently used direct current for energizing the electromagnet 29, for example via a rectifier, not shown, which is connected to preferably a three-phased A.C. mains.

Besides, the pressure mechanism may be of any suitable construction. FIG. 5 shows another example. 30 is a driving wheel which, for example, is driven from the shaft 12, FIG. 2, via a slip clutch, not shown, permitting the stopping of the movement of the wheel 30. 31 and 32 are two gear wheels in engagement with the wheel 30, and driving two eccentrics 33 and 34 each provided with a cam 35 and 36 in the shape of a hollow cylinder, the internal surface of which guides a feeding member, 37 and 38, respectively, and which internally holds a pressure spring, 39 and 40, respectively. The feeding members 37 and 38 are fixed to the underside of the presser table which on its upper side has a suitable coating 42. At one end of the presser table 41 is fixed a protruding follower 43, serving for the alignment of the presser table in relation to the book to which the cover is to be applied, and which book is retained immovably in the vertical direction between the conveyor belts of the book feeding device.

The mechanism in FIG. 5 works in the following manner. An arriving book B releases, in a manner to be described more closely in the following, the drive wheel 30, for example, by withdrawing a pawl arresting said wheel. The drive wheel 30 turns the wheels 31 and 32 in the clockwise direction so that the eccentrics 33 and 34 are set in motion. The feeding members 37 and 38 and the presser table 41 connected therewith perform a cyclic movement as indicated by the circle at the left-hand top of the figure. At the moment when the presser table 41 with the coating 42 hits the book B, the movement of the presser table will become rectilinear, the coating 42 sliding along the book B until the follower 43 engages the book. Hereafter the book and presser table keep pace until the speed component of the presser table in the horizontal direction becomes smaller than the speed of the book in the same direction. When the eccentrics have taken one turn round in the cyclic movement they are again stopped, for example, by the above mentioned pawl engaging the gear wheel 30 and stopping the movement thereof.

The close-pressing mechanism 5 may in a manner known per se be, designed as a conveyor, like the conveyor 2, but may also be designed mainly as shown in FIG. 6 as in using certain glues it may be desirable to effect a close-pressing of the cover to the spine of the book after the book has left the cover-applying presser mechanism. The close-pressing mechanism in FIG. 6 comprises an endless horizontal conveyor belt 50 which passes around two rollers, 51 and 52, which over part of the stretch between the two rollers are supported by a stationary but, if desired, adjustable and/or resilient pressure member 53, for example, a rail or a metal plate, and are over the remaining part of said stretch pressed locally against a number of rollers 54 individually suspended in a carrier frame, the shafts sliding in slots 55 and being actuated by pressure springs 56. The frame with the rollers 54 may be adjustable as a unit.

Above the components 2, 3, 4, 5 and 6 provision is

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made for a book feeding device comprising two conveyor belts 60 and 61, of which the former, 60, passes around a drive roller 62 and a roller 63, and the latter 61 passes around a drive roller 64 and a roller 65. The conveyor belts 60 and 61 are kept tight by adjustable tightening rollers 66 and 67. The drive rollers 62 and 64 are—via one shaft each—of which only one 68 is illustrated in FIG. 2, connected with a shaft 12b in the gear box 13 via a pair of conical gear wheels 69 and 70. The conveyor belts 60 and 61 are along the parts facing each other guided against up and down movement by means of U-shaped rails 71 and 72, such as it will appear of the partial section shown in FIG. 7. One of the rails 72 is mounted displaceably towards and away from the other rail 71 and may be secured in the adjusted position by means of a bolt 73, at each end of said rail. The adjustment means may also, in a manner known per se, comprises a spindle with a hand wheel or any other mechanism whatsoever for providing a parallel displacement of the rail 72. In the U-rails 72 there are mounted a number of thrust pads or other pressure members 74 supporting the conveyor belts 60 and 61. The thrust pads 74 are actuated by pressure springs 75 so that the thrust pads are kept pressed outwards against the back of the conveyor belts.

In alignment with the pressure station there is a cover-feeding device, but as such device is known per se, and does not as such constitute part of this invention, it shall not be described in detail. The cover-feeding device comprises a table 80 for a supply of covers which one by one are fed under the influence of a control means. A cover released from the supply stack is passed on to a conveyor 81 having a number of parallel inclined rollers 82 driven by a belt located under the rollers, against which belt the rollers are in frictional engagement. The roller conveyor 81 has no rollers in the place where the presser mechanism is located. At the end of the roller conveyor there is an adjustable stop 83 which at the same time contains an electrical switch 83a which is actuated when a cover engages the stop. Further there is an adjustable resilient stop 84 ensuring the correct position of the cover during the application, namely so that the cover is kept into engagement against an aligning rail along one side of the roller conveyor. With a view to lifting the cover over and past the stop 84, there is an electromagnetically operated release device 85 comprising a lifting finger 86.

In the embodiment shown the controlling means of the machine comprise two switches, 90 and 91, FIG. 1. The switches may, for example, be micro switches and in the embodiment shown in the drawing they are designed as double switches, i.e. that each of them is constituted by two switches actuated one after the other when a book is passing, the actuation member of the switch members protruding into the path of feeding of the books. The switches may be mounted displaceably in the direction of feed of the books so that the correct timing may be obtained by adjusting the position of the switches.

FIGS. 3 and 4 show two circuit diagrams, each comprising the four possibilities of connection which may occur when each of the switching devices is constituted by two series-connected double switches. The switching device in FIG. 3 consisting of the switches 90a and 90b controls the cover applying device in that the switches, for example, may be included in a circuit comprising a power supply and a relay which, when actuated, involves a release of the cover applying device, so that a cover is advanced. In the upper row, marked A in FIG. 3, the position of the switches will be seen, when the switch mechanism is not actuated. In this case, the switch 90a is open and the switch 90b closed. An arriving book firstly closes the first switch 90a, so that the situation illustrated by the row marked B occurs, in which case both switches 90a and 90b are closed, and an impulse is sent to the cover emitting mechanism. During



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its further travel forward the book engages the switch 90b whereby the situation shown in the row C occurs, i.e. that the series connection is open, because the switch 90b is open. When the book has left the switch 90a, but still actuates the switch 90b, the situation shown in the row D occurs, where both switches 90a and 90b are open. If, hereafter, there is an intermediate space between the book having involved the aforementioned sequence of contact operations, and the subsequent book fed by the book feeding device, the situation shown in the row A again occurs. If this is not the case but on the contrary two books follow immediately after each other the contact 90b will remain open and, consequently, a cover for the subsequent book cannot be advanced. Hereby the machine is secured against errors as a consequence of the books following too closely upon each other. Such fault does not occur during normal operation because it is possible, by using a conveyor at the insertion end of the machine, for example, a belt conveyor running a little faster than the conveyor bringing the book forward from the preceding working machine, to secure a suitable minimum spacing between the books. A corresponding effect as the one described in FIG. 3 may be obtained by using a relay of delayed action so that a repeated actuation may only occur after a predetermined time interval following a preceding actuation.

FIG. 4 shows the corresponding situation for the switching device controlling the presser mechanism. Here there are two series-connected switches 91a and 91b, and it will be seen that the closing of the series-connection first occurs when the rear edge of a book has left the actuation member for the switch 91a but is still in contact with the switch member for the switch 91b. This position is shown in the lowermost row D. It is, of course, possible to use only a single switch which may be included in the series connection of a power supply, preferably a D.C. source, e.g. a rectifier, supplied with three-phased A.C. current, and the electromagnet which actuates the presser mechanism. The said circuit may also actuate the electromagnet indirectly through a relay, which connects a power supply to the electromagnet.

FIG. 8 shows a circuit diagram for an embodiment of the circuit for actuating the cover-applying presser mechanism. 91 is the switch actuated by the book, 83a is the switch actuated by the cover when advanced into correct position, 92 is an electric delaying arrangement, and 93 is a power supply, while 94 is a relay to the contacts of which a power supply 95 and the electromagnet 29 of the presser member are connected. In this case the switch is a single switch, and the electric circuit is so arranged as to be prepared for the moment when an arriving book actuates the switch. The impulse proper initiating the actuation of presser mechanism is, however, the impulse obtained at the moment the book disengages the switch. The provision of the function here described is well-known by the man skilled in the art, and need, therefore, not be described in detail here.

The described machine operates in the following manner. The conveyor 2 and the book feeding device 7 are started preferably so, that the book feeding device runs a little faster than the conveyor 2, hereby a minimum spacing between the books can be ensured. The books are introduced between the two conveyor belts in the book feeding device with their spines facing downwards. When the books travel by the gluing roller, glue is applied to their spines. The glue may hereafter be partly dried by heating and/or blowing. This is not shown in the drawing. When a book actuates the switch 90, a cover is as a consequence of the impulse hereby given to the cover-feeding device advanced above the presser mechanism 4 and actuates the switch 83a whereby the circuit shown in FIG. 8 is prepared so that it can be closed when the book actuates the switch 91. A delaying relay may be inserted in the circuit between the switch 90 and

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the cover-feeding device so that the time during which the cover-feeding device works can be adjusted dependent on the size of the cover to be supplied from the supply stack, e.g. by means of a rotary sucking roller.

At the moment when the relay 94 is energized, the electromagnet 29 in the presser mechanism is energized too, whereby the presser frame 21 with rollers 22 moves in the vertical direction and thereby lifts the cover upwards into engagement with the overhead disposed book which is clamped between the conveyor belts of the book feeding device. The rollers 22 have the effect that there is no appreciable friction between the presser mechanism and the cover, and as the friction between the cover and the book is many times greater, the cover is carried along with the book and it proves that this takes place each time with extreme accuracy in the position of the cover in relation to the book. In known machines, care is taken that the book and the cover are conveyed with one and the same speed, when the cover is applied to the book. In some machines the book is arrested when the cover is applied to the book. In these machines both cover and book are at this moment also conveyed with the same speed, viz. the speed nil at the moment of approach. In the machine according to the invention the moving book carries the cover along with its own travelling speed from the moment when contact between the book and cover is obtained.

The introduction of the delaying arrangement 92 with adjustable delay has the effect that the time during which the presser mechanism maintains the pressure of the cover against the spine of the book, can be adjusted so that the machine may easily be adapted to different sizes of books and working speeds, inter alia with a view to obtaining the highest possible degree of efficiency in each individual case.

During the continuous movement of the book it passes the close-pressing device 5 which takes care of a further close-pressing of the cover to the spine of the book. Also in this place the book may, if so desired, be exposed to heat with a view to quick drying of the glue. Next, the book is passed in between the folding rails 6 which fold the cover along the edge of the book spine around the book.

Eventually, the book reaches the end of the machine and may be removed manually or automatically by any known arrangement, completing, if necessary, the folding of the cover.

Various other alterations and modifications than those described may be made in the present invention without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

Having thus described my invention, I claim:

1. A machine for applying covers to books, comprising a continuously working book feeding device for uninterrupted feeding of books with any interspacing and with the books positioned in the vertical plane with their spines facing downwards,
  - a cover feeding device for feeding horizontally disposed covers one by one to a pressure station located under the book feeding device,
  - a presser device having an at least vertically movable surface for pressing the cover fed against the overhead-disposed book, when said book is located in a pre-determined position,
  - and controlling means being independent of the book feeding device, for controlling the cover feeding device and the presser device, respectively, which controlling means are arranged for being actuated by the books advanced by the book feeding device.
2. A machine as claimed in claim 1 wherein the book feeding device comprises two endless conveyor belts having two parts located opposite each other at a distance corresponding to the thickness of a book.



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3. A machine as claimed in claim 1 wherein the presser mechanism comprises a movably disposed presser frame having presser members and means for moving the presser frame in the direction towards the book feeding device.

4. A machine as claimed in claim 1 wherein the presser mechanism comprises a movably disposed presser frame having presser rollers mounted rotatably therein, and an electromagnet for moving the presser frame in the direction towards the book feeding device.

5. A machine as claimed in claim 1 wherein the presser mechanism comprises a vertically movable resilient presser table having a protruding feeding member, transmission means for applying a cyclic movement to said presser table, driving means for driving the said transmission means and a slip clutch inserted between the said transmission means and the driving means.

6. A machine as claimed in claim 1 wherein the controlling means comprises two electrical switches of which one switch is included in a circuit which, when the switch is closed, releases the feeding of a cover by means of said cover feeding device, and the other contact is included in a circuit which after having been actuated by the switch activates said presser device.

7. A machine for applying covers to books comprising a book feeding device having two endless vertical conveyor belts, of which two parts are lying with short distance opposite each other and between which parts the books are fed, and means for adjusting the mutual distance of said two paths in dependence on the book thickness, means for driving the two conveyor belts with same speed, and means for adjusting said speed,

a cover feeding device for feeding covers to a presser station under the conveyor belts, a presser device having an at least vertically movable surface for pressing the cover fed against the overhead-disposed book while said book is in motion, and

controlling switches being independent of the book feeding device and positioned in the path of the books

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fed, for controlling the book feeding device and the presser mechanism, respectively.

8. A machine as claimed in claim 7, comprising after the presser device viewed in the travelling direction of the book feeding device a close-pressing device which when a book and cover leave the presser device keeps the cover pressed against the spine of the book during the further travel.

9. A machine as claimed in claim 7, comprising guiding means for folding the cover near the delivery end of the book feeding device.

10. A machine as claimed in claim 7, comprising a conveyor for conveying the finished books away at the delivery end of the book feeding device.

11. A machine as claimed in claim 7, wherein the controlling circuit comprising the controlling switch for controlling the presser device includes a further controlling switch which can be actuated by a cover when said cover is located in the correct position above the presser device and which further controlling switch has to be actuated in order that, when a book has actuated the first mentioned controlling switch, an impulse can be given for actuating the pressure device.

12. A machine as claimed in claim 7, comprising adjustable electrical delaying means for the actuation of the pressure device.

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