# United States Patent

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**Continuation-in-part of Ser. No. 677,258, Oct. 23, 1967, now Patent No. 3,510,119.**
[45] Patented **Dec. 1, 1970**
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[54] **SIGNATURE HANDLING APPARATUS**
**3 Claims, 6 Drawing Figs.**


[52] **U.S. Cl.** ..... **270/54;** 271/5, 271/51
[51] **Int. Cl.** ..... **B65h 39/02**
[50] **Field of Search** ..... 271/51; 270/54—56



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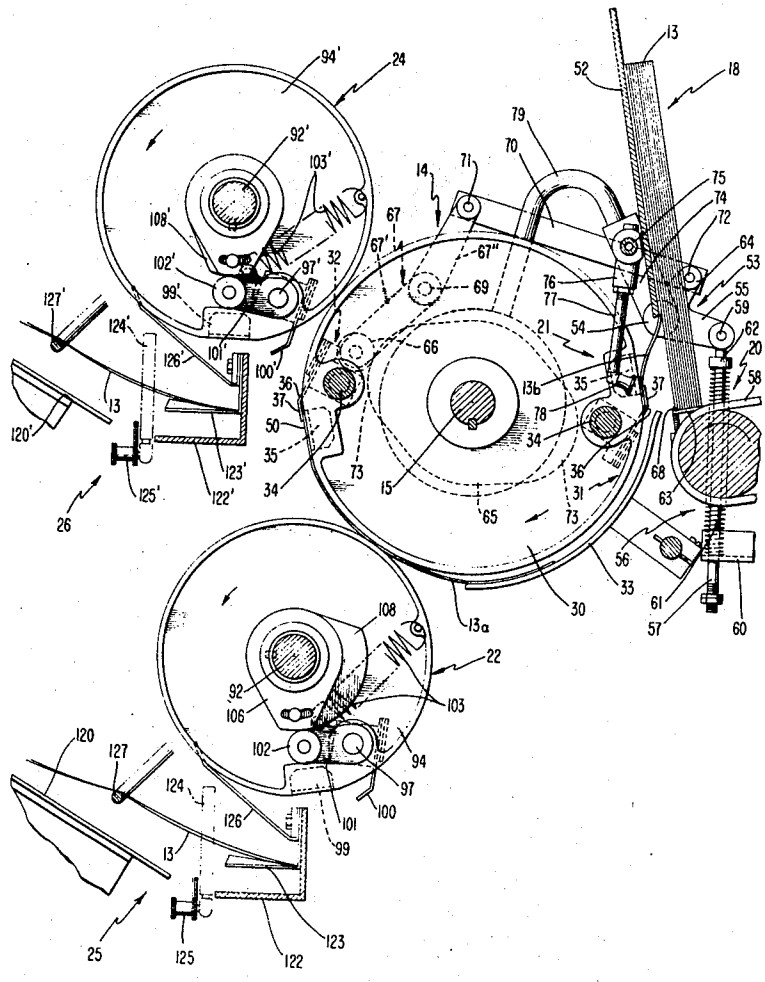
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**ABSTRACT:** An apparatus and method for handling signatures, sheets, and the like, such apparatus being adapted for use in collating apparatus having a series of hoppers from which signatures are fed in rapid succession to a plurality of conveyors where the signatures are gathered in collated form. The invention particularly relates to a novel apparatus and method for effecting the transfer of signatures in generally flat condition from one of said hoppers to said plurality of conveyors. The apparatus includes a single primary transfer reel receiving signatures from the hopper and transferring them in generally flat condition, and a plurality of similar, similarly driven secondary transfer reels interposed between the primary transfer reel and the respective conveyors, said secondary transfer reels each receiving selected ones of the signatures transferred by the primary transfer reel and carrying them in generally flat condition to the conveyors.

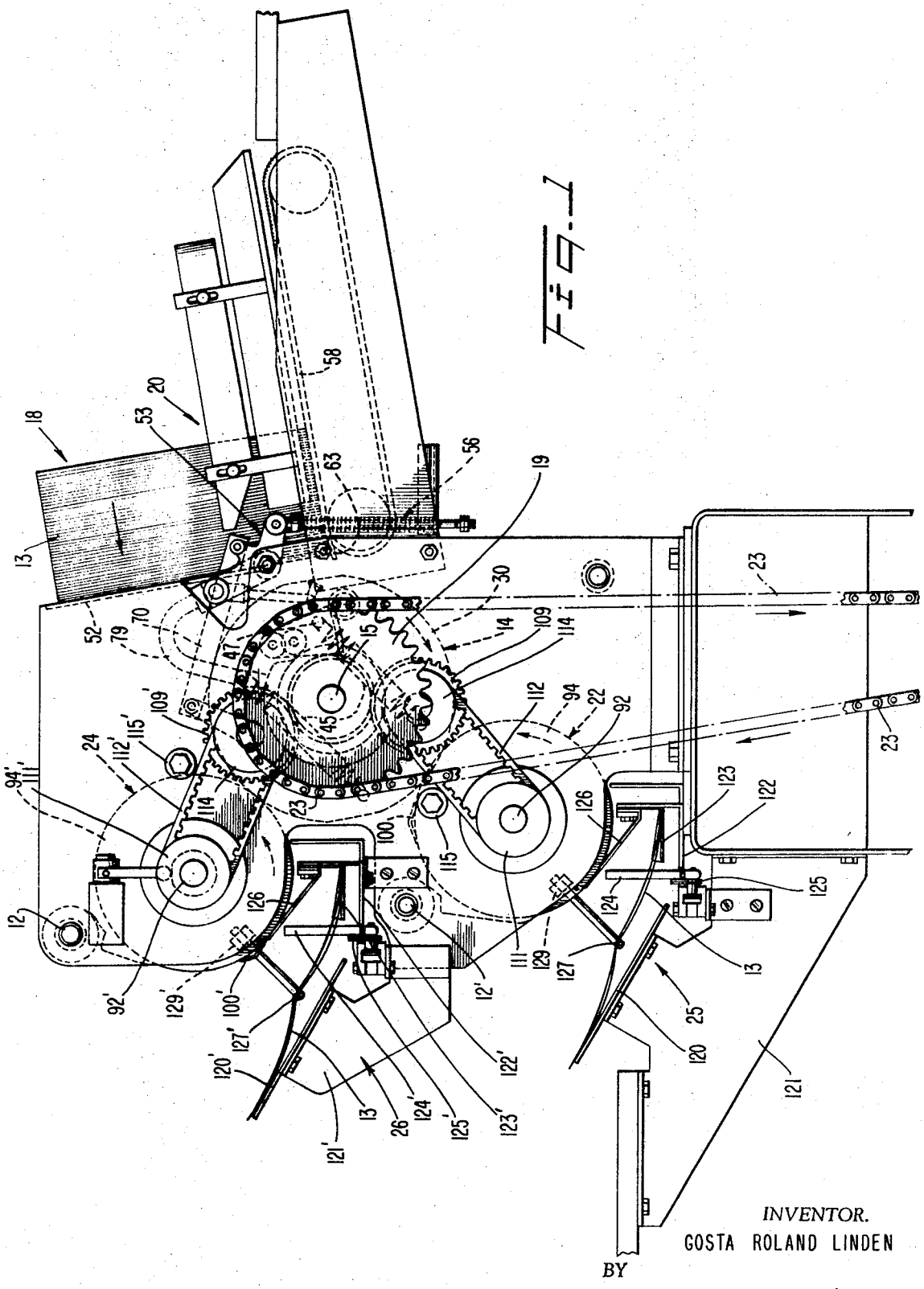


FIG. 1

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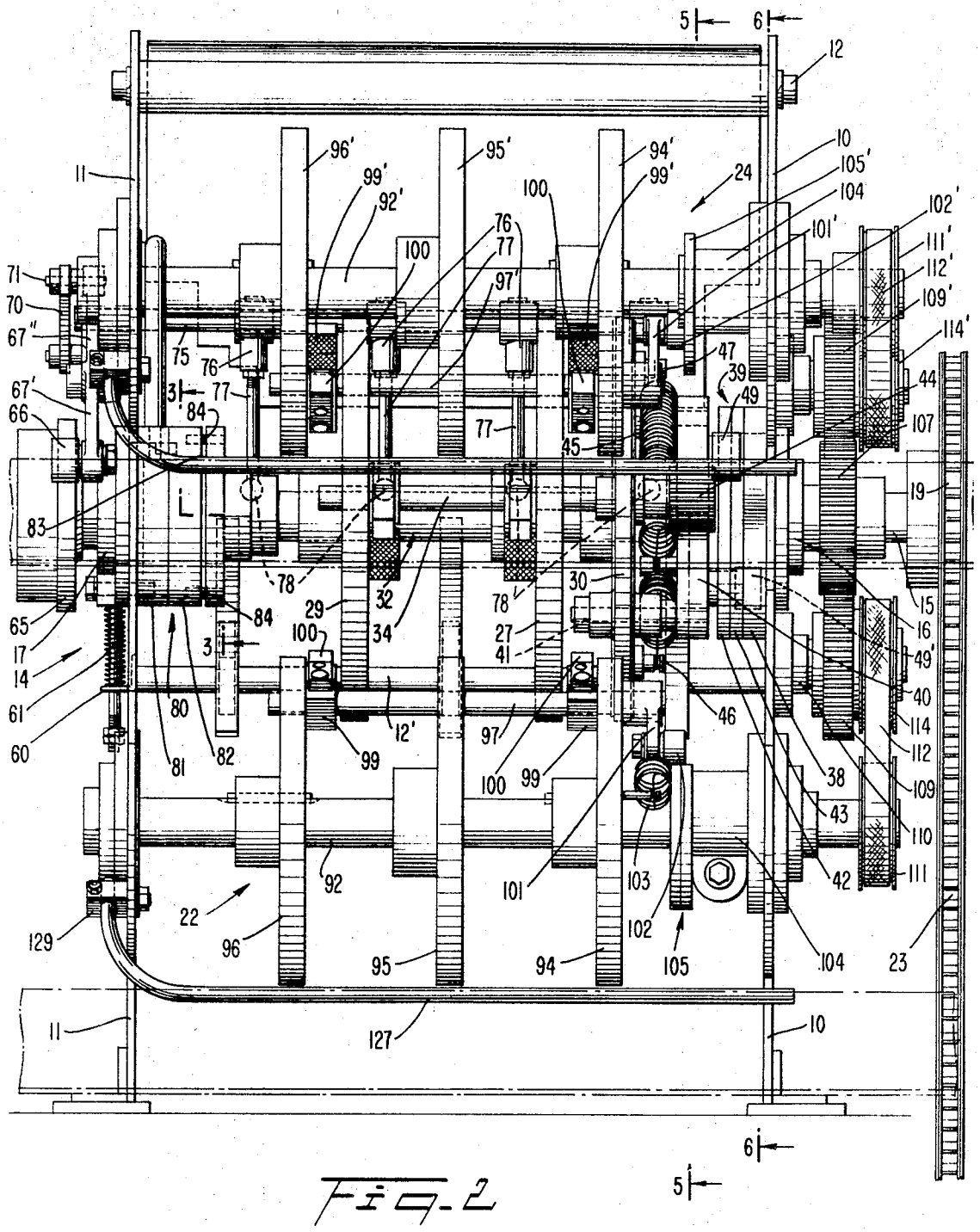



Fig. 2

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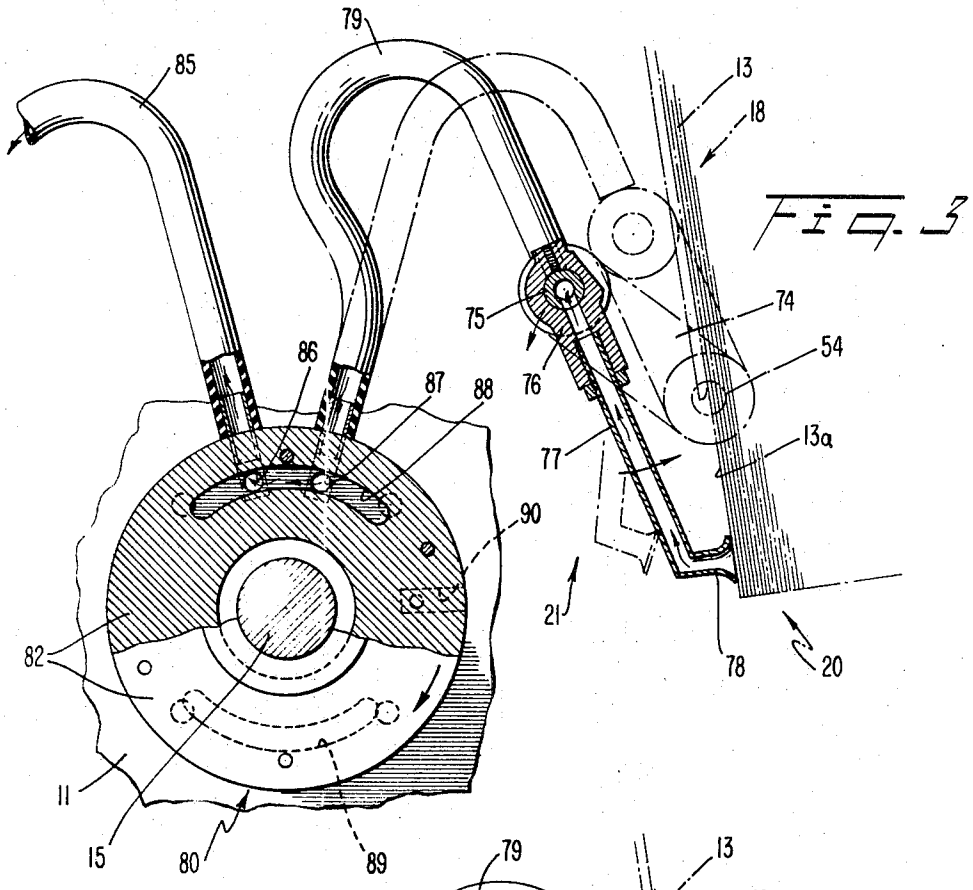



Fig. 3

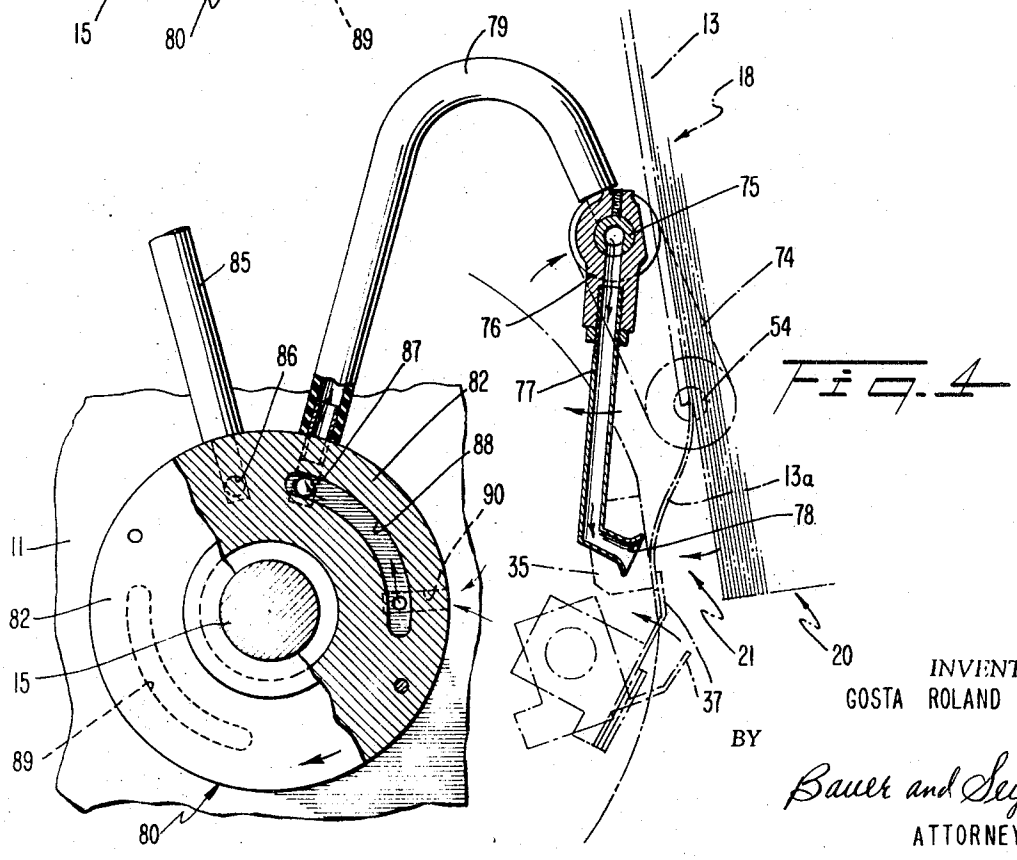



Fig. 4

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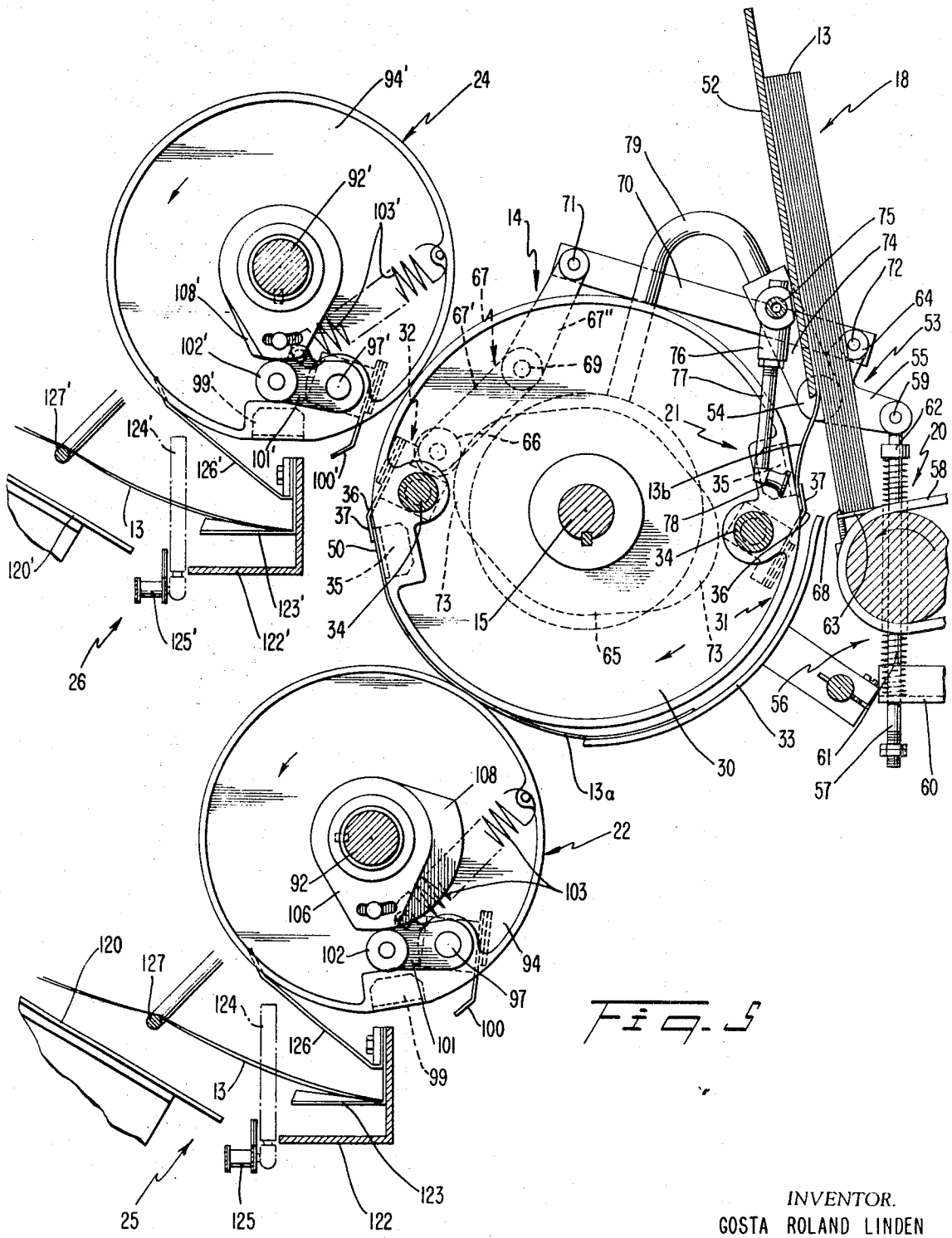



Fig. 5

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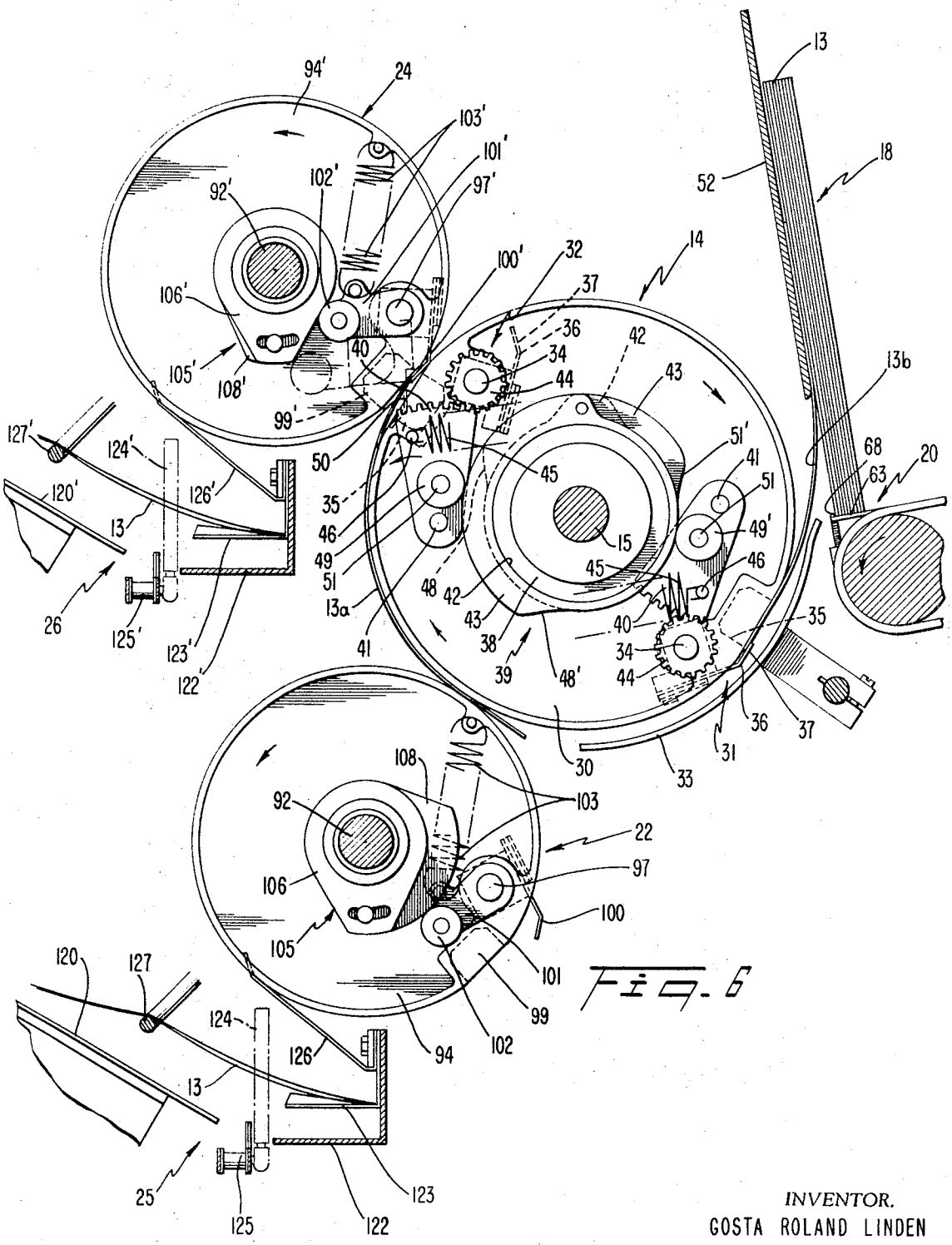



Fig. 6

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# SIGNATURE HANDLING APPARATUS

This application is a continuation-in-part of U.S. Pat. application Ser. No. 677,258, filed Oct. 23, 1967, now U.S. Pat. No. 3,510,119. The invention relates to an apparatus and a method wherein a plurality of stacked signatures are fed in succession from a hopper to successive collating conveyors by transfer mechanism interposed between the hopper and each of the conveyors.

In Gore U.S. Pat. No. 3,147,007, issued Sept. 1, 1964, and assigned to the assignee of the present invention, there is disclosed an apparatus for handling signatures and adapted for generally the same purpose as the apparatus of the present invention. In the apparatus of Gore, however, the first or primary transfer mechanism is of the so-called planetary type, each of the rotating or planet signature transfer means on the reel of the first transfer mechanism being provided with its own signature gripper means in the form of vacuum cups, such gripper means also feeding the signatures from the hopper.

In contrast thereto, the apparatus of the present invention employs a first or primary reel type transfer means in the form of a rotatable frame, the first transfer means having a plurality of angularly spaced signature transfer stations thereon at each of which the signatures lie in generally "flat" condition, disposed about the periphery of the frame. The signatures are thus readily accessible at all times, and may be readily removed from the first transfer means when necessary, as upon the misfeeding of one or more signatures. Further, the gripper means on the first transfer means are mechanically operated and thus are positive in their operation. The described construction of the first transfer means of the present invention permits the use of a single transfer means, here disclosed as a vacuum cup transfer means, mounted on the stationary frame of the apparatus and disposed to transfer signatures one at a time from the hopper to the first transfer means.

In the apparatus shown in the above patent to Gore a second transfer means is disposed between the first transfer means and each of the collating conveyors, the plurality of second transfer means being angularly spaced about the axis of the first transfer means. In such prior apparatus, however, the two secondary transfer means are of different construction and are driven at different speeds. In the apparatus of the present invention, the two secondary transfer means are of identical construction and are driven at the same speed, thereby permitting the duplication of parts in the manufacture of the apparatus, and simplifying the timing of the primary and secondary transfer means relative to each other.

The invention has among its objects the provision of a signature feeding apparatus which maintains the signatures in generally flat condition while feeding them from a hopper to successive conveyors.

Another object of the invention is the provision of signature feeding apparatus wherein the signatures being fed are readily accessible at all times, and may be readily removed from the apparatus when necessary.

A further object of the invention is the provision of signature feeding apparatus having a first or primary transfer means and a plurality of second transfer means receiving signatures from the primary transfer means, all of the transfer means having mechanically operated signature gripping means.

A still further object of the invention is the provision of signature feeding apparatus having a first transfer means and a plurality of second transfer means wherein the second transfer means are of at least substantially the same construction.

Yet another object of the invention is the provision of improved mechanism for transferring signatures one at a time from a hopper to a signature transfer mechanism such as a reel having signature gripping means thereon.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.



In the drawings, wherein like reference characters refer to like parts throughout the several views:

FIG. 1 is a fragmentary view in side elevation of signature feeding mechanism in accordance with the invention, such mechanism supplying signatures to one station of each of two collating conveyors;

FIG. 2 is a view in end elevation of the apparatus of FIG. 1, the view being taken in the direction from left to right in FIG. 1, the two collating conveyors being omitted for clarity of illustration;

FIG. 3 is a fragmentary view in vertical section through the apparatus, the section being taken along the broken section line 3–3 of FIG. 2, the view showing in solid lines the suction pickup of the apparatus engaging a signature being fed from the hopper, the position of such pickup before it engages the signature being shown in phantom lines;

FIG. 4 is a view similar to FIG. 3 but with the suction pickup having released the signature which it engages in FIG. 3 and such signature engaged by a gripper on the primary transfer reel;

FIG. 5 is a view in vertical section through the apparatus showing the parts thereof in a position somewhat different from those in FIGS. 1 and 2, the vacuum pickups being shown as having released a signature which is now engaged by a gripper on the primary transfer reel, the section being taken along the line 5–5 of FIG. 2;

FIG. 6 is a view in vertical section along line 6–6 of FIG. 2 through the apparatus, such view showing the parts of the apparatus in a still different position, later than that of FIG. 5, with two signatures disposed upon the primary transfer reel.

One form of signature handling and feeding mechanism constructed and operated in accordance with the present invention is herein illustrated in a signature gathering machine wherein a series of supply stacks or hoppers (one shown) containing piles of printed and folded sheets referred to as signatures are simultaneously fed from said hoppers by a series of similar signature transfer means. Each of the signature transfer means alternately deposits a signature on two spaced apart pusher type conveyors so that the signatures from the hoppers are successively assembled flatwise one upon another into groups on each conveyor for subsequent stitching and/or binding operations to form complete books, magazines or the like. It will be understood that this novel signature handling and feeding mechanism may also be embodied in other machines for handling and feeding plain sheets of paper as well as signatures. For the sake of simplicity and brevity in illustrating and describing the present invention, and since all the feeders are identical in construction, arrangement and operation, only one of the series of signature handling mechanisms is herein illustrated and described.

The illustrative apparatus of the invention includes a first transfer reel having a plurality of signature transferring stations spaced thereabout, and means for feeding one by one the signatures from a hopper to such first transfer reel. An automatically operated first gripper means is provided at each station on the first transfer reel, the respective first gripper means engaging the leading end of signatures which are successively fed from the hopper. A plurality of second transfer reels, two shown herein, which are of similar construction and are similarly driven in synchronism with the first reel, are spaced angularly about the first transfer means and are each interposed between the first transfer reel and a respective conveyor of the collator. The second transfer reels, which have automatically operated second gripper means thereon, are of such construction and are so mounted that the path of the second gripper means thereon is tangential to the cylinder containing the path of the first gripper means on the first transfer reel, but is laterally displaced therefrom. The signatures on the first transfer reel are transferred to successive second transfer reels, and from there are transferred to respective collating conveyors.

In the preferred embodiment, a single means having time-operated vacuum cups is employed to feed the signatures from

one end of the stack thereof in the hopper to successive transfer stations on the first transfer means. Each of the second transfer means is of the same construction, and is driven at the same speed but in a different phase relationship relative to the first transfer means. As a result of such construction, that is, the use of a single means for transferring signature means from the hopper, and the identical construction of the second transfer means, the construction and maintenance of the apparatus of the invention are markedly simplified.

## GENERAL ORGANIZATION OF THE APPARATUS

Turning now to the drawings, the apparatus of the invention has a fixed frame which includes spaced upright parallel main frame members affixed to a suitable base such as a table, as shown. The right-hand platelike main frame member in FIG. 2 is designated 10, the generally similar left-hand frame member being designated 11. The upper and intermediate portions of frame members 10 and 11 are secured together in the desired spaced relationship by cross or spreader members affixed to the frame members 10 and 11, an upper crossmember being designated 12 and a lower crossmember being designated 12'. The parts of the signature handling apparatus, to be described, are supported upon such frame, such parts including a signature hopper 20 having a partially open lower end, a first or primary signature transfer means 14, means 21 for feeding signatures one at a time from the hopper to the first transfer means, a plurality (two shown) of secondary transfer means 22, 24 selectively receiving signatures from the primary transfer means, and a plurality (two shown) of pusher type conveyors 25,26, one such conveyor being associated with each secondary transfer means.

A stack 18 of a plurality of signatures 13 is held in the hopper 20, signatures 13 being fed therefrom one at a time by a feeding means generally designated 21 which in this instance is of the vacuum cup type. Signatures thus fed by the means 21 are delivered to the first or primary signature transfer means 14, which is of the reel type. Means 14 has a main horizontal shaft 15 which extends between the frame members 10 and 11 and is journalled in bearings 16 and 17 affixed to such respective frame members. Shaft 15 is driven by suitable means (not shown) such as an electric motor which is connected to such shaft by a chain 23 entrained about a driving sprocket 19 on the end of the shaft outwardly of frame member 10.

Angularly spaced about the shaft 15 is a plurality of second or secondary transfer means of the reel type, there being two such transfer means shown, the lower of which is designated 22 and the upper of which is designated 24. The paths of signatures carried by the primary and secondary transfer means coincide at one angular zone of each of such means. Transfer means 22 and 24 are driven in timed relationship to the primary transfer means 14 so that a signature 13 carried by transfer means 14 is released from the primary transfer means at the same time as it is being gripped by the gripping means on the respective secondary transfer means. The secondary transfer means 22 and 24 discharge their respective signatures to the respective pusher type collating conveyors 25 and 26, where they are superimposed upon and/or underlie other signatures which have been fed to the conveyors by other similar signature handling mechanisms. The use of two or more secondary transfer means 22, 24 permits the pusher type collating conveyors to be run correspondingly more slowly than if all of the signatures discharged from the primary transfer means were deposited upon a single conveyor. As a consequence, the speed of the pusher fingers upon the conveyors is decreased and there is much less danger of injuring the stacked signatures by the signature engaging fingers of a conveyor.

### The Primary Transfer Means 14

As shown more clearly in FIG. 2, the primary transfer means 14 includes a right-hand disc 27 and a left-hand disc 29, such discs being spaced apart along the shaft 15. The signatures being fed by transfer means 14 are supported on the peripheries of such discs 27, 29. Discs 27 and 29 are affixed to the shaft 15 and rotate therewith along with a further, gripper operating disc 30, which is affixed to the shaft outwardly of the disc 27. In the embodiment shown, the transfer means 14 has two signature feeding stations which are spaced 180° about its axis, the first such station being designated 31 and the second being designated 32. Since the two stations are identical except as noted below, only station 31 need be described in detail.

At the location of the station 31 on the transfer means 14 there is a cross gripper shaft 34 which extends between and is journalled in the discs 27 and 29. Shaft 34 extends outwardly beyond disc 27 to the gripper operating disc 30 in which the end of the shaft is also journalled. Attached to the laterally inner faces of each of the discs 27 and 29 at the station 31 is a fixed gripper pad 35, the radially outer surface of which lies on a shallowly flattened zone 50 of the respective discs 27 and 29. Affixed to the gripper shaft 34 by suitable collarlike fittings telescoped over the shaft 34 adjacent such discs are gripper leaf springs 36. The trailing end 37 of each gripper spring overlies the respective gripper pad 35 when the gripper is closed, as shown in FIGS. 5 and 6. The shaft 34 is oscillated in timed relationship to the rotation of the shaft 15 and the first transfer means 14 mounted thereon so that the gripper means is open to receive the lower or leading end of a signature which has been separated from the stack 18 by means 21, is closed immediately thereafter, and remains closed until the signature is ready to be transferred to the gripper means of a respective one of the secondary transfer means 22 and 24. The remainder of the thus gripped signature travels about the reel 27, 29 of means 14 upon the innner surface of curved guides 33 which are spaced outwardly from the peripheries of discs 27 and 29.

Such timed operation of the gripper means 35, 36 is effected as follows. Mounted upon the inner face of frame member 10 and disposed around the main shaft 15 is a composite cam 39 which in this instance has two ringlike portions 42 and 43 of the same external contour and a third cam ring 38. An annular fitting 38' adjustably mounts the parts 38, 42, and 43 of the composite cam upon the frame member 10, fitting 38' having a circular cylindrical hub upon which the cam portions 38, 42, 43 are adjustably mounted and secured by set screws (not shown). It will be seen that by loosening the set screws for retaining the cam parts 38, 42, and 43, such parts may be turned relative to the fitting 38' and to each other in order suitably to adjust the timing of the operation of the gripping means 35, 36 at stations 31, 32.

In order to open and close the gripping means 36 through a larger arc there is employed in the operating mechanism for each a gear segment 40 (FIG. 6) on one arm of a lever which is pivotally mounted at its outer end on a cross shaft 41 which is affixed to the disc 30. The gear teeth of the gear segment mesh with a pinion 44 affixed to the gripper shaft 34. A coil tension spring 45, which extends between a spring anchor 46 on gear segment 40 and a spring anchor 47 on disc 30 constantly urges the gear segment in a clockwise direction, as it is shown in FIG. 6, that is, in the gripper closing direction. The gear segment 40 is cyclically thrust in the opposite direction against the opposition of spring 45 by a cam following roller 49 which is journalled on the gear segment lever intermediate its length. Roller 49 engages and follows only the portions 42, 43 of the above described composite cam 39 as the reel of means 14 rotates with shaft 15 with respect to the cam 39. The gripper means at station 31 is identical with that at station 32 except that the cam follower roll 49' at station 31 is so disposed as to engage only the portions 38, 43 of the cam 39.

It will be apparent from the above that the gripper means at each of stations 31 and 32 remains open so long as its cam follower roll engages a high zone of the cam portions which it follows, and is closed by its spring when its cam follower roll engages a low zone of its cam portions. The cam follower 49' at

station 31 (FIG. 6) after having entered the low zone of cam portions 38, 43 remains closed until the reel 14 has turned sufficiently clockwise for the roll 49' to begin to climb ramp 48 of cam portion 38. Thereafter the gripper means at station 31 remains open until such station again approaches the signature hopper 20, at which time roll 49' travels down the ramp 51' of cam portion 43. The gripper at station 32 remains closed until its roll 49 encounters ramp 48' of cam portion 42, and remains open thereafter until roll 49 travels down ramp 51' on cam portion 43. The gripper means of station 31 on reel 14 is thus closed as such station travels from hopper 20 to the lower secondary transfer means 22. The gripper means of station 32 is closed during the travel of such station from hopper 20 to the upper secondary transfer means 24. After the stations 31 and 32 have reached their respective secondary transfer means 22 and 24, their gripping means are opened to permit transfer of the signatures which they grip to the proper secondary transfer means.

## The Hopper 20

The hopper 20 is provided with an inclined conveyor having a driven belt 58, such conveyor being provided with conventional side guides, as shown. A transverse and upwardly and forwardly inclined plate 52 serves to stop the stack 18 of signatures 13, and with the cooperation of a bottom support 63 supporting the stack as shown. The end stop plate 52 terminates substantially above the bottom support 63, so as to permit access of the vacuum separator means 21 to the lower end of the forwardmost signature in the stack. The bottom support 63 has a plurality of adjustable pins 68 on its forward end, so that the forwardmost signature in the stack is stably held until it is gripped and separated by the means 21.

## The Vacuum Cup Separator 21

As shown in FIGS. 1 and 5, at the right-hand edge of the frame of the apparatus as it is there shown, and adjacent the lower, forward end of the hopper 20 there is disposed a crank lever 53 which oscillates about a horizontal shaft 54 extending between the frame parts 10 and 11. Lever 53 has a first, generally horizontal arm 55 to which is secured compression spring means 56 constantly urging the lever counterclockwise as it is shown in FIGS. 1 and 5. Such means 56 includes a rod 57 which is pivotally secured to the end of arm 55 by a pin 59, a fixed lower abutment 60 through which the lower end of rod 57 extends, and a coil compression spring 61, the lower end of which engages the upper end of the abutment 60 and the upper end of which engages a nut or collar 62 adjustably mounted upon the rod 57. It will be seen that the spring 61 constantly urges the arm 55 upwardly and thus the lever 53 counterclockwise.

The crank lever 53 has a second, generally upright arm 64 which is connected to a cam follower for operating the vacuum cup separator. The cam 65 (FIGS. 1 and 5) for operating the vacuum separator is mounted upon the left-hand end of the main shaft 15 of the primary transfer means as it is shown in FIG. 1, and rotates with such shaft. Cam 65 is of symmetrical shape (FIG. 5), having two lobes 73 disposed 180° apart, and two low zones between the lobes. A cam follower roll 66 is journalled on the outer end of a first arm 67' of a first-class cam follower lever 67, lever 67 being pivotally mounted approximately centrally thereof on a stub shaft 69 which is affixed to the frame part 11. The other arm 67'' of lever 67 is connected at its outer end by a pivot pin 71 to the rear end of a bar 70, the forward end of the bar 70 being connected by a pivot pin 72 to the outer end of the second lever arm 64 of crank lever 53. It will be apparent that the coil compression spring 61 acting through the described linkage causes roll 66 to follow cam 65.

Crank lever 53 has a third arm 74 to which is affixed a vacuum cross pipe 75. Spaced along the cross pipe 75 and affixed thereto are a plurality of fittings 76 from each of which a sucker carrying pipe 77 depends. Affixed to the lower end of each pipe 77 is a sucker head 78, the signature engaging portion of which is made of resilient material such as soft rubber. A flexible hose 79 extends from the upper end of a fitting on the left-hand end of cross pipe 75 to a source of vacuum, to be described.

In its operation the described oscillation of the crank lever 53 by the cam 65 and cam follower 66 and the spring means 56 causes the suckers 78 to be simultaneously moved between the full line and phantom line positions thereof shown in FIGS. 3 and 4. When the cam follower roll 66 engages a lobe 73 of cam 65 the suckers 78 are retracted as shown in FIGS. 4 and 5 and in phantom lines in FIG. 3, and when the roll 66 engages a low zone of the cam the spring means 56 advances the suckers 78, now connected to a source of vacuum, into the position thereof shown in full lines in FIG. 3 wherein it operatively engages the foremost signature 13*a*. As they are advanced, the suckers are moved counterclockwise in an arc; as they are retracted they move clockwise in an arc. Such motion of the suckers upon retraction bends the lower edge portion of the signature 13*a*, which they engage, away from the stack 18. Upon retraction of the sucker toward its inner position, the sucker is shut off from its source of vacuum, whereupon the signature is released from the sucker, and falls into the open gripper means on the primary transfer means 14 which is then disposed adjacent the hopper 20 as shown in FIG. 4.

A rotary valve 80 is provided to connect the sucker heads 78 to the source of vacuum and to disconnect it therefrom at appropriately timed intervals. The valve 80 is formed by a disc 81, which is affixed to frame member 11 (FIG. 1), and a rotary disc 82 which is driven by the main shaft 15 of the transfer means 14 and is thrust in strong face-to-face sealing engagement thereagainst. The rotary disc 82 is driven by the shaft 15 through the intermediary of a disc 83 affixed to the shaft, there being pins 84 affixed to the disc 83 which extend into blind bores in the outer face of disc 82, coil compression springs (not shown) telescoped about the pins 84 acting between the discs 83 and 82 in order to thrust disc 82 against disc 81.

Appropriate holes and grooves are provided in the confronting faces of the discs 81 and 82, some of the grooves communicating with a main vacuum supply pipe 85 and others communicating at predetermined intervals during the rotation of the shaft 15, with the sucker heads 78.

The parts are so constructed and arranged, as above explained, that the sucker heads are not connected to vacuum until they begin their outward swing toward the end signature 13*a* held in the hopper 20, the vacuum being cut off from the sucker heads when the sucker heads pull the lower end of the gripped signature above the curved feeding channel formed between the peripheral edges of the discs 27 and 29 and the outer curved guide members 33 which confront such edges but are radially spaced therefrom as shown in FIG. 5. In the construction shown the disc 81 is provided with a port 86 connected to conduit 85 and a port 87 connected to conduit 79, the two ports being angularly spaced and communicating with the face of disc 81 in contact with disc 82. A further port 90 in disc 81 communicates with the atmosphere. Two oppositely disposed identical part-circular grooves 88 and 89 are located in the face of disc 82 engaging disc 81, grooves 88 and 89 lying on a circle coaxial of and of the same diameter as that upon which ports 86, 87, and 90 lie. When disc shaft 15 and thus disc 82 are disposed as shown in FIG. 3 the suckers 78 are connected to the source of vacuum through groove 88. When disc 82 is disposed as shown in FIG. 4, the suckers 78 are cut off from the source of vacuum and are connected to the atmosphere through port 90. Such actions are repeated when disc 82 has rotated through 180°, so that groove 89 then cooperates with ports 86 and 87, and, upon further rotation, with port 90.

THE SECONDARY TRANSFER MEANS 22 AND 24

Since the two secondary transfer means **22** and **24** are identical except for the gripper operating cams, only the lower secondary transfer means **22** is here described in detail. Parts of transfer means **24** which are the same as those of transfer means **22** are designated by the same reference characters with an added prime. Transfer means **22** has a main horizontal shaft **92** which is journalled at opposite ends of bearings mounted in the side frame members **10** and **11**. Fixedly mounted upon shaft **92** intermediate the length thereof are three discs which are designated **94, 95,** and **96,** respectively, reading from right to left in FIG. **2**. Discs **94** and **96** lie laterally outwardly of and close to discs **27** and **29,** respectively, of the primary transfer means **14**; disc **95** lies equidistant between discs **94** and **96**. At one angular position of the discs **94, 95, 96** there is disposed a gripper shaft **97** which is journalled in such discs. Mounted on the laterally inner surfaces of each of the discs **94** and **96** at the inner face thereof are gripper pads **99** which are similar in construction to the gripper pads **35** employed on the first or primary transfer means **14**. Associated with the gripper pads **99** are gripper fingers **100** in the form of bent leaf springs, the root portions of the gripper fingers **100** are affixed to fittings secured to the shaft **97**. Rocking of shaft **97** causes the gripper fingers **100** to oscillate to an open position spaced from the gripper pads **99**; rocking of shaft **97** in the opposite direction causes the fingers **100** to move into their closed operative position in which the ends thereof overlie the pads. The grippers **99, 100** on the transfer means **22** are selectively operated so that they are in open position when the leading edge of a signature **13** being carried by the primary transfer means **14** approaches them. Thereupon the gripper **35, 36** on the transfer means **14** opens and the gripper means **99, 100** on the secondary transfer means **22** closes so that the signature is now carried forward by the secondary transfer means **22**.

Actuation of the gripper means **99, 100** is effected by a gripper cam lever **101** which is affixed to the outer end of the shaft **97** adjacent the frame member **10**, a cam follower in the form of a roll **102** journalled adjacent the outer end of lever **101**, a ringlike composite cam **105** affixed to frame member **10**, and a gripper return spring **103**. Cam **105** is mounted upon a gripper cam hub **104** secured to frame member **10**, as shown in FIG. **2**. The spring **103** is a coil tension spring, the opposite ends of which are secured to anchoring means on the disc **94** and on the lever **101**. As shown in FIGS. **5** and **6**, the spring **103** acts to maintain the cam follower roll **102** in contact with the periphery of cam **105**, the spring yielding to permit the opening of the gripper means **99, 100** upon the presentation of the lobe of cam **105** to the cam follower roller **102**.

The cam **105** which is affixed to the frame member **10** is composed of two parts **106** and **108** (FIG. **6**) which are adjustable angularly with respect to each other whereby to vary the length of the cam high zone or low. This permits the duration of the time during which the gripper **100** remains open to be suitable adjusted so that the transfer of the signature from the primary transfer means **14** to the secondary transfer means **22** may be effected smoothly. The cam **105'** of the upper secondary transfer means **24** also as two cam members **106', 108'**, cam **106'** being fixedly secured to frame member **10** and cam member **108'** being adjustable relative thereto. Cams **106, 106'** control the opening of the respective grippers whereas cams **108, 108'** control their closing.

The main shaft **15** of the primary transfer means **14** is provided with a pinion **107** (FIG. **2**) affixed thereto. Pinion **107** serves as the means for driving the two secondary transfer means **22, 24** in timed relation with but in the opposite direction from the primary transfer means **14**. Since the parts of the drive trains for means **22** and **24** are similar, only that for means **22** is specifically described, those for unit **24** being the same with an added prime. A pinion **109**, which is of the same diameter as pinion **107**, journalled on a stub shaft **110** affixed to plate member **10** meshes with pinion **107**. A Timing belt sprocket **114** is affixed to pinion **109** so as to rotate therewith. A Timing belt **112** is entrained over the pulley **114** and over a further pulley **111** on the shaft **92** of the secondary transfer unit **22**. Pulleys **111** and **114** are of the same diameter, as shown. The belt **112** is maintained suitable tight by an adjustable eccentrically mounted belt tightening pulley **115** (FIG. **1**). It will be apparent that such means for driving the secondary transfer means **22** and **24** drives them at the same angular speed as, and maintains them at all times in synchronism with, the primary transfer means **14** and with each other. The primary transfer means **14** has an effective outer diameter which somewhat exceeds that of the secondary transfer means **22** and **24**, since the primary transfer means must accommodate two equally angular spaced signature gripping stations thereabout whereas each secondary transfer means has only one signature gripping means upon it.

The Collating Conveyors

The lower collating conveyor **25** and the upper collating conveyor **26** are similar, the same reference characters being employed to designate similar parts except for the addition of a prime to the characters for unit **26**. In unit **25** a transverse inclined plate **120** is shown supported on a bracket **121** affixed to the frame of the apparatus. Generally beneath the lower secondary transfer means **22** there is disposed a longitudinally extending raceway **122** having a flat plate upon which signatures are gathered and along which they are conveyed from one collating station to another. The signatures are conveyed along the raceway **122** by a plurality of upstanding pusher members **124** which are attached to the horizontal upper run **125** of a chain. Signatures carried by the reel of the secondary transfer means **22** are released by the grippers **100** thereof when the grippers reach an approximate 8 o'clock position as the parts are shown in FIG. **1**. The signatures released by the grippers **100** are removed from the reel of transfer means **22** by an inclined stripper plate **126** so as to fall with its leading, folded edge upon a pan **123** of the raceway and with the rear portion of the signature upon a guide rod **127** which is mounted at its rear end upon a block **129** affixed to the frame member **11**. The signature last discharged from the secondary transfer means **22** is carried along the pan **123** and guide rod **127** by a respective finger **124**; after such signature has travelled sufficiently to clear the forward end of pan **123** and the free end of the guide rod **127**, it then falls upon the stack of collated signatures upon plate **122** and is carried by the conveyor as a part of such stack to the next signature transferring station.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art.

I claim:

1. Apparatus for transferring signatures in generally flat condition from a stack of signatures in a hopper in sequence to a plurality of spaced similar conveyors, comprising a primary transfer reel rotatable near the discharge end of the hopper on an axis fixed with respect to the hopper, a plurality of first signature gripping means angularly spaced about the axis of the primary transfer reel and fixedly positioned angularly on said reel when in signature-gripping position, means for bending an edge portion of successive signatures away from said stack to be gripped by said first gripping means, means for periodically operating the respective first gripping means to grip said bent edge portion of successive signatures to withdraw the signatures from the hopper so that the remainder of each signature trails the gripped edge portion thereof and lies spread out along and conforms to the periphery of the pri-

mary transfer reel, a plurality of secondary transfer reels, one for each conveyor, interposed between the primary transfer reel and the respective conveyors, means for continuously rotating the primary transfer reel in one direction and the secondary transfer reels in synchronism therewith in the opposite direction, the secondary transfer reels being angularly displaced from each other about the axis of the primary transfer reel, second signature gripping means on each of the secondary transfer reels to grip said edge portion of signatures presented thereto by a said first gripping means moving in the same general direction so that the remainder of the gripped signature trails the gripped edge portion thereof and lies spread out along and conforms to the periphery of the secondary transfer reel, means for periodically operating the first gripping means in sequence at predetermined angular positions of the primary transfer reel to release signatures to respective second gripping means, and means for periodically operating the second gripping means to grip said edge portion of signatures fed thereto by the primary transfer reel and to release such signatures after the secondary transfer reels have rotated so that the signatures thereon are brought into the respective conveyor. 2. Apparatus according to claim 1 wherein the said edge portion of each signature as withdrawn from the hopper is the leading edge thereof throughout the entire movement thereof by the primary transfer reel and the respective secondary transfer reel.

3. Apparatus according to claim 1 wherein the signatures are disposed in upright on-edge position with said edge portion lowermost in the stack in the hopper, the primary transfer reel rotates close to tangency with the lower end of the hopper, and the said edge portions of successive signatures in the hopper are presented to the first gripping means by a signature feeding means which is mounted at a fixed location relative to the hopper and which grips the foremost signature in the stack adjacent the lower edge thereof, moves such lower edge outwardly from the hopper and thereafter releases the signature in position to be gripped by a respective first gripping means on the primary transfer reel.

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# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,544,097 Dated December 1, 1970

Inventor(s) Gosta R. Linden

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, line 1, after "into" insert -- proximity to --

Signed and sealed this 23rd day of March 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents