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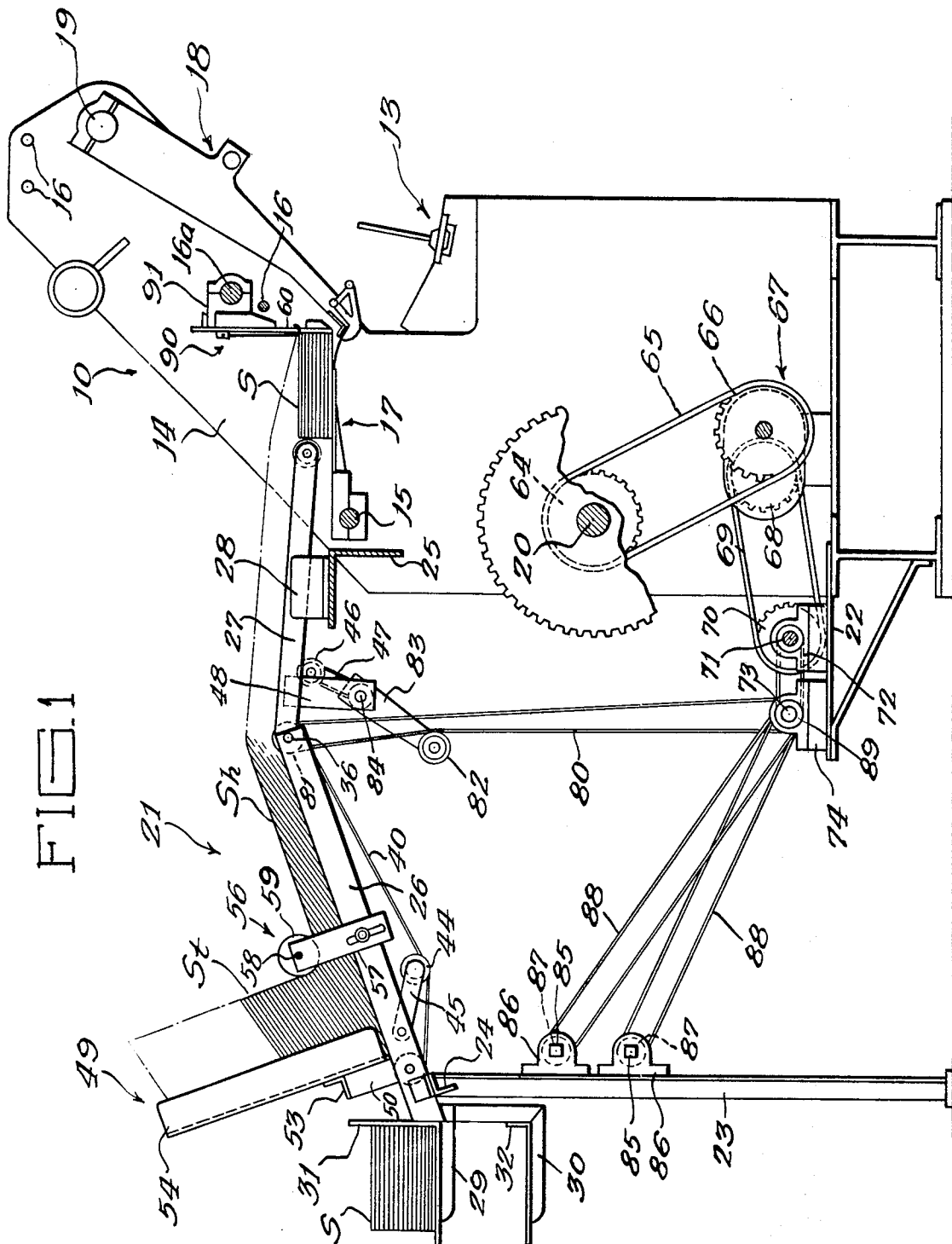
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3,522,943

SIGNATURE FEEDER FOR GATHERING MACHINE

Filed March 27, 1968

5 Sheets-Sheet 1



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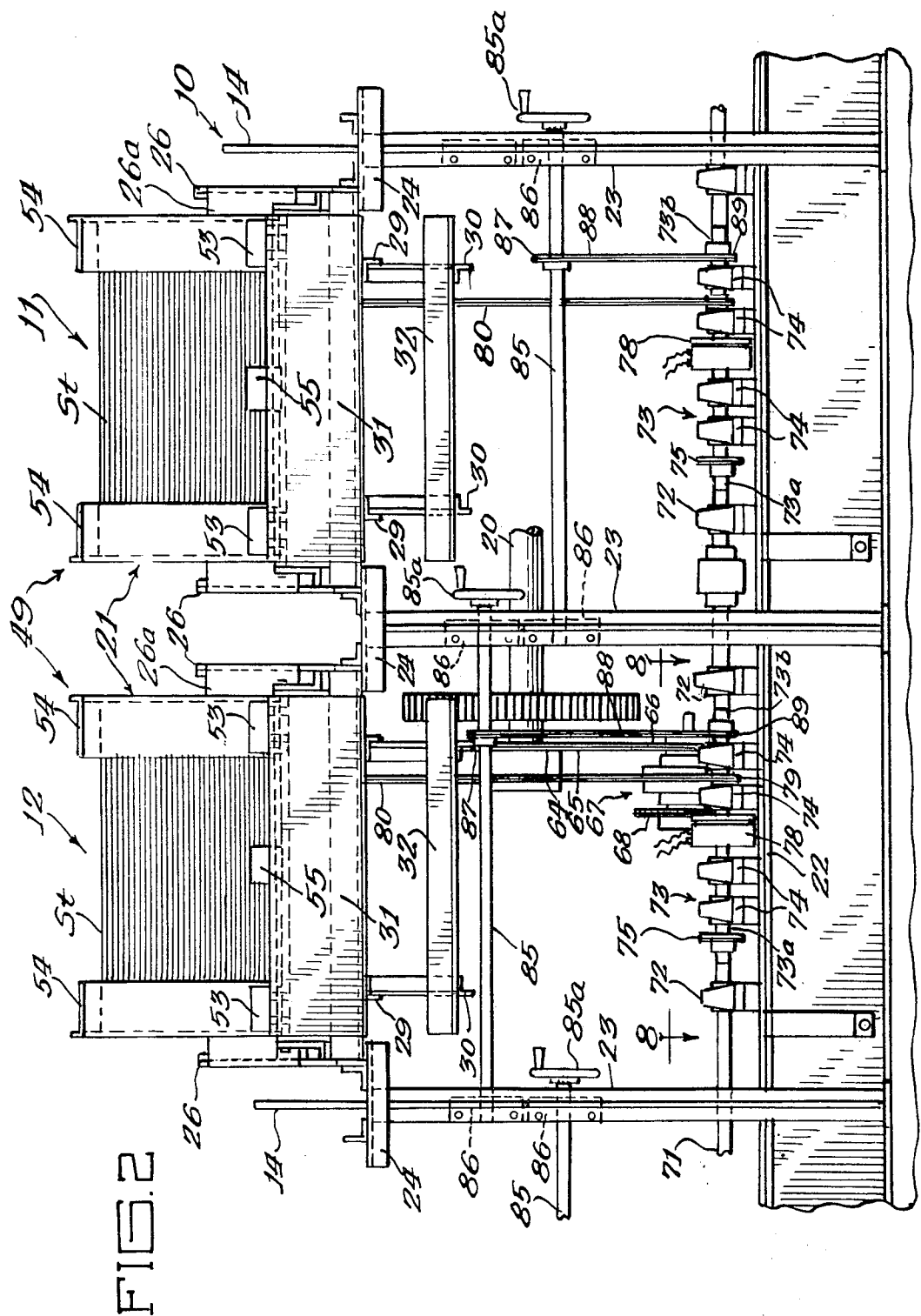
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SIGNATURE FEEDER FOR GATHERING MACHINE

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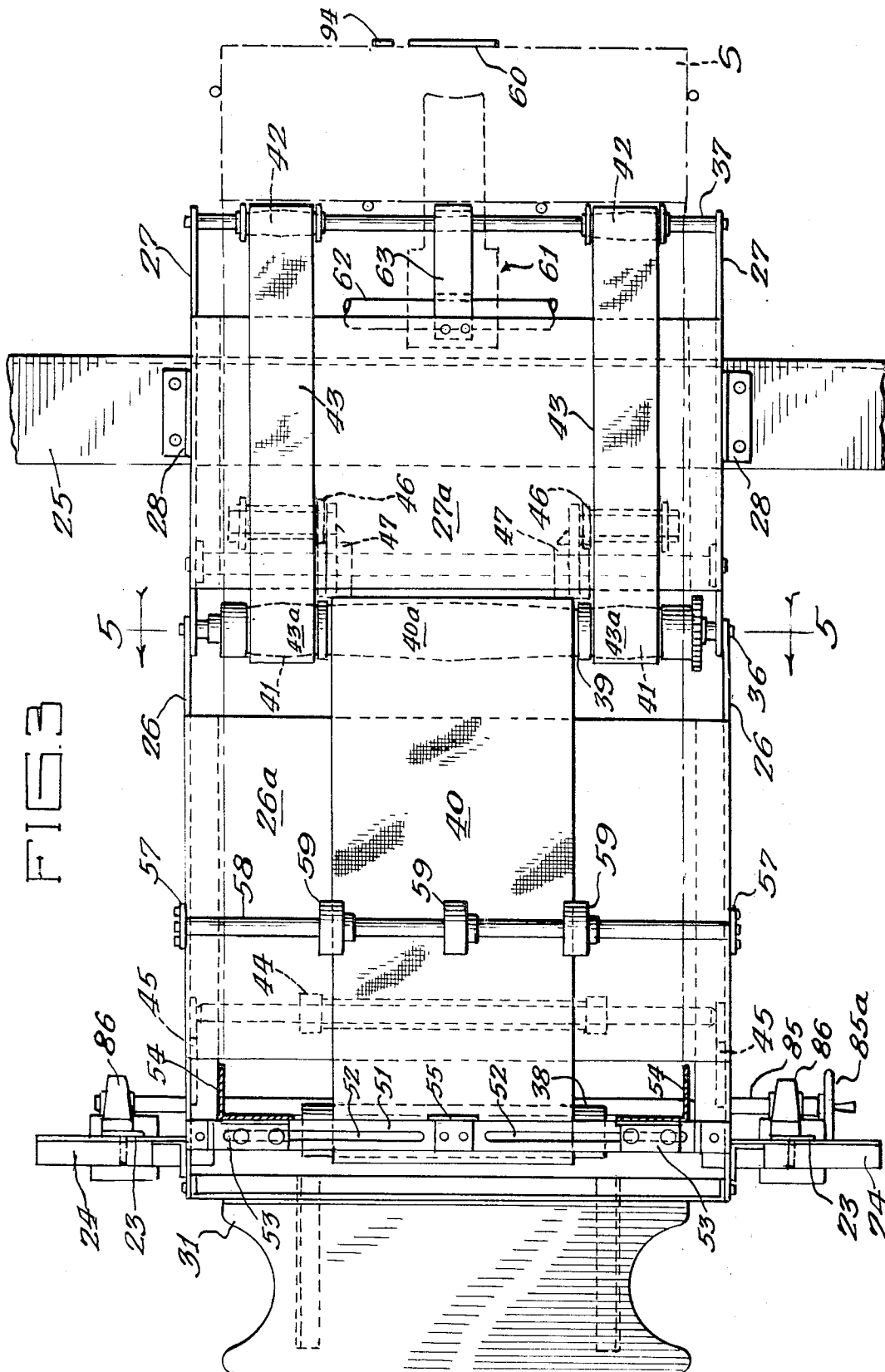
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SIGNATURE FEEDER FOR GATHERING MACHINE

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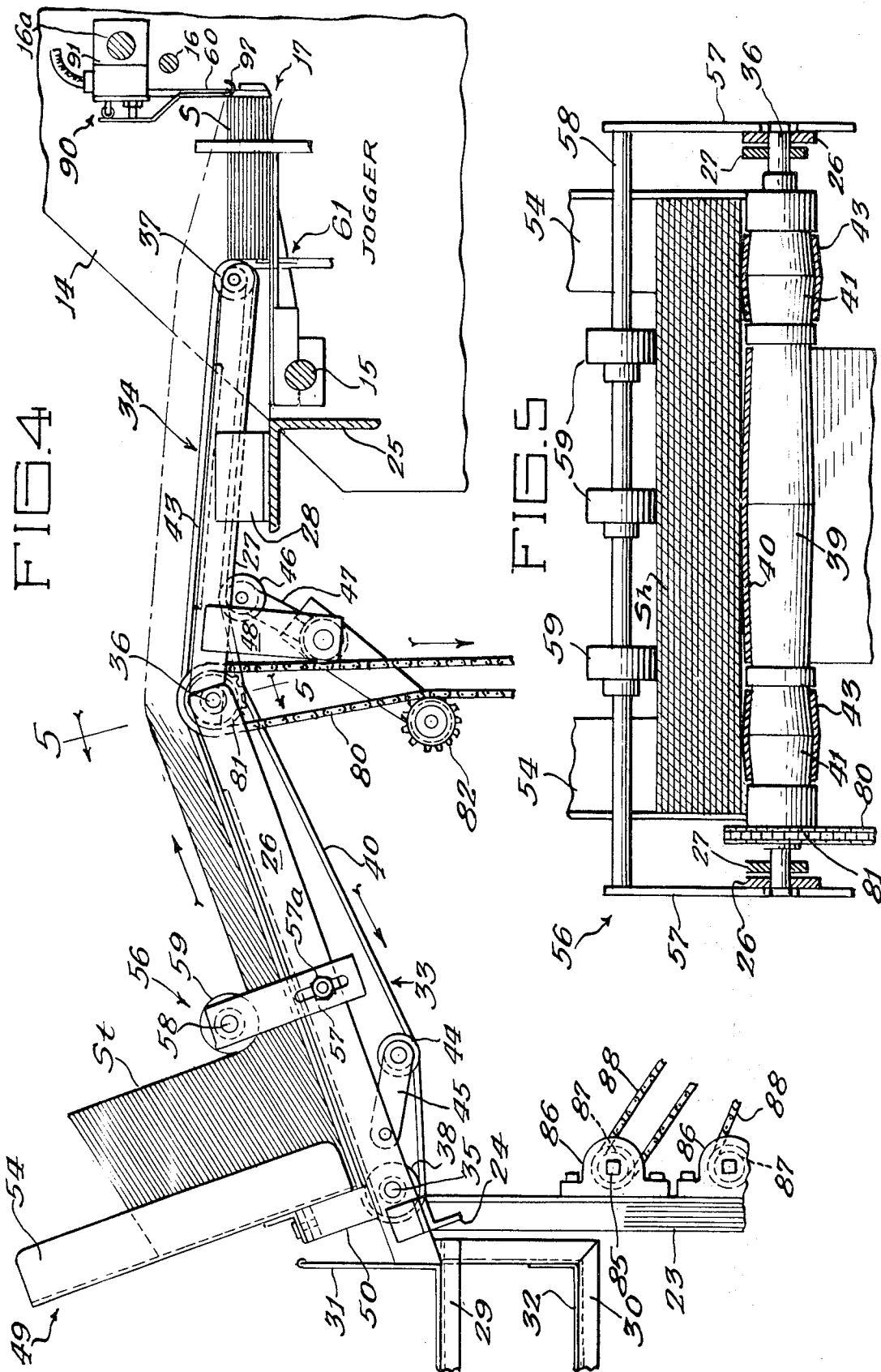
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SIGNATURE FEEDER FOR GATHERING MACHINE

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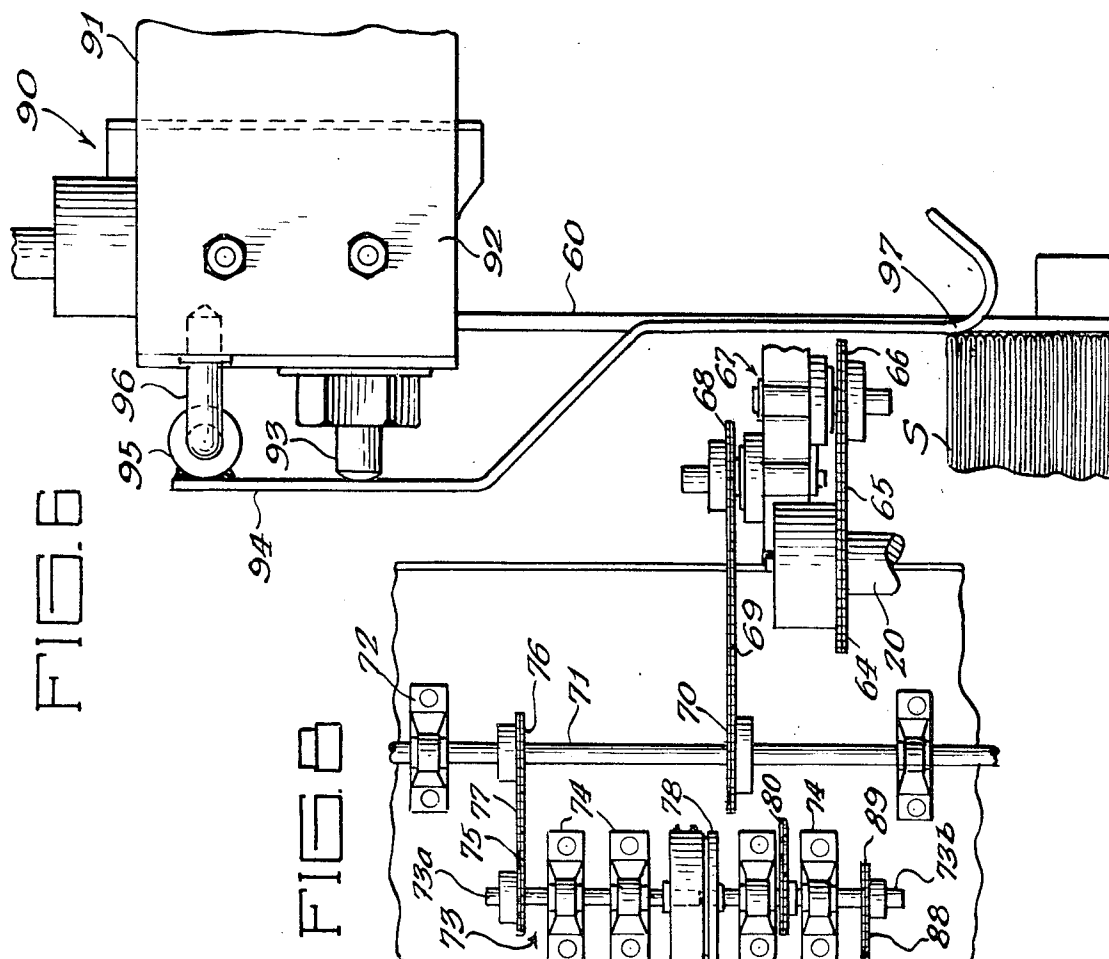
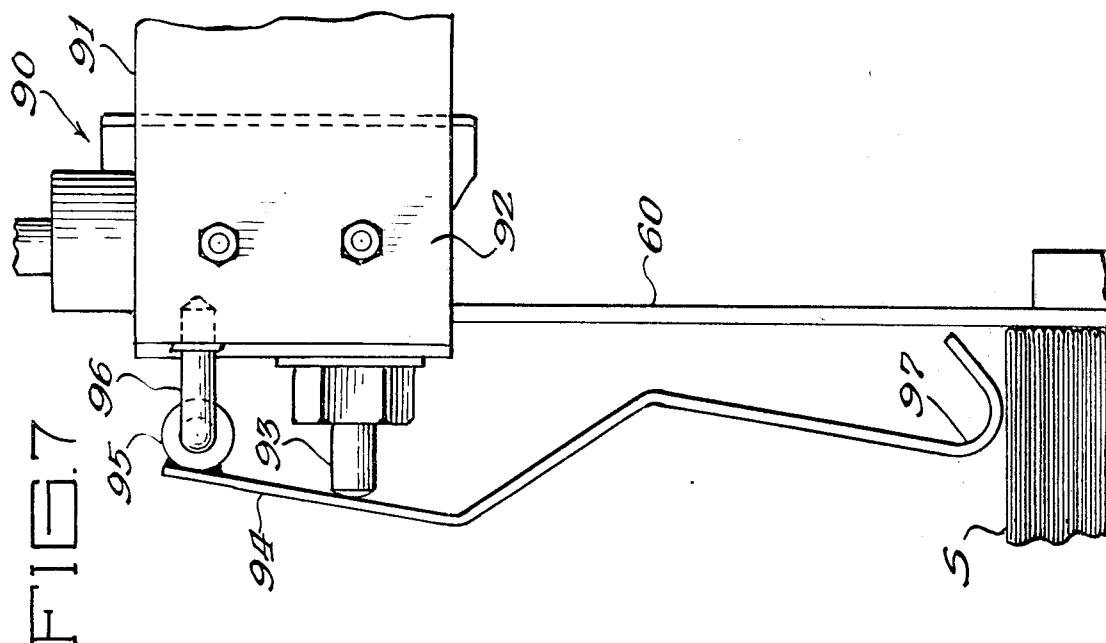
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SIGNATURE FEEDER FOR GATHERING MACHINE

Filed March 27, 1968

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3,522,943

SIGNATURE FEEDER FOR GATHERING MACHINE

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8 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus in which conveyor means feeds a shingled stream of signatures from the bottom of a large stack directly onto the top of a supply of signatures in a signature supply box of a gathering machine, with the conveyor means being driven intermittently when sensing means senses that the top of the supply in the box has dropped below a predetermined level.

BACKGROUND OF THE INVENTION

As is well known in the art, it is necessary in the binding of a book to gather a complete set of the different signatures which make up the book, and this operation is performed by a gathering machine that has a moving endless carrier which passes in front of a line of signature supply boxes. The gathering machine withdraws a signature from the bottom of a supply in each supply box and feeds it onto each station on the carrier so that, when any particular carrier station reaches the end of the gathering machine it has received one signature from each supply box and has a complete set of signatures required for binding into a book.

It is always necessary for a large gathering machine to be attended by one or two skilled operators who are able to take care of any malfunction; but it is also necessary in high speed bindery operations to have several unskilled helpers whose sole job is to take packs of signatures which are stored behind the signature supply boxes and place them in the boxes. The boxes must have a relatively small capacity to permit easy feeding of signatures from the bottom of the supply, and with a high speed machine it is necessary to have an unskilled helper for about every four or five signature supply boxes. Such articles as mail order catalogs and metropolitan telephone directories may contain anywhere from 90 to 130 signatures and thus require that many signature boxes in the gathering machine; and accordingly this type of bindery operation requires a large number of unskilled workers to fill the signature supply boxes of the gathering machines from the storage pool adjacent the machines, which usually consists of signatures stacked on pallets.

By providing each signature supply box of a gathering machine with the apparatus of the present invention, it is practical for one helper to handle the supply of signatures to 8 or 10 gathering machine boxes, rather than only 4 or 5.

The invention is of particular value to printing and binding establishments which produce large mail order catalogs and metropolitan telephone directories, because each of the very large books which requires upward of 90 signature supply boxes is only printed once or twice a year, so that it is necessary for the bindery to hire large numbers of temporary unskilled laborers whose services are required for only a few weeks while a single large catalog or telephone directory is being printed. The vast majority of the work in any bindery requires a gathering machine having no more than about thirty signature supply boxes, and even with conventional equipment this means only five or six helpers to the

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machine. For the periodic large binding jobs from ten to twenty-five extra helpers may be required on each shift, or thirty to seventy-five extra helpers a day. It is obviously very desirable in a printing and binding operation to eliminate, to the greatest possible extent, the need for this type of extra hiring.

SUMMARY OF THE INVENTION

In accordance with the present invention, apparatus is provided for feeding a shingled stream of signatures onto the top of the supply of signatures in a gathering machine supply box, and abutting them against a stop. The apparatus includes a first endless signature conveyor which is inclined upwardly in the direction of signature travel so that the signatures placed on the receiving end of the conveyor in a stack will form a shingled stream with their leading ends uppermost. A second endless signature conveyor has a receiving end overlapping the first conveyor to receive a shingled stream of signatures, inclined downwardly, and terminates at the rear of a supply box in the gathering machine. A pair of signature guide plates is positioned above the receiving end of the first conveyor to support a large stack of signatures directly upon the receiving end portion of the first conveyor with their trailing edges aligned generally perpendicular to the conveyor surface, and a metering means in the form of rollers is positioned in spaced relationship to the surface of the first conveyor in a position where it maintains signatures in the stack with their trailing edges in vertical alignment until they pass beneath the bottom level of the metering means. Once they pass below the bottom of the metering means, forward movement of the first conveyor belt causes them to automatically form a shingled stream. Sensing means at the front of the signature supply box senses when the top of the supply of signatures in the box is below a predetermined level, and when this condition is sensed a clutch is engaged to drive both conveyors off of a constantly running power source until the supply of signatures in the box is sufficiently replenished, at which point the clutch is disengaged and the conveyors stop operating.

It has been found that signatures having different numbers of pages and formed of paper stock of different weights and finishes require somewhat different relationships to the first conveyor in order to form a shingled stream that will feed properly onto the second conveyor and into the box. Thus, for example, signatures formed of relatively heavy coated stock may be fed in a relatively shallow stream which occupies a relatively small angle to the surface of the first conveyor, and when signatures of this type are being fed the metering rollers are placed relatively close to the surface of the first conveyor. On the other hand, satisfactory feeding of the relatively thin, uncoated stock used for such publications as telephone directories requires that the shingled stream be much more nearly upright on the belt, and thus much deeper relative to the surface of the belt. When this type of signature is being fed, the metering rollers are positioned correspondingly higher above the surface of the first conveyor so as to minimize belt damage to the individual signatures.

A signature gatherer supply box must contain a relatively small supply of signatures because the gatherer draws the signatures seriatim from the bottom of the supply, so the weight on the bottom signature must be relatively small. However, it is possible to maintain a stack of signatures above the receiving end of the first conveyor which is several times higher than the maximum supply which may be present in the supply box. The large stacks, therefore, permit one helper to handle many

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more gathering machine supply boxes than he could by placing the signatures directly in the supply boxes.

When the signature supply box of a gathering machine is hand-loaded, the helper takes relatively small packs of signatures from large supplies of signatures which have been printed and stacked on storage pallets in an area behind the gathering machine. The signatures must be manually manipulated by the helper to "wind" the signatures—i.e., to slide them and riffle their edges so as to break signatures apart and get air between them so the gathering machine may remove one signature at a time from the supply in the box. This is necessary because the signatures stored on a pallet have the air squeezed out from between them by the weight of signatures on top, and may be stuck together if the ink was slightly tacky when they were stacked. It is also necessary for the helper to hand-jog the signatures in order to get their leading edges into perfect alignment before they are placed in the supply box. The helper must also be sure that he is placing the correct signatures in each supply box, and to assist in this the signatures have index marks along the folded edges.

The device of the present invention eliminates the need for winding the signatures because sufficient winding occurs during the formation of the shingled stream on the first conveyor. Hand-jogging of the signatures is also eliminated because they are jogged in the supply box. Likewise, the machine shingles the signatures with their folded edges exposed so that the index marks along the folded edges are visible on the conveyor and thus permit quick visual inspection of the index marks as the signatures approach the supply box on the conveyors.

Even with a high-speed gathering machine the signatures are fed from the stack into the supply box at a rather slow rate, so that there is ample time to inspect the signatures on the conveyors.

The principal object of the invention, therefore, is to provide a simple, relatively inexpensive, and dependable apparatus for feeding signatures to the signature supply box of a gathering machine.

Another object of the invention is to provide signature feeding apparatus which feeds signatures in response to the sensing of a need for additional signatures in the supply box.

Yet another object of the invention is to provide signature feeding means which may be readily adjusted to feed signatures containing different numbers of pages and signatures which are printed on different kinds of paper stock.

Still another object of the invention is provide signature feeding means which eliminates hand "winding" and jogging of the signatures, and which permits the signatures to be visually inspected as they approach the supply box.

A further object of the invention is to provide signature feeding means which may be rapidly cleared of signatures for changeover when needed.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of one station of a signature gathering machine provided with the signature feeding apparatus of the present invention;

FIG. 2 is a rear elevational view of a pair of adjacent signature feeding apparatus in accordance with the invention;

FIG. 3 is a plan view on an enlarged scale of a single signature feeding apparatus embodying the invention;

FIG. 4 is a fragmentary side elevational view of a single signature feeding apparatus and gathering machine supply box;

FIG. 5 is a fragmentary section on an enlarged scale taken substantially as illustrated along the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary side elevational view on an enlarged scale showing the sensing means in the signature supply box in the position that it occupies when a

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supply of signatures in the box is above a predetermined level;

FIG. 7 is a view like FIG. 6 with the sensing means in the position it occupies when the supply of signatures in the box drops below the predetermined level; and

FIG. 8 is a fragmentary section on an enlarged scale taken substantially as illustrated along the line 8—8 of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIGS. 1 and 2, a conventional gathering machine, indicated generally at 10, has a plurality of signature supply stations, such as the stations 11 and 12 in FIG. 2, which are disposed side by side along the path of travel of a gatherer conveyor, indicated generally at 13 in FIG. 1. Each pair of adjacent signature supply stations includes parallel side frame members 14 which are connected by tie bars 15, 16 and 16a. Each signature supply station includes a signature supply box, indicated generally at 17, and a signature feed arm assembly, indicated generally at 18, which is mounted on a rock-shaft 19 for rocking movement between the position of FIG 1 where it removes a signature from the bottom of a supply S of signatures in the box to a position where it deposits a signature on the conveyor means 13. A main drive shaft 20 extends the length of the gathering machine to provide the necessary power for driving the various parts of the gathering machine including the rock shafts 19. The structure as heretofore described is that of a conventional gathering machine; and the device of the present invention consists of the signature feeder, indicated generally at 21, which will now be described.

The signature feeder 21 includes a platform 22 which is cantilever mounted at the bottom of the gathering machine 10 to extend from the rear of the gathering machine, a pair of supporting legs 23, a cross member 24 which surmounts each of the legs 23, a bracket 25 which extends between the side plates 14 of each pair of adjacent gathering machine stations, and first and second conveyor side frame members 26 and 27, respectively, which are supported upon the transverse brackets 24 and the angle bracket 25, to the latter of which they are secured by fastening brackets 28. A first conveyor table 26a extends between the side frame members 26, and a second conveyor table 27a extends between the side frame members 27. At the rear of the conveyor side frames 26 are arms 29 and 30 which support shelves 31 and 32 to receive quantities of signatures s which may be transferred manually as required into a signature stack S which will be discussed in more detail.

Referring now particularly to FIGS. 3, 4 and 5, the conveyor side members 26 and 27 support a first endless conveyor, indicated generally at 33, and a second endless conveyor, indicated generally at 34. Journalled in the conveyor side frames 26 and 27 are a first conveyor idler shaft 35, a common conveyor drive shaft 36, and a second conveyor idler shaft 37. Centrally mounted on the shafts 35 and 36 are rollers 38 and 39 about which is trained a first endless conveyor belt 40. Flanking the conveyor roller 39 on the common drive shaft 36 are relatively narrow second conveyor sheaves 41, and aligned with the sheaves 41 are sheaves 42 on the shaft 37 which cooperate with the sheaves 41 to carry a pair of parallel second conveyor endless belts 43 which thus have receiving ends 43a that overlap the discharge end 40a of the belt 40. The first endless conveyor belt 40 is held taut by a tensioning roller 44 which is carried on pivoted arms 45 beneath the first conveyor side frames 26, while the second conveyor endless belts 43 are held taut by tensioning sheaves 46 that are carried on pivoted arms 47 mounted in depending brackets 48 below the second conveyor side frames 27. As seen in FIG. 3, the first endless conveyor belt 40 and the second endless conveyor belts 43 are provided with rough surfaces which catch in the trailing edges of signatures s which form a shingled stream

on the conveyor belts as seen in FIG. 4; so that when the belts are driven they positively engage the trailing edges of the signatures to feed the latter toward the gathering machine supply box 17. The endless conveyor belts 40 and 43 are fabricated from standard, commercially available rough top rubber belting which is available in similar form from various manufacturers of rubber top conveyor belting.

In order that a large stack *St* of signatures may be supported over the infeed end of the first conveyor belt 40, means 49 are provided for aligning the trailing edges of signatures in the stack *St*. The signature aligning means includes a base 50 which has a cross bar 51 that is slotted at 52 to receive fastening bolts of brackets 53 by means of which angle members 54 are mounted for transverse adjustment to accommodate them to signatures of varying lengths from head to foot. A central angle member 55 is riveted to the cross bar 51 to provide a low central element which assists in keeping the central areas of the signatures toward the bottom of the stack *St* from being forced out of alignment by the pressure of the signatures above them in the stack. The signature stack aligning means 49 is seen in FIGS. 1 and 4 to be positioned substantially perpendicular to the signature supporting surface of primary conveyor belt 40, so that a stack *St* of signatures supported on the belt leans against the guide means 49 with the trailing edges of all the signatures substantially aligned with one another.

In order that movement of the first conveyor belt 40 may pull signatures out from under the stack *St* in a shingled stream *Sh*, metering means, indicated generally at 56, is provided to confine signatures above a predetermined level with their trailing edges against the guide means 49. The metering means includes a pair of upright brackets 57 that are mounted on the first conveyor side frame members 26 and carry a cross-shaft 58 upon which metering rollers 59 are journaled. As best seen in FIG. 4, the brackets 57 are provided with slots 57a which receive bolts that impale the first conveyor side frame members 26 in order that the metering rollers 59 may be adjusted normal to the surface of the first conveyor belt 40. As previously pointed out, the purpose of this adjustment is to afford optimum feeding of different types of signatures, and in particular of signatures printed on paper stock of different types. The higher the metering rollers 59 are positioned, the more upright the shingled stream of signatures is with respect to the surface of the conveyor belt 40. As illustrated in the drawings, the metering means 56 is adjusted to handle relatively heavy signatures printed on heavy coated paper of the type used in high-grade periodicals such as National Geographic and others. For optimum feeding of signatures printed upon very lightweight uncoated stock, such as is used in telephone directories or mail order catalogs, the metering means 56 must be positioned a substantially greater distance above the surface of the first conveyor 40 than is illustrated in the drawings.

Operation of the first conveyor belt 40 and the second conveyor belt 43 causes the shingled stream *Sh* of signatures to be carried toward the signature supply box 17 and causes the leading edges of the signatures to abut against a stop plate 60 which is positioned at the front of the supply box. In order that the signatures in the supply box 17 may have their leading edges properly aligned for withdrawal by the arm 18, the apparatus includes jogger means, indicated generally at 61, which includes an eccentrically mounted shaft 62 at the center of which is a jogger arm 63 which abuts against the trailing edges of signatures in the supply box so that, when the eccentrically mounted shaft 62 is driven by a drive means (not illustrated) the jogger arm 63 repeatedly bumps the trailing edges of the supply of signatures to keep them pushed firmly against the stop 60 and align their folded edges.

As best seen in FIGS. 1, 2 and 8, drive means for the

first conveyor means 33 and the second conveyor means 34 is driven off the main drive shaft 20 of the gathering machine. For this purpose, the drive shaft 20 is provided with a sprocket 64 from which a roller chain 65 drives an input sprocket 66 of a gear reducer, indicated generally at 67. An output sprocket 68 of the gear reducer drives a chain 69 that is also trained over a sprocket 70 on a signature feeder drive shaft 71 that is journaled in pillow blocks 72 and extends the length of one section of the gathering machine, consisting of six boxes, so as to permit all the signature feeders in the section to be driven from a single drive sprocket 64 and gear reducer 67.

A signature feeder drive control shaft means 73 for each of the signature feeder units is journaled in pillow block 74 on the brackets 22, and is provided with a sprocket 75 that is aligned with a sprocket 76 on the drive shaft 71 so that a drive chain 77 may drive the control shaft means 73 from the shaft 71. The means 73 includes a drive shaft portion 73a upon which the sprocket 75 is mounted, and a coaxial driven shaft portion 73b, with the two shaft portions connected to opposite sides of an electric clutch 78 so that, when the clutch is energized and engaged, the driven portion 73b of the shaft means is rotated. Keyed to the driven shaft portion 73b is a sprocket 79 about which is trained a drive chain 80 that also encircles a drive sprocket 81 on the common conveyor drive shaft 36. Tension in the drive chain is maintained by a tensioning sprocket 82 which is journaled at the outer end of an arm 83 that is pivoted at 84 on the bracket 48. Accordingly, when the clutch 78 is energized and engaged the power train functions through the sprockets 76-75 and drive chain 77 to rotate the drive portion 73a of the feeder drive control shaft means 73, through the clutch 78 to drive the driven portion 73b of the shaft means, and through the sprocket and chain system 79-80-81 to drive both of the conveyors.

In order that the conveyor belts may be operated manually when desired, a manual drive shaft 85 having a handwheel 85a is journaled in pillow blocks 86 on the legs 23 and provided with a sprocket 87 to receive a chain 88 which is also trained around a sprocket 89 on the driven shaft portion 73b.

The electrical supply circuit for the feeder is provided with one or more conveniently located hand switches (not shown) for opening the feeder circuit when desired. By using the handwheel to run the belts 40 and 43 in reverse, signatures may be pushed back under the stack *St* for quick removal at the end of a run, or where a catalog or magazine includes special signatures for different regions of the country. This is increasingly common in catalogs and magazines; and an important feature of the present machine is that it permits rapid change-over from one signature to another.

Energization of the clutch 78 is controlled by sensing means, indicated generally at 90, which is associated with the signature supply box 17 and which is illustrated in detail in FIGS. 6 and 7. As best seen in FIG. 4, a clamping bracket 91 is mounted upon the gathering machine tie bar 16a where it serves as a mounting both for the signature stop 60 and for the sensing means 90. As seen in FIGS. 6 and 7, the sensing means includes a normally open limit switch 92 which has a spring loaded switch plunger 93, and a sensing finger 94 provided with a collar 95 by means of which it is pivotally mounted upon a bracket 96. The sensing finger 94 rests against the plunger 93 and has a lower end portion 97 which hangs into the signature supply box 17 where, as seen in FIG. 6, it is contacted by the signatures in the upper portion of the supply *S* when they abut against the stop 60, and this keeps the switch plunger 93 depressed. When the supply of signatures drops below a predetermined level the sensing finger is free to pivot and, as seen in FIG. 7, the spring loaded plunger 93 pivots the sensing

finger 94 outwardly and movement of the plunger to its extended position closes the switch to energize the electric clutch 78 and cause the conveyor means to feed signatures on to the top of the supply. When the signatures in the supply are again above the predetermined level they force the sensing arm 94 to return to the position of FIG. 6 against the bias of the spring loaded plunger 93, and this again opens the limit switch to de-energize the clutch 78 and stop the conveyor.

The foregoing detailed description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

I claim:

1. In a gathering machine, the combination comprising:

a signature supply box for holding a first stack of signatures having a height not in excess of a predetermined first level and not below a second predetermined level; means for continuously moving signatures one at a time from the bottom of said first stack out of said box at a predetermined rate; conveyor means for carrying a stream of shingled signatures and depositing said signatures on top of said first stack at a rate in excess of said predetermined rate, said conveyor including means for holding a second stack of signatures to be carried by said conveyor means and deposited on said first stack;

metering means for controlling the depth of said shingled stream as it moves on said conveyor means from under said second stack;

means for driving said conveyor means at a speed depositing said signatures on said first stack at a rate greater than said predetermined rate;

means for sensing when the height of said first stack has reached said second predetermined level as the result of signature removal from said first stack and for sensing when said first stack has reached said first predetermined level as a result of deposition of signatures on said first stack; and

means controlled by said sensing means for causing said driving means to drive said conveyor means only when the height of said first stack is between said two predetermined levels.

2. The apparatus of claim 1 in which the means for driving the conveyor means runs continuously, and the means controlled by the sensing means includes a clutch which is engaged only when the top of said first stack is below said predetermined level.

3. The apparatus of claim 1 in which the metering means comprises roller means above said conveyor means and so positioned as to retain the trailing edge alignment of all signatures in said second stack except those below the plane of the axis of the roller means.

4. The apparatus of claim 1 in which the metering means is adjustable normal to the surface of said conveyor means so as to permit adjustment of the depth of the stream.

5. The apparatus of claim 1 which includes a stop in said signature box against which the shingled signatures in said stream abut and means for jogging signatures in said box against said stop.

6. The apparatus of claim 1 which includes means for driving said conveyor means in reverse to return a shingled stream of signatures to the bottom of said second stack.

7. The apparatus of claim 6 which the reverse conveyor driving means includes a manually rotatable shaft.

8. A method of transferring signatures in a gathering machine to a moving endless carrier which comprises establishing and continuously maintaining first and second spaced vertical signature stacks; continuously removing signatures one by one from the bottom of said first stack and depositing said signatures at a predetermined rate on said carrier; intermittently removing signatures from the bottom of said second stack as a shingled stream and directing said stream onto the top of said first stack; controlling said removal of said signatures from said second stack and their deposition on said first stack to confine such removal and deposition to intervals when said first stack has a level between said two predetermined levels and to effect such removal and deposition at a rate greater than the removal of signatures from the bottom of said first stack; and intermittently adding lifts of signatures to the top of said second stack to maintain the same.

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U.S. Cl. X.R.

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