March 6, 1973 H. R. MEBUS 3,718,939

GATHERER-BINDER TRANSFER SYSTEM

Filed May 14, 1971 2 Sheets-Sheet 1

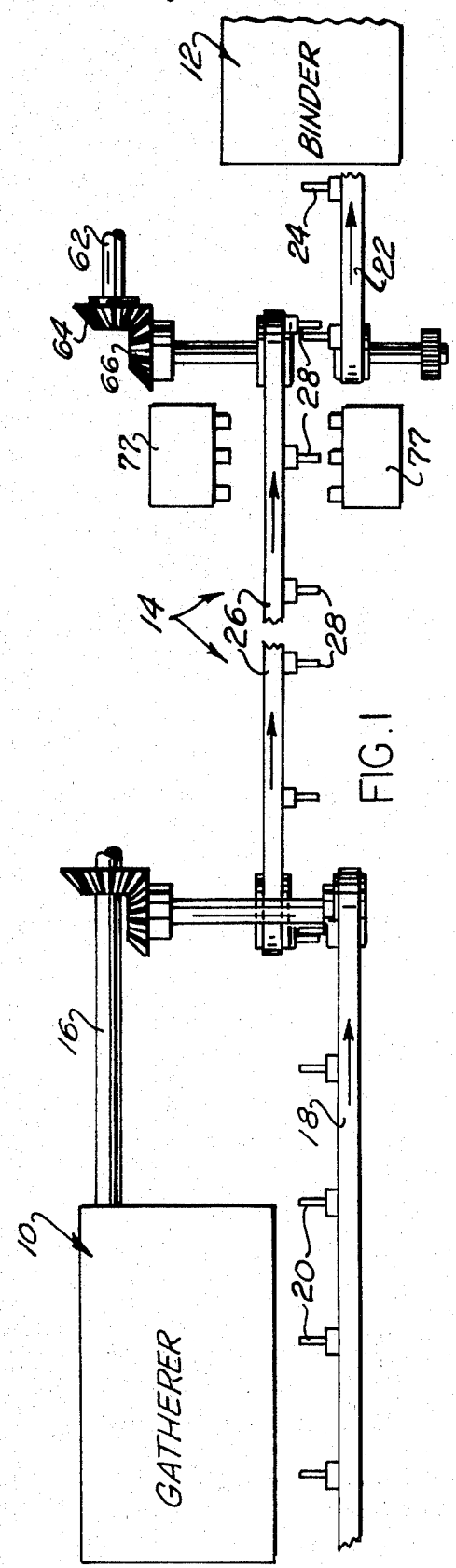

FIG. 1

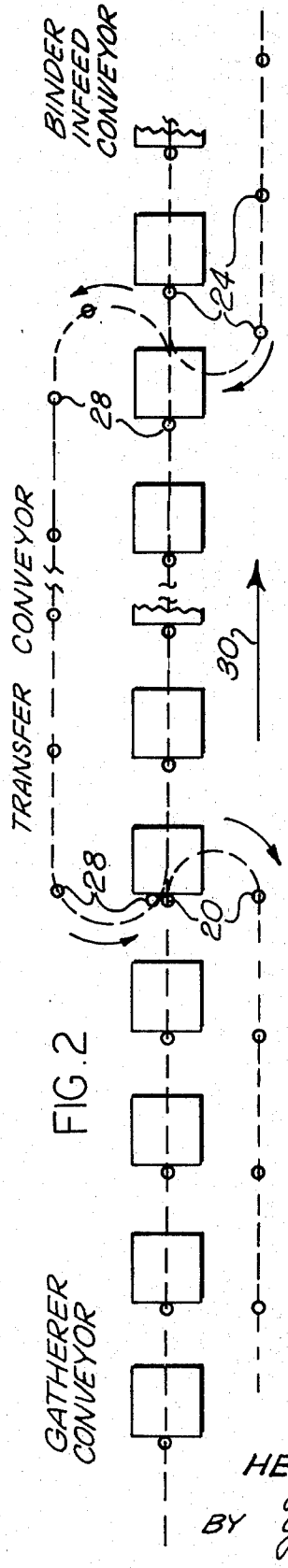

FIG. 2

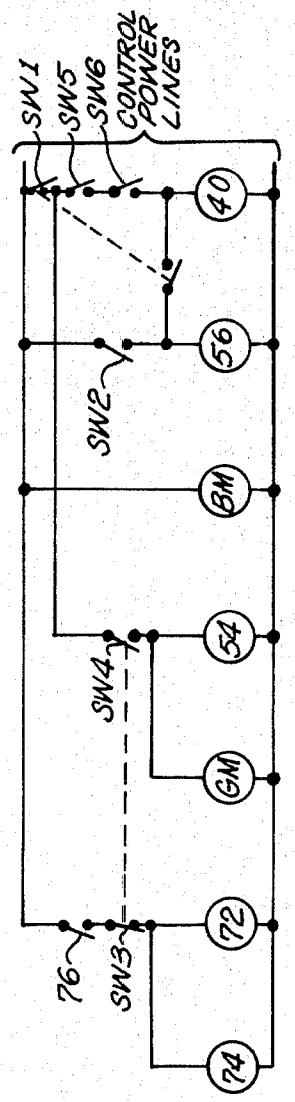

FIG. 5

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GATHERER-BINDER TRANSFER SYSTEM

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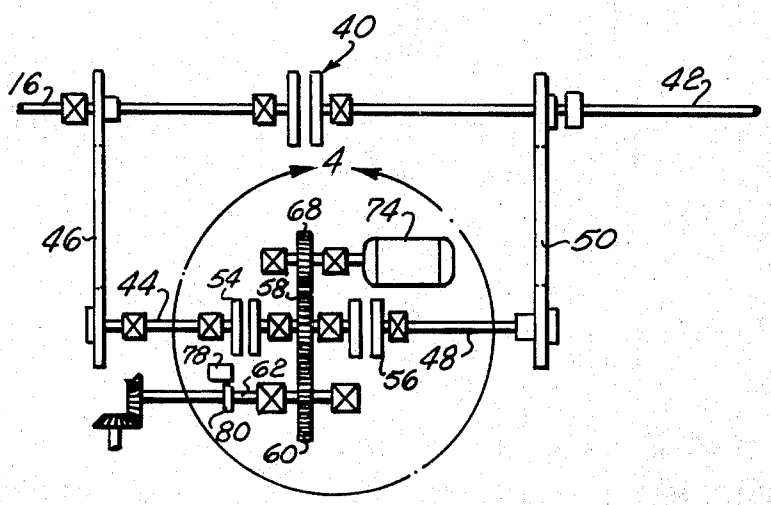

FIG. 3

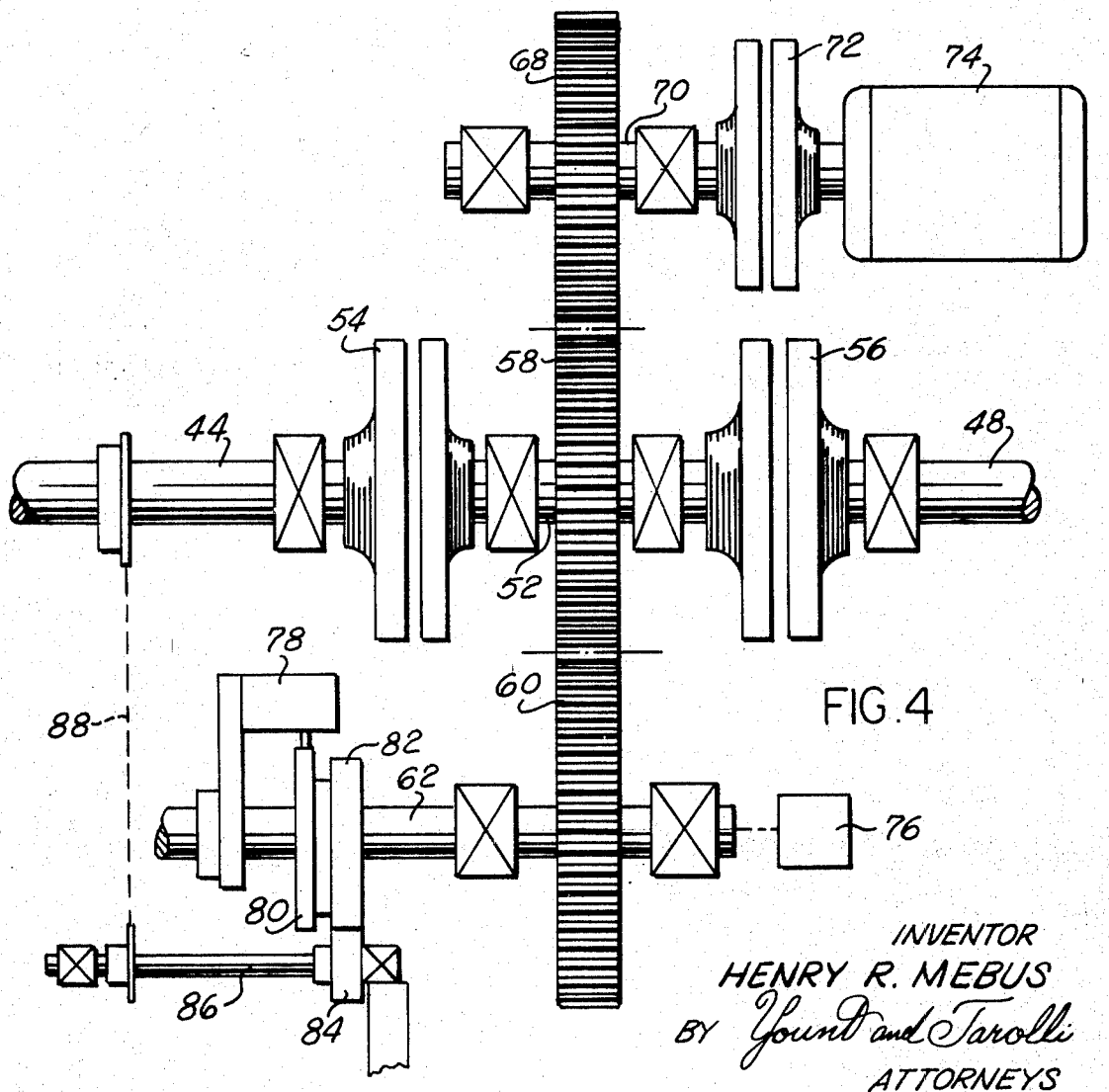

FIG. 4

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United States Patent Office 3,718,939
Patented Mar. 6, 1973

3,718,939

GATHERER-BINDER TRANSFER SYSTEM

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Filed May 14, 1971, Ser. No. 143,532
Int. Cl. B42c 19/00
U.S. Cl. 11—1 R 11 Claims

ABSTRACT OF THE DISCLOSURE

A transfer mechanism for transferring signatures from a gatherer to a binder with the transfer mechanism including a transfer conveyor driven in synchronism with the gatherer conveyor and the binder infeed conveyor until the gatherer stops whereupon the transfer conveyor is driven by the binder until the transfer conveyor is clear of signatures. Thereafter, the transfer conveyor automatically stops and is locked in proper timed relationship with the stopped gatherer conveyor while the binder continues operating at a constant speed whereby restarting of the gatherer enables the gatherer to come up to binder speed and be synchronized with the binder before any signatures are conveyed to the binder.

This invention relates to a system for transferring articles from one station to another and, more particularly, to a transfer conveyor arrangement for transferring signatures from a gatherer to a binder.

Although the invention will be described with particular reference to transferring signatures from a gatherer to a binder, it will be appreciated that the principles of the invention have broader application and may be used in other types of automated systems in which articles are to be transferred from station to station.

Present day binder equipment contemplates a gatherer which feeds signatures to a signature conveying chain which, in turn, feeds the signatures to an in-feed conveyor chain of a binder where the binding operations are performed. The gatherer conveyor chain is driven by the gatherer and the binder in-feed conveyor chain is driven by the binder. This equipment is designed to operate at 200 cycles or more per minute for high speed production.

In the event of a fault at the gatherer necessitating temporary stoppage of the gatherer, it has been the practice to reduce the binder speed to approximately 40 cycles per minute. This reduction in binder speed is necessitated by the need, once the gatherer has been restarted, to bring the gatherer up to binder speed and synchronized with the binder before signatures are fed to the binder. By reducing the binder speed, it has been possible to achieve synchronism with approximately one cycle of the gatherer. However, it is desirable to operate a binder at a constant speed to assure high quality production. Moreover, where two gatherers are feeding a binder, it is apparent that slowing down the binder when one gatherer is stopped materially reduces productivity of the other gatherer.

It is a primary object of this invention to provide a transfer conveyor mechanism which cooperates with the gatherer and the binder to permit operation of the binder at constant speeds even when the gatherer is intermittently stopped and restarted.

It is a further object of this invention to provide a transfer conveyor system which cooperates with a gatherer and a binder to enable the gatherer to be brought up to speed and synchronized with the binder without decreasing the speed of the binder.

A further object of the invention is to provide a transfer conveyor which is driven in synchronism with a gatherer and a binder and which is operative upon stoppage of the gatherer to continue to feed books to the binder until the conveyor is cleared and is then automatically stopped in the proper timed relationship to the gatherer.

In accordance with the preferred form of the invention, there is provided a gatherer and a gatherer conveyor chain driven by a gatherer motor and a binder and an in-feed conveyor chain driven by a binder motor. A transfer conveyor chain is positioned between the gatherer conveyor chain and the in-feed conveyor chain with the transfer conveyor chain being adapted to be driven by both the gatherer and binder when the two machines are operating in synchronism but, in the event of a gatherer stoppage, to be driven by the binder until the transfer conveyor chain is cleared of books. Thereafter, the transfer conveyor chain is automatically stopped while the binder continues operating at a constant speed. A timing motor is then actuated to drive the transfer conveyor chain to a position where it is in proper timed relationship with the stopped gatherer conveyor chain. The gatherer may then be restarted with the gatherer conveyor chain and the transfer conveyor chain driven in synchronism by the gatherer drive motor. As the gatherer is brought up to speed, the gatherer and the transfer conveyor chain are reconnected to the binder for synchronous operation. The length of the transfer conveyor chain is such that the gatherer achieves synchronous speed with the binder before any signatures are delivered to the in-feed conveyor of the binder.

Those objects, features and aspects of the invention, as well as others will be apparent upon a complete reading of the following description which, together with the drawings, discloses but a preferred embodiment of the invention.

Referring now to the drawings wherein like reference numerals indicate like parts in the various views;

FIG. 1 is a schematic top plan view illustration of the gatherer conveyor, the transfer conveyor and the infeed conveyor contemplated by this invention;

FIG. 2 is a schematic side elevation view of the conveyor system of FIG. 1;

FIG. 3 is a schematic lay out of a suitable drive train for the transfer conveyor system of FIGS. 1 and 2;

FIG. 4 illustrates in enlarged detail the encircled portion of FIG. 3; and

FIG. 5 is a schematic circuit diagram showing a suitable control circuit which may be used with the invention.

Referring now to FIG. 1, there is illustrated a gatherer-binder combination in which a gatherer is indicated at **10** and a binder at **12** with the transfer conveyor mechanism which is the subject of this invention schematically illustrated at **14**. The gatherer **10** may be of any conventional construction, as shown for example in U.S. Pat. 3,311,368, and includes a main drive shaft **16** and a gatherer conveyor chain **18** having upstanding conveyor pins **20** spaced along the length thereof. The spacing between each pin **20** corresponds to one cycle of the gatherer **10**.

The binder **12** may also be of a conventional construction and reference may be had to U.S. Pat. Nos. 3,258,798 and 3,319,499 for a disclosure of such binders. The binder **12** includes an in-feed conveyor chain **22** which is driven by the binder and which includes upstanding conveyor pins **24**.

In accordance with the principles of this invention, there is provided a transfer conveyor chain **14** which is positioned between the gatherer conveyor chain **18** and the in-feed conveyor chain **22** to transfer signatures from the gatherer chain to the in-feed conveyor chain. The conveyor mechanism comprises an endless conveyor chain **26** having upstanding conveyor pins **28**. The spacing between the pins **28** correspond to the spacing of the pins **20** and

24. As illustrated, the transfer conveyor chain 26 is inverted with respect to the conveyor chains 18, 22 and is offset in the manner illustrated in FIG. 2. The operation of the transfer conveyor chain 26 is synchronized to coincide with the operation of the two conveyor chains 18, 22. In this manner, a signature is moved in the direction of arrow 30 (FIG. 2) first through engagement of the pins 20 on chain 18 to the transfer conveyor chain 26 where the signature is engaged by the pins 28 and moved forward until reaching the in-feed conveyor chain 22 where the pins 24 then engage the signatures to advance them to the binder 12. It will be noted that at the point of transfer between the gatherer conveyor and the transfer conveyor, the signature is engaged by both a pin 20 and a pin 28. Similarly, at the point of transfer from the transfer conveyor to the in-feed conveyor, the signature is engaged by both a pin 28 and a pin 24.

Referring now to FIGS. 3 and 4, the drive system for the transfer conveyor mechanism is illustrated. As is conventional, the main drive shaft 16 is adapted to be coupled through a gatherer-binder clutch 40 to the binder power shaft 42. Engagement of the clutch 40 locks both the gatherer and binder into one synchronously operating system with the gatherer motor receiving its speed control signals by suitable tachometer generators and control equipment. Since the details of clutch 40 form no portion of this invention, they have been omitted; however, the clutch is commercially available on gatherer-binder equipment supplied by Harris-Intertype Corporation, Easton, Pennsylvania.

The drive system further includes a gatherer transfer drive shaft 44 connected by a chain drive 46 to the gatherer drive shaft 16 and a binder transfer drive shaft 48 connected by a chain drive 50 to the binder power shaft 42. A shaft 52 coaxial with the shafts 44, 48 is adapted to be selectively connected by a gatherer clutch 54 and a binder clutch 56 to the shafts 44, 48. A gear 58 connected to shaft 52 is adapted to mesh with a gear 60 which is supported on a transfer conveyor drive shaft 62. The shaft 62 has a bevel gear 64 at one end thereof in meshing engagement with a gear 66 by which drive is supplied to the transfer conveyor chain 26.

The gear 58 also meshes with a gear 68 supported on a shaft 70 and which is selectively connected by a timing clutch 72 to a low speed gear head motor 74 for a purpose hereinafter described.

From the foregoing it will be appreciated that with clutch 56 engaged, drive will be imparted to the transfer conveyor chain 26 from the binder power shaft 42 through the chain drive 50, gears 58, 60, shaft 62 and gears 64, 66. Similarly, with the gatherer clutch 54 engaged, drive will be imparted to the transfer conveyor chain 26 from the gatherer drive shaft 16 through chain drive 46, gears 58, 60, shaft 62 and gears 64, 66. With both clutches 54, 56 engaged, the transfer conveyor chain 46 is driven by both the gatherer drive shaft 16 and the binder shaft 42. Hence, the described drive arrangement provides for selective drive of the transfer conveyor chain by either the binder or the gatherer or by both the binder and gatherer.

The remainder of the drive mechanism and the circuit of FIG. 5 will be described with reference to the operation of the system. With both the gatherer and binder operating in synchronism, clutches 54 and 56 are engaged, clutch 72 is disengaged and the gatherer-binder clutch 40 is engaged. Switches SW1, SW2, SW4, SW5 and SW6 are closed. The gatherer-conveyor chain 18 is driven from the gatherer shaft 16 while the in-feed conveyor chain 22 is driven by the binder. The transfer conveyor chain 26 is driven by both the gatherer and binder. In this manner, the gatherer, binder, and the conveyor chains are all locked together for synchronous operation.

In the event of a gatherer stop for some reason, such as a misfeed occurring at one of the gatherer pockets, an electrical signal will be generated which will open switch SW1 to stop gatherer motor GM, disengage the gatherer-binder clutch 40 and apply a brake, not shown, to stop rotation of the gatherer-conveyor chain 18. At the same time, the opening of switch SW1 causes disengagement of the gatherer clutch 54. In this condition, the binder motor BM, which continues to operate at the same speed as when the gatherer stopped, continues to drive the binder and the transfer conveyor chain 26 so that the signatures being transported by the conveyor chain 26 continue to be delivered to the in-feed conveyor 22. However, since the gatherer conveyor chain 18 has stopped, the transfer conveyor chain 26 no longer receives signatures from the gatherer.

After the transfer conveyor 26 has delivered the last of its signatures to the in-feed conveyor 22, the absence of any further signatures on the transfer conveyor 26 is detected by any suitable means, such as a series of photoelectric sensors 77, which generate a signal to open switch SW2 and disengage clutch 56 thereby interrupting all drive to the transfer conveyor chain 26.

Upon restarting the gatherer, it is necessary that the transfer conveyor chain 26 be properly synchronized with the gatherer conveyor chain 18 so that signatures pass smoothly from the one conveyor to the other. To this end, a conventional speed-sensitive switch 76 is connected to the transfer conveyor drive shaft 62. This switch, which is normally open, closes when rotation of shaft 62 stops to produce a signal which engages clutch 72 and actuates motor 74 to drive the transfer conveyor chain 26 to a position where it is in time with the gatherer chain 18. The proper positioning of the transfer chain with respect to the gatherer chain is signaled by a limit switch arrangement which includes a limit switch 78 and a limit switch cam 80. The limit switch cam 80 is rotatably supported on the shaft 62 and includes a gear 82 which meshes with a pinion 84 on a cam drive shaft 86. The shaft 86 is drivingly connected by a drive chain 88 with the gatherer conveyor shaft 44. Hence, as the gatherer is driven, the cam 80 is rotated in synchronism. When the gatherer stops, cam 80 also stops rotating. The cam 80 has a peripheral surface which is concentric to the shaft 62 with the exception of a single high point or lobe which may be considered to correspond to the position of one of the pins 20 on the conveyor chain 18. The circumferential distance around the cam would correspond to the spacing between adjacent pins of the conveyor chain 18. Hence, when the gatherer conveyor chain 18 is stopped, the rotational position of the high point on the cam 80 is indicative of the position of one of the pins 20. The limit switch 78 is connected for rotation to shaft 62 so that when the gatherer conveyor chain 18 is stopped and, hence, cam 80 stops rotating, the limit switch 78 will rotate relative to the cam 80. During synchronous operation of the gatherer and binder, there would be no relative rotation between switch 78 and cam 80.

By adjusting the rotational position of cam 80 and the limit switch 78 so that the limit switch is positioned on the high point of the cam when the transfer conveyor chain 26 is properly timed with the gatherer conveyor chain 18, it will be appreciated that the retiming of the two conveyor chains is accomplished simply by actuating the motor 74 to drive shaft 62 until the limit switch 78 reaches the high of the cam. At this point, the limit switch will be actuated to produce an electrical signal which will open switch SW_3 to disengage clutch 72 and stop motor 74. At the same time, switch SW4 is closed to re-engage the gatherer clutch 54. Since the gatherer is stopped, the engagement of the clutch 54 will act as a brake to prevent any coasting of the gear train 58, 60 and 68.

In this condition, the gatherer binder clutch 40 remains disengaged, clutch 54 has been engaged, and clutches 56 and 72 are disengaged. When the gatherer is restarted, both the gatherer conveyor chain 18 and the transfer conveyor chain 26 will operate as one unit with the transfer conveyor chain 26 being immediately available to receive signatures from the gatherer conveyor chain 18. It is an

important aspect of this invention that, by reason of the clutches **40** and **56** being disengaged, the gatherer **10** may be brought up to a speed synchronous with the speed of the binder **12** without the necessity for slowing down the binder. Thus, the transfer conveyor chain **26** is of such a length that sufficient cycles of the gatherer **10** are available to permit the gatherer **10** and, hence, the conveyor chains **18**, **26**, to achieve a speed synchronous with that of the binder **12** and the in-feed conveyor chain **22** before any signatures are delivered to the in-feed conveyor. Once the gatherer has been brought up to a speed close to that of the binder, switch SW5 is closed and when the proper phase relationship is established, SW6 closes to re-engage clutch **40**. At the same time, clutch **56** would be engaged so that the transfer conveyor chain **26** will be driven both by the binder and the gatherer and the entire system will operate as a unit.

While the invention has been described with reference to a single gatherer **10** feeding signatures to the binder **12**, the invention is particularly adapted for use in a system wherein two gatherers are feeding signatures in alternation to a single binder. In such a system, a transfer conveyor system of the type shown in FIGS. 1 and 2 would be associated with each gatherer with the two transfer conveyors cooperating with the in-feed conveyor of the binder. The binder and the in-feed conveyor would operate at twice the speed of the gatherers and their associated transfer conveyors such that the in-feed conveyor would receive signatures alternately from one transfer conveyor and then the other. In this manner, the binder could operate at, for example, 200 books per minute while the two gatherers are each operating at 100 books per minute.

With a dual gatherer system, each transfer conveyor system would be provided with a drive and synchronizing system of the type shown in FIGS. 3 and 4. A separate gatherer-binder clutch **40** would be provided for each gatherer with the conventional gear box associated with the binder providing the means to enable the binder to operate at twice the speed of the gatherer while permitting clutch **40** to interconnect each gatherer shaft with the binder shaft when the system is operating as a synchronous unit.

In the event of a fault at one of the gatherers causing shut-down of that gatherer, the transfer conveyor system associated with that gatherer will continue to feed signatures to the binder in alternation with the transfer conveyor of the other gatherer until it is cleared. Thereafter, the transfer conveyor for the shut-down gatherer will be stopped and re-timed with its gatherer in precisely the manner above-described. At the same time, the other gatherer will continue to deliver signatures via its transfer conveyor to the binder with both the gatherer and binder continuing to operate synchronously at speeds of 100 and 200 books per minute, respectively. Of course, with the one gatherer shut down, the binder receives only one-half as many signatures as with both gatherers operating.

When the gatherer fault has been corrected, that gatherer is restarted and re-timed with the binder in the same manner as described above.

Although the invention has been described with reference to a preferred embodiment, it is to be understood that neither the illustrated embodiment or the terminology employed in describing it is intended to be limiting; rather, it is intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed is:

1. In a system for processing articles, said system including a first unit for delivering the articles and motor means for driving said first unit, a second unit for receivin the articles and motor means for driving said second unit independently of said first unit, first conveyor means for feeding the articles from said first unit toward said second unit and second conveyor means for receiving said articles and feeding the articles into said second unit, means for accumulating articles delivered by said first conveyor means and feeding the accumulated articles in timed relation to said second conveyor means and drive means for actuating said accumulating means, said drive means including means for driving said accumulating means by said first motor means and means for driving said accumulating means by said second motor means whereby said accumulating means may be selectively driven by either of said motor means.

2. The system of claim **1** wherein said drive means further includes means for driving said accumulating means simultaneously by both of said motor means.

3. The system of claim **1** and further including timing motor means operable independently of both of said first and second motor means and operatively connected to said accumulating means for driving said accumulating means to a position in timed relation with one of said conveyor means.

4. In a system for gathering and binding signatures and including:

a gatherer,

a binder,

a gatherer motor for driving said gatherer,

a binder motor for driving said binder,

a gatherer conveyor chain operatively driven by said gatherer and adapted to receive signatures fed by said gatherer,

an in-feed convey or chain driven by said binder and adapted to feed signatures to said binder,

a transfer conveyor chain for receiving signatures from said gatherer conveyor chain and delivering the signatures to said in-feed conveyor chain,

drive means for driving said transfer conveyor chain in synchronism with said gatherer and said binder, said drive means being operative to drive said transfer conveyor chain independent of said gatherer, and

timing means for synchronizing the operation of said transfer conveyor chain with said gatherer.

5. The system of claim **4** wherein said drive means comprises:

first coupling means for driving said transfer conveyor chain from said gatherer motor,

second coupling means for driving said transfer conveyor chain from said binder motor,

said first and second coupling means being operative to drive said transfer conveyor chain simultaneously from both said gatherer motor and said binder motor.

6. The system of claim **4** wherein said timing means includes a timing motor, and coupling means for selectively driving said transfer conveyor chain from said timing motor.

7. The system of claim **6** wherein said timing means further includes a first timing element operatively connected to said gatherer conveyor chain and a second timing element operatively connected to said transfer conveyor chain.

8. A conveyor system for feeding articles from a first station to a second station, said conveyor system comprising:

a first endless conveyor having spaced apart article engaging means thereon,

first drive means for driving said first conveyor,

second endless conveyor means having a plurality of spaced apart article receiving means thereon,

second drive means for driving said second conveyor means,

means for selectively interconnecting said first and second drive means for synchronous operation of said first and second conveyor means,

endless transfer conveyor means having a plurality of spaced apart article receiving means thereon,

said transfer conveyor means being positioned to receive articles from said first conveyor means and deliver the articles to said second conveyor means,

drive means for driving said transfer conveyor means,

said drive means including means for selectively driving said transfer conveyor means in synchronism with

said second conveyor means independent of said first conveyor means,

means for selectively disengaging the drive of said transfer conveyor means from synchronous operation with said second conveyor means, and

means for synchronizing said transfer conveyor means with said first conveyor means when said transfer conveyor means is disconnected from synchronous operation with said second conveyor means.

9. A method of feeding signatures from a gatherer to a binder and wherein a synchronously operating transfer means is provided to receive signatures from the gatherer and deliver the signatures to the binder, said method comprising the steps of:

continuously feeding signatures from the gatherer to the transfer means until a fault occur at the gatherer,

stopping the gatherer to correct the fault while continuing to feed any accumulated signatures in said transfer means to said binder until all accumulated signatures have been fed to said binder,

stopping the feed from said transfer means while continuing to operate said binder,

re-timing said transfer means to the stopped gatherer,

restarting the gatherer and transfer means in synchronism,

feeding signatures from the gatherer to said transfer means while said gatherer and transfer means are being brought up to speed, and

establishing synchronism between said gatherer, said transfer means and said binder before the signatures fed to said transfer means are fed to said binder.

10. The method of claim **9** wherein the speed of said binder is maintained constant both while said gatherer and said transfer means are shut down and while being brought back up to synchronous speed.

11. The method of claim **9** wherein a plurality of gatherers each having a transfer means associated therewith are used to feed a binder with the plurality of transfer means feeding signatures in alternation to said binder, and wherein each gatherer and its associated transfer means continues to operate synchronously with said binder while any one gatherer is stopped to correct a fault.

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LAWRENCE CHARLES, Primary Examiner

U.S. Cl. X.R.

198—209