

Sept. 16, 1958

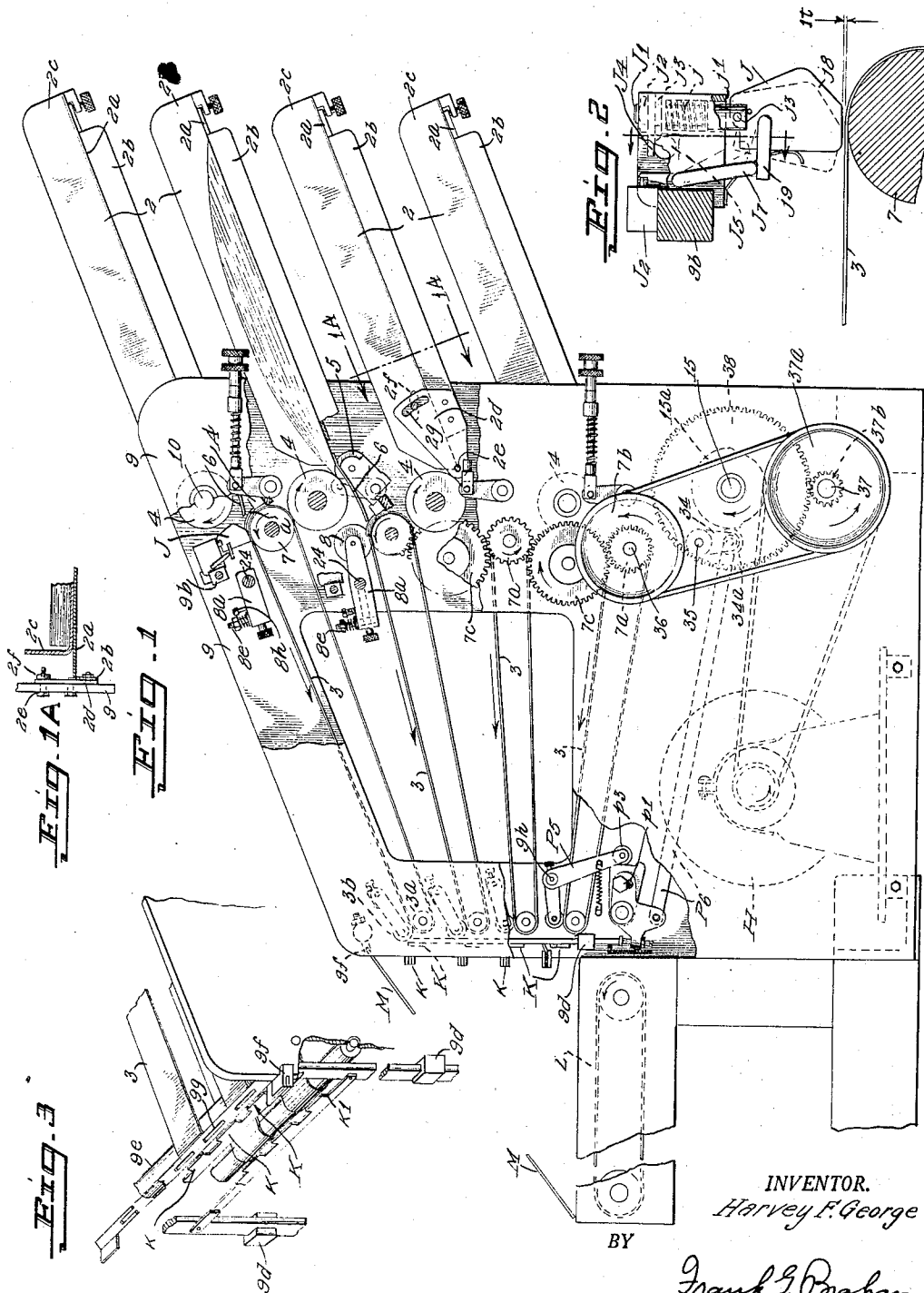
H. F. GEORGE

2,852,250

SHEET COLLATING MACHINE

Filed Oct. 9, 1953

6 Sheets-Sheet 1



INVENTOR.
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Sept. 16, 1958

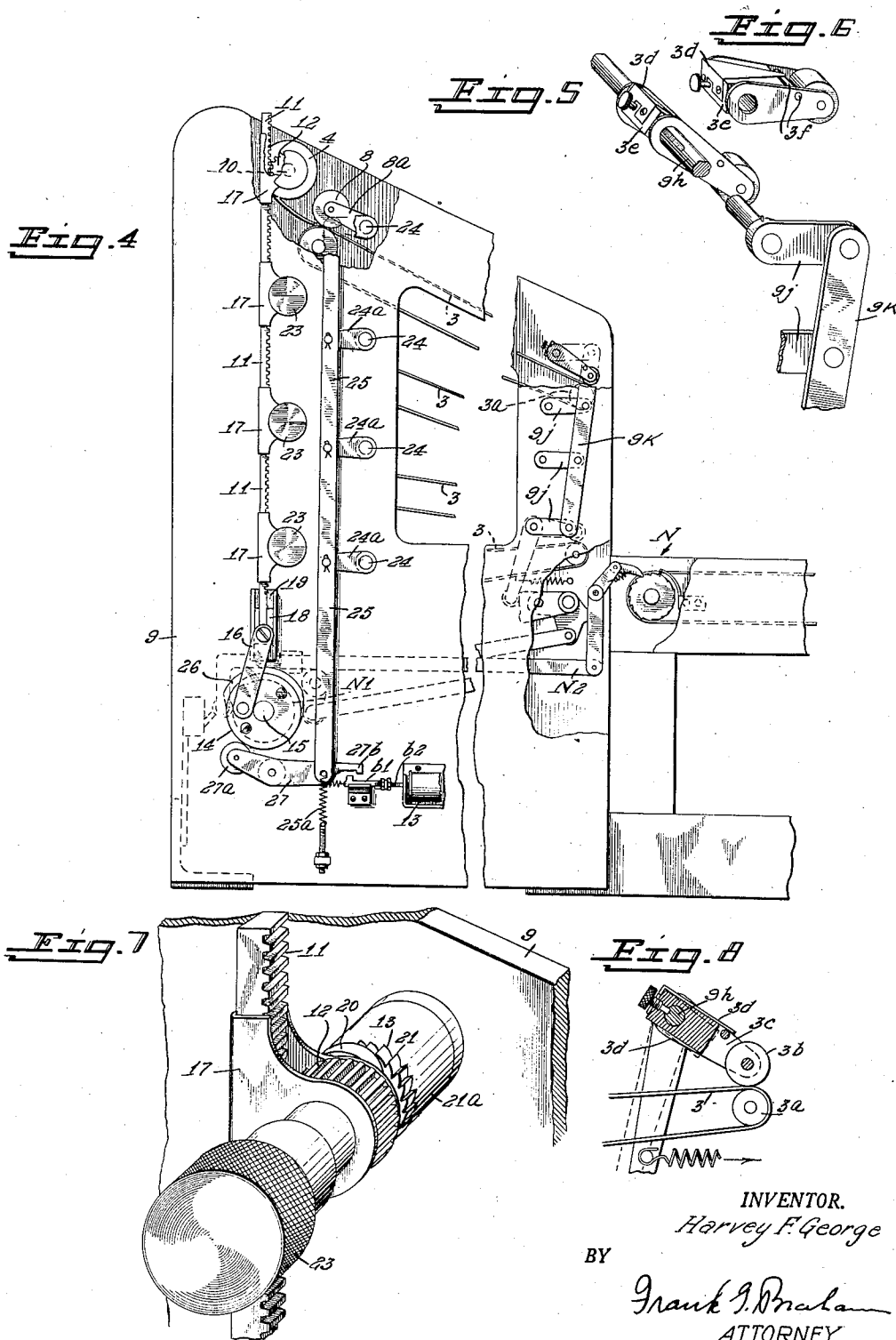
H. F. GEORGE

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SHEET COLLATING MACHINE

Filed Oct. 9, 1953

6 Sheets-Sheet 2



Sept. 16, 1958

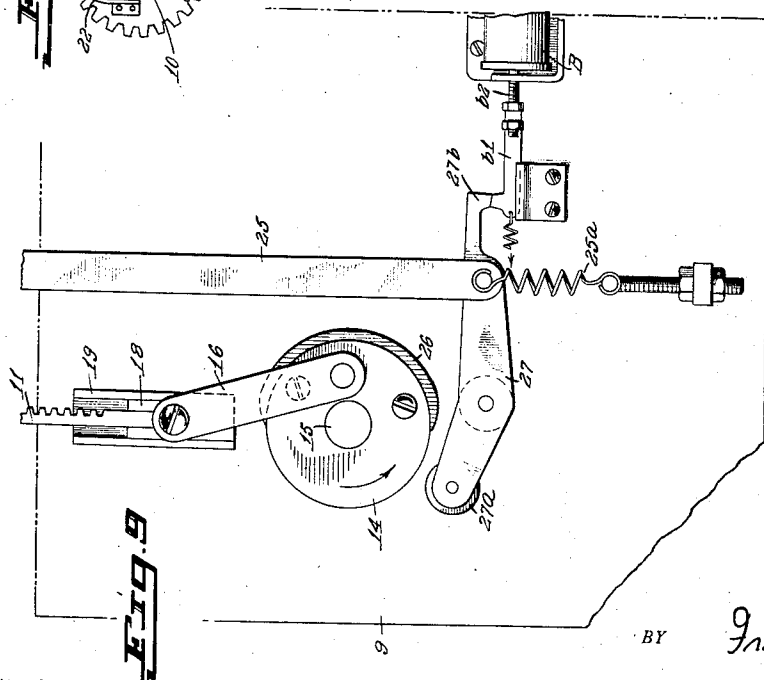
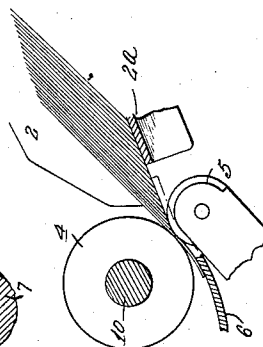
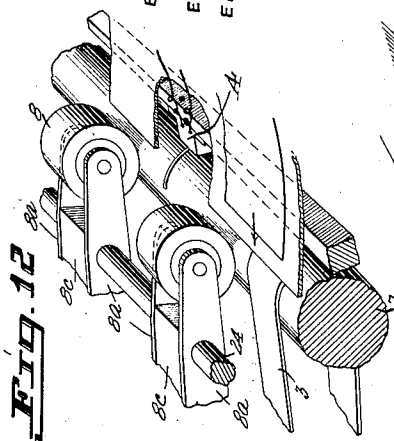
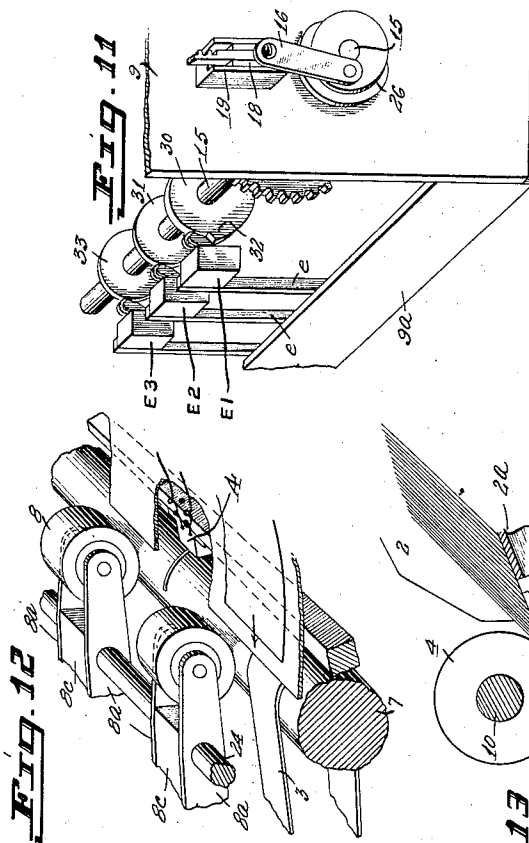
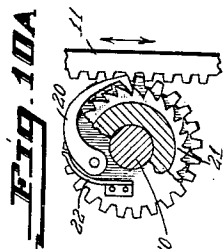
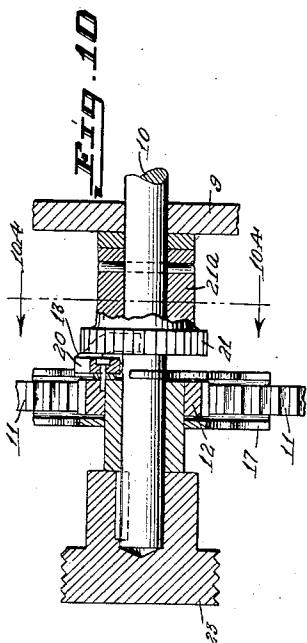
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SHEET COLLATING MACHINE

Filed Oct. 9, 1953

6 Sheets-Sheet 3



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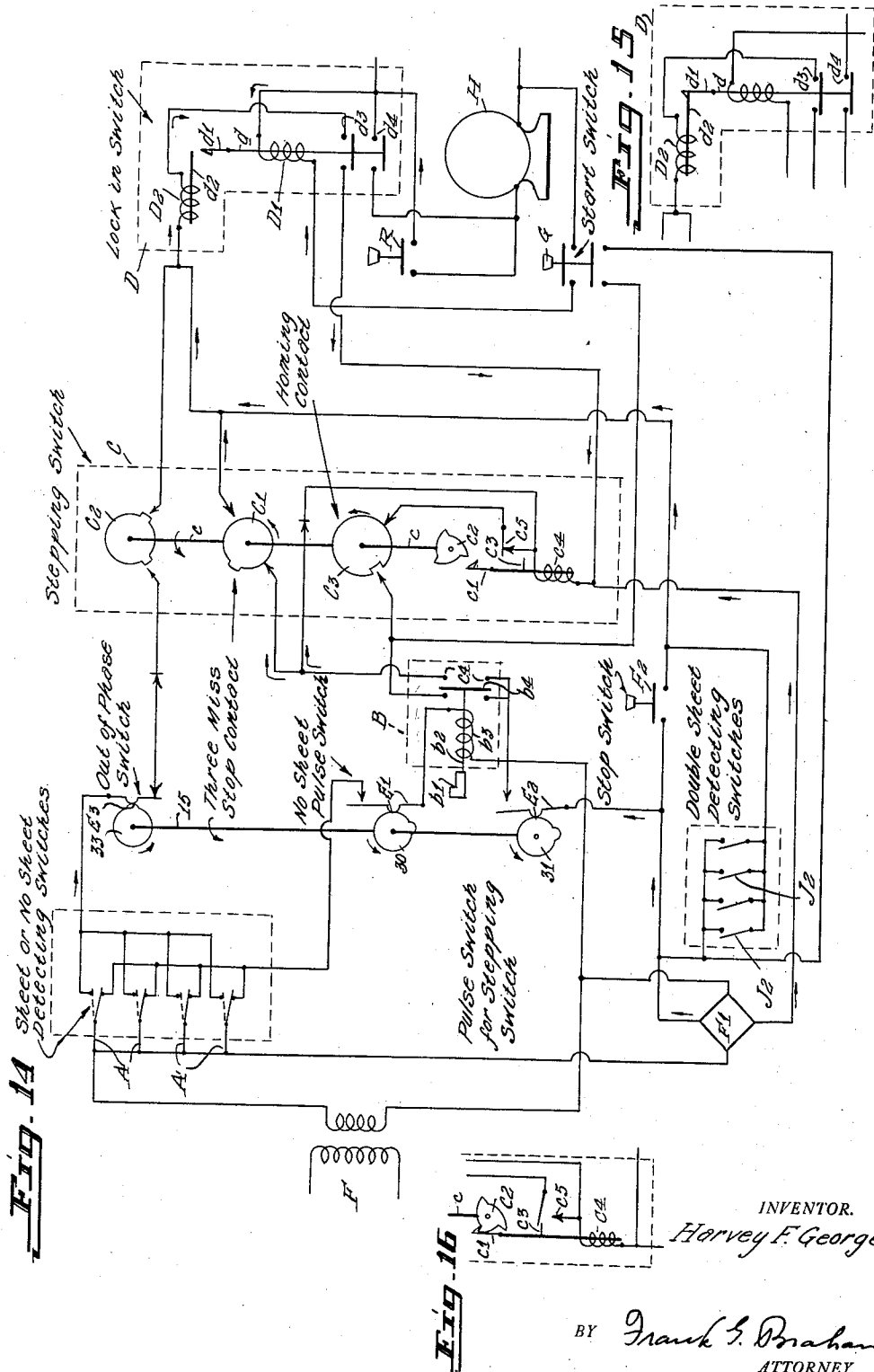
H. F. GEORGE

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SHEET COLLATING MACHINE

Filed Oct. 9, 1953

6 Sheets-Sheet 4



Sept. 16, 1958

H. F. GEORGE

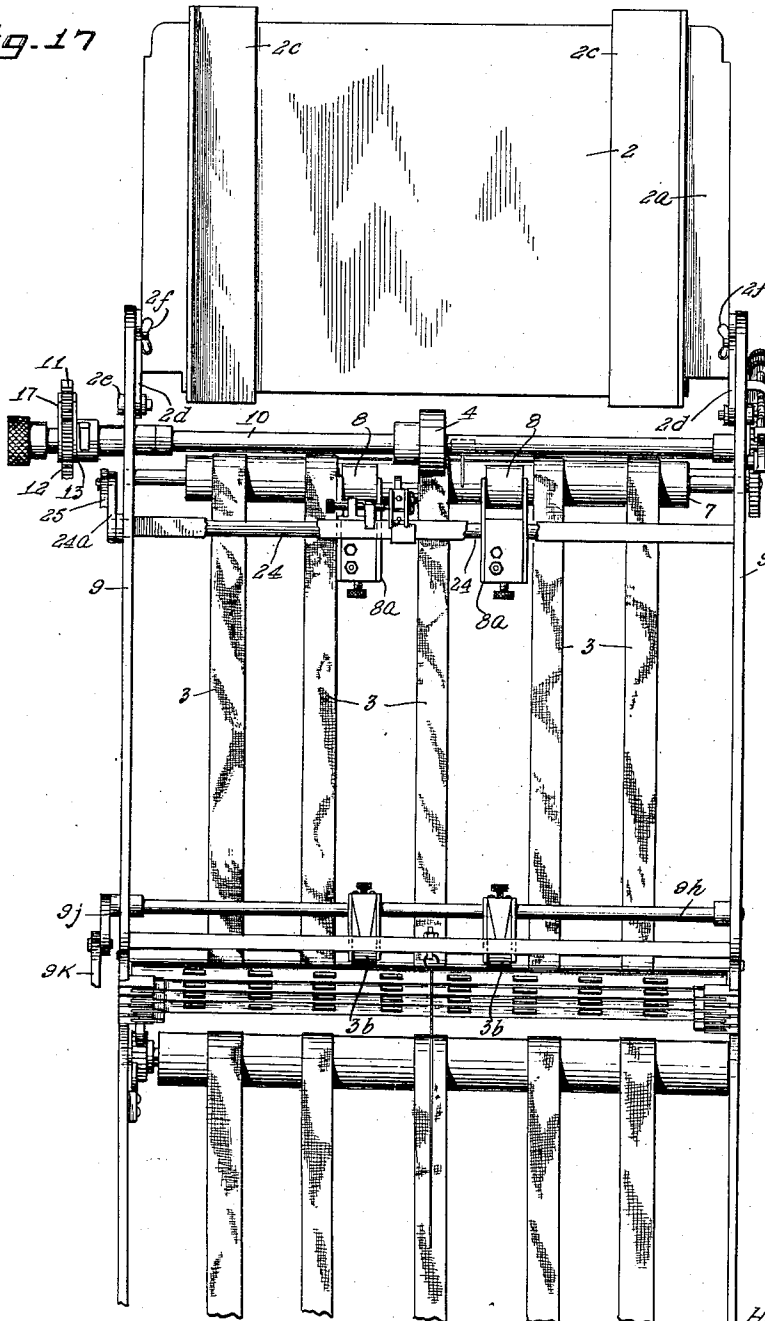
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SHEET COLLATING MACHINE

Filed Oct. 9, 1953

6 Sheets-Sheet 5

Fig. 17



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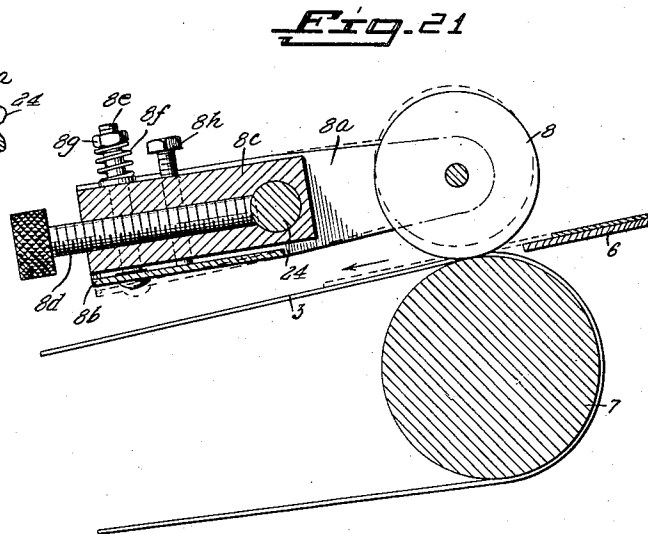
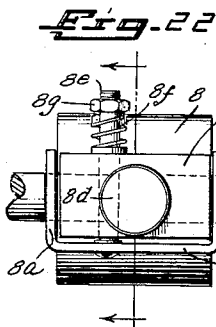
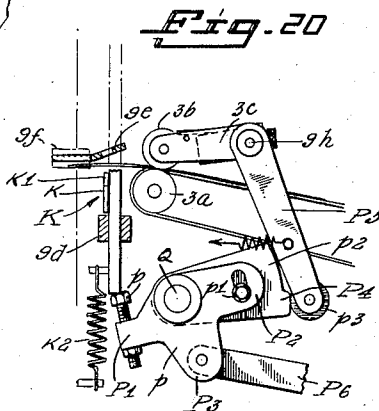
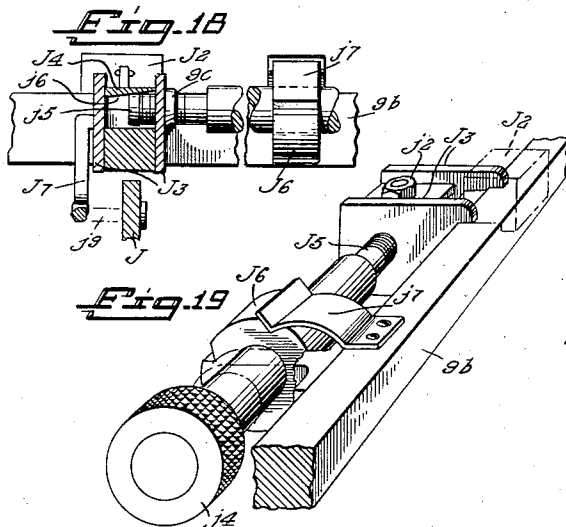
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H. F. GEORGE
SHEET COLLATING MACHINE

2,852,250

Filed Oct. 9, 1953

6 Sheets-Sheet 6



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2,852,250

SHEET COLLATING MACHINE

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Application October 9, 1953, Serial No. 385,187

18 Claims. (Cl. 270—58)

This invention is directed to an improved basic unit for collating machines, which is simple in construction and capable of handling a wide variety of paper stock at high speeds with a maximum degree of accuracy in the compilation of the collated sets produced. Continuous load type feeders arranged one above the other and a common actuating mechanism associated therewith, are employed so that the individual sheets may be withdrawn simultaneously from their respective feed bins or containers and directed by means of a corresponding number of belt transporters to a normally closed gate member adapted first to align the approaching sheets vertically by their leading edges and then release them collectively for gravitational compilation into sets upon a horizontally disposed conveyer arranged to receive them.

While accuracy of the collated sets is a prime factor or requisite in these machines, it nevertheless quite frequently happens that the feeders will either "miss" a sheet or feed double sheets, due to causes disassociated with the machine. For example, damage to the original paper stock would cause the feeders to miss a sheet, and adherence together of two sheets would cause a double sheet feed. In the present machine, however, means are provided whereby the absence of a sheet to be fed will not only be detected but the machine will be allowed to progress through three consecutive cycles in an endeavor to "pick up" the missing sheet, while the advance of the other sheets in the set are automatically retarded. Separate safety means functioning to stop the operation of the machine the instant a double sheet is detected, are also provided since such sheets necessarily must be removed manually from the machine. Moreover, to prevent possible jams as a result of sheets traveling out of phase in their course of collation, a further safeguard is provided to stop the operation of the machine at the moment any one of the four sheets may be caused to hesitate or be abruptly arrested for any of the well known reasons.

In the embodiment illustrated, these and other safety precautions to bring about rapid and accurate collation, are controlled electrically by the automatic operation of suitable switch devices and the resultant opening and closing of different circuits in a manner later to be described. However, it should be understood that the invention is not limited to any specific form or embodiment except insofar as such limitations are specified in the appended claims.

Referring to the drawings:

Fig. 1 is a side elevation of the improved collator partly broken away to show more clearly certain essential parts thereof.

Fig. 1A is an enlarged detail vertical section taken on the line 1A—1A of Fig. 1.

Fig. 2 is a detail elevation on an enlarged scale and partly in section, showing one of the four adjustable switch actuating plates associated with the belt drive rollers, for stopping the operation of the machine in the event a double sheet is fed to the transporters.

Fig. 3 is a perspective view showing a portion of the

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vertically movable gate member and parts immediately associated therewith.

Fig. 4 is an elevation showing the other side of the improved collator and parts of the sheet feed and belt drive mechanism attached thereto.

Fig. 5 is a detail perspective view showing a portion of the sheet discharge.

Fig. 6 is a detail perspective view of a sheet delivery pressure roller and its actuating spring.

Fig. 7 is a detail perspective view showing a portion of the vertically reciprocating rack bar and the means for imparting the intermittent rotation to the sheet feed rollers.

Fig. 8 is a detail vertical section through the supporting member for a pressure roller, and indicating the manner in which it functions.

Fig. 9 is an elevation showing on an enlarged scale, certain parts of the vertical link and rack bar actuating devices for controlling the rotation of the sheet feed rollers.

Fig. 10 is a vertical longitudinal section taken on the line 10—10 of Fig. 7.

Fig. 10A is a vertical section taken on the line 10A—10A of Fig. 10.

Fig. 11 is a perspective view showing the three pulse contact switches and the operating means therefor, which permit the machine to continue its operation for three successive cycles before it is automatically stopped, under certain abnormal conditions.

Fig. 12 is a detail perspective view showing the position of a "no-sheet" detecting switch in relation to a set of sheet extracting and transport drive rollers.

Fig. 13 is a detail vertical section through the discharge end of a bin and showing the manner in which the two sheet feed rollers associated therewith perform their function.

Fig. 14 is a labeled diagram showing the various switches and the different circuits controlled thereby in the improved machine.

Fig. 15 is an electrical diagrammatic detail showing the "lock-in" switch in its active position.

Fig. 16 is an electrical diagrammatic detail showing the actuating member of the "stepping" switch in its active position.

Fig. 17 is a top plan view of Fig. 1 taken at right angles to the inclination of the uppermost belt conveyer.

Fig. 18 is a detail vertical section taken on the line 18—18 of Fig. 2.

Fig. 19 is a detail perspective view showing the means for adjusting the safety device employed to prevent the delivery of sheets above a given thickness to the belt transporters.

Fig. 20 is a detail showing a sheet in the course of being discharged from the lowermost transporter, and the relative position of the parts controlling such operation.

Fig. 21 is a detail vertical section showing the manner of mounting the individual idlers for or associated with the belt drive rollers and indicating in dotted lines their capability of yielding independently of their controlling rock shafts under normal conditions, and

Fig. 22 is an end elevation of the idler shown in Fig. 21.

As best shown in Figs. 1 and 4, the improved collator preferably is a 4-station machine, being equipped with four inclined load type bins or containers 2 and a corresponding number of belt type sheet transporters 3 where-to the sheets are fed one after another from the bins by means of rollers 4 and spring pressed idlers 5 engaging said rollers. As the sheets are being fed to the respective transporters they obtain temporary support upon an intervening bridge plate 6 for directing them into the "bite" between belt drive rollers 7 and superposed spring actuated idlers 8 associated therewith and whereby the sheets

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are quickly withdrawn from the bins 2 preparatory to their final advance by the individual transporters for compilation into sets.

The sheet bins 2 (Figs. 1 and 17) each comprise a bottom plate 2a formed with depending side flanges 2b, and a pair of angular side plates 2c secured to the bottom plate so as to be capable of adjustment toward and from each other when desired to accommodate sheets of different widths. At their discharge ends, the bins also include a pair of triangularly shaped bracket plates 2d secured respectively to the depending side flanges of the bottom plate 2a and engaging fulcrum studs or bolts 2e projecting inwardly from upright side walls 9 of the machine frame so that the bins first may be tilted to the proper inclination and then clamped in place by means of thumb nuts 2f which engage other bolts projecting from said frame members through appropriately curved slots 2g formed in the bracket plates 2d.

The sheet feed rolls 4 associated with the several bins 2 (Figs. 4 and 17) are pinned or otherwise secured to individual horizontal shafts 10 mounted at or near their opposite ends in the side walls 9, and rotatable intermittently through a given number of degrees in the proper direction during each machine cycle to insure the partial delivery of a sheet by said rollers from the bins to the transporters 3. The means employed for rotating the shafts 10 includes a vertically disposed, reciprocating rack bar 11 (Figs. 7 and 10) arranged in mesh with pinions 12 loosely mounted on the shafts 10 but operatively connected thereto through the medium of separate ratchet devices 13 adapted to rotate said shafts only in the proper direction. Operation of the rack bar 11 is effected by a disc 14 keyed to a main drive shaft 15 and provided with a link 16 which is eccentrically attached thereto and in turn operatively connected to the lower end of the rack bar. During its vertical movements the rack bar 11 is sustained in mesh with the pinions 12 by guide members 17 supported from the rock shafts 10, and to facilitate its operation the rack bar at its lower end as well the link 16, are connected to a stabilizer 18, slidably mounted in a fixed upright bracket 19 of the machine frame. Rotation of the sheet feed rollers 4 in the present instance (Figs. 10 and 10A) is effected by the downward movement of the rack bar 11 through the medium of push pawls 20 pivotally attached to corresponding side faces of the pinions 12 and held normally engaged with ratchet wheels 21 under the tension of appropriate springs 22 also attached to said pinions. The ratchet wheels 21 are formed with elongated hub portions 21a secured to the shafts 10 of the feed rollers so as to impart the rotary movement thereto in the proper direction. The arrangement is such that as the rack bar 11 is reciprocated by rotation of the disc 14, the pinions 12 will be rotated respectively in opposite directions, first to effect the rotation of the shafts 10 through the medium of the pawls 20 and ratchet wheels 21, and then to move idly to shift the pawls relatively to the ratchet wheels to their original angular position. As a result, the leading ends of the sheets will be advanced from the bins 2 sufficiently far to locate them between the belt drive rollers 7 and the idlers 8 associated therewith. For reasons later to be pointed out, these operations may be effected manually instead of automatically while the machine is at rest, by means of a knurled thumb nut 23 secured to the free end of the individual shafts 10 adjacent the pinions 12.

The idlers 8 (Figs. 4, 12 and 17), are arranged in sets of two, one set for each transporter, which are supported by arms 8a from rock shafts 24 arranged one above the other and mounted at their opposite ends in the upright side walls 9 of the machine frame. At one end the shafts 24 (Fig. 4) are provided respectively with a crank arm 24a connected to a common vertical link 25 operative during each machine cycle in opposition to a pull spring 25a and whereby said shafts are rotated in opposite directions. As more clearly shown in Figs. 21 and 22, the two

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supporting arms 8a for the individual idlers 8, are freely mounted on the rock shafts 24 and formed with U-shaped extended portions 8b adapted to accommodate rectangular blocks 8c which are secured to said shafts by elongated clamping screws 8d. Since it is desirable to hold the idlers 8 resiliently against the belt drive rollers 7 in order that they may properly perform their individual functions independently of the rock shafts 24, the U-shaped portions of their supporting arms 8a are provided with upstanding studs 8e projecting through and sufficiently far above the block 8c to receive a compression spring 8f and a clamping nut 8g for regulating the tension of said spring. Adjustable stop screws 8h disposed alongside the studs 8e and projecting downwardly through the blocks 8c, serve to sustain the idlers 8 against the tension of the springs 8f in their normal position. The parts are so arranged that when the rock shafts 24 are rotated by the vertical link 25, the idlers 8 collectively will be momentarily disengaged from the belt drive rollers 7 against the tension of the pull spring 25a and permit the advance therebetween of sheets from the bins 2 by the sheet feed rollers 4. Then, and as the idlers 8 are released, they will be held individually and to the exclusion of the spring 25a, under the tension of the springs 8f which are adapted to insure the extraction of the sheets from the bins and their continued advance by the belts of the transporters 3. Operation of the vertical link 25 is controlled by a cam element 26 on the main drive shaft 15 before mentioned, and its upward movement is effected by means of a horizontally disposed rocking lever 27 connected at one end to the lower extremity of the link and provided at its other end with an anti-friction roller 27a engaging said cam element.

In the event a sheet from any one of the bins 2 should fail to be delivered at the proper moment and in the manner already stated to the corresponding transporter 3, it is proposed according to the present invention: first, to detect the absence of the missing sheet without interrupting the machine cycle of operation and at the same time slow down the advance of sheets after their delivery to the other transporters, to an extent determined by the intermittent rotation of the sheet feed rollers 4; and finally permit the operation of the machine to continue for a maximum of two more additional cycles. If the presence of the missing sheet should be detected during this limited period, the sheets will automatically be caused to resume their normal speed of advance and as determined by the rotary speed of the belt drive rollers. On the other hand, if the missing sheet should remain undetected until the end of said period, the operation of the machine will be automatically stopped for manual investigation. The means employed to bring about the above results, includes a micro-switch A (Figs. 1 and 12) associated with each belt drive roller 7 and operable by the leading ends of the sheets as they are fed to the individual transporters 3. The switches A respectively, are provided with a delicate actuating finger a and if, through the absence of a sheet at the beginning of a machine cycle, any one of said switches should fail to perform its normal function, a circuit will be closed through the medium of a solenoid B to a stepping switch C (Fig. 14) later to be described and which in turn, is adapted to delay for two additional cycles, the release of a "lock in" switch D for stopping the operation of the machine. Moreover and to permit the free but slower advance of the non-missing sheets delivered to the transporters 3 by the feed rollers 4, an interponent b1 (Figs. 4 and 9), is attached to one end of the core member b2 of the solenoid B and arranged so as to be introduced momentarily into the path of a projection 27b formed on the rocking lever 27, when said solenoid is energized. In this way, the return movement of the vertical link 25 under the tension of the spring 25a, is prevented and as a result, the idlers 8 associated with the belt drive rollers 7, are sustained in their raised position out of engagement with the sheets,

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as they are being advanced intermittently along the transporters by the sheet feed rollers 4 during the three cycle period or until the presence of the missing sheet is detected. In the latter instances the interponent b1 will be caused to remain in its inactive position and the stepping switch C allowed to home so that the operation of the machine may continue uninterrupted.

The above results (Figs. 11 and 14), are accomplished by means of two pulse switches E1 and E2 controlled by separate cam elements 30 and 31 pinned to the drive shaft 15, and operable one slightly in advance of the other, during each machine cycle so as to energize the magnetic coil b3 of the solenoid B in the event a missing sheet should be detected in the manner stated, and thus not only locate the interponent b1 in its active position but at the same time inaugurate the operation of the stepping switch C by closing a circuit thereto from a transformer F through the medium of a rectifier F1. However, if at the end of the three cycle period the missing sheet still should remain undetected, a "three miss" contact C1 associated with the stepping switch C is adapted to close a separate circuit from the transformer F to the "lock in" switch D and thus stop the operation of the machine. As best shown in Fig. 11, the pulse switches E1 and E2 are supported at the upper ends of vertically disposed bracket arms c rising from a cross bar 9a of the machine frame, and the cam elements 30 and 31 are formed with individual high portions 32 adapted to operate said switches in timed relation to each other.

It is further proposed according to the present invention, to automatically stop the operation of the machine, if the sheets should happen to be fed "out of phase" to the transporters 3 while the stepping switch is located in its home position as shown in Fig. 14. To this end, a third pulse switch E3 similar in form to the switches E1 and E2 and likewise controlled by a cam element 33 on shaft 15, is employed to close a circuit from any one of the detecting switches A to the "lock in" switch D through the medium of a second contact C2 also associated with the stepping switch C. Like the three cam elements 30, 31 and 33, the two contacts C1 and C2 as well as a homing contact C3 constitute individual cam elements which are mounted on the arbor c of the stepping switch C, and as indicated diagrammatically in Fig. 14, are capable of being rotated collectively for three consecutive machine cycles through 120 degrees whenever the operation of the stepping switch is inaugurated in the manner already stated. Rotation of the arbor c is effected by a vertically reciprocable, toothed plunger c1 controlled by a solenoid C4 and engaging a ratchet wheel c2 secured to one end of the arbor. Consequently, at the start of the first machine cycle and as the solenoid B is energized a circuit will be closed from the rectifier F1 through the coil of the solenoid C4, to actuate the plunger c1 and thus turn the homing contact C3 from its normal position through the first step of its rotary movement. At the same time the circuit controlled by the "out of phase" switch E3 to the "lock in"—switch D, will be broken temporarily by the rotation of the contact C2, or until the contact C3 of the stepping switch C, again returns to its homing position. In this way the stepping switch C and the "out of phase" switch E3 are permitted to perform their individual functions automatically, and one to the exclusion of the other, as required. It may also be observed and as further indicated in Fig. 14 that the plunger c1 of the solenoid C4 is provided with an offset member c3 which is adapted during the upward movement of the plunger, to operate a normally closed contact switch C5 and thus de-energize momentarily said solenoid so as to impart the intermittent rotation to the arbor c of the stepping switch C.

The "lock in" switch D (Figs. 14, 15 and 16) is arranged in the main circuit established by a manually operated control switch G, from an electric motor or generator H, and includes a primary magnetic coil D1 as well

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as a similar secondary coil D2. As the coil D1 is energized by the closing of the switch G, the core member or plunger d thereof will be actuated in opposition to a spring (not shown) to effect an engagement between a yieldable pawl element d1 (Fig. 15) attached to one end of the plunger, and a retractile core member d2 of the secondary magnetic coil D2. At the same time contact switch plates d3 and d4 secured to the other end of the plunger d are adapted to close separate circuits from the generator H through the control switch G and the magnetic coil D2 of the lock in switch D. However, when emergencies arise during collations such as those already described, the secondary coil D2 will be energized to retract the plunger d from its engagement with the pawl element d1 and thus break the circuits established by the "lock in" switch D to automatically stop the operation of the machine.

The improved machine also includes safety means located preferably adjacent the receiving end of the respective transporters 3, for detecting the presence of a double sheet or one thicker than those selected for collation as they are fed to the transporters under the influence of the sheet feed rollers 4. In the embodiment illustrated (Figs. 2, 18 and 19), such means includes a vertically disposed detector plate J pivotally connected at its upper end to a similarly disposed stud J1, and operable by a sheet of abnormal thickness, so as to close an electrical circuit through a micro-switch J2 to the lock-in switch D and thus stop the operation of the machine. The stud J1 (Fig. 2) is mounted for vertical adjustment in a bifurcated bracket J3 secured to a cross bar 9b of the machine frame, and the connection between said stud and the detector plate J, is such as to permit yielding of the latter edgewise only in the sheet feed direction whenever it may be actuated. However, in order that the detector plate J may properly perform its function, the adjustments of the stud J1 toward and from the underlying belt drive roller 7, must be effected according to the thickness of the sheets being collated. To this end, a compression spring j seated in the bracket J3 and engaging a collar j1 formed on the stud J1 near its lower end, tends constantly to move the stud as well as the detector plate J downwardly toward the belt drive roller 7, and micro-metric means are employed for effecting the adjustments of the detector plate J in opposition to said spring, through the medium of an offset lifting member J4 disposed within the side walls of the bifurcated bracket J3 and secured to the upper end of the stud J1 by a clamping nut j2. A pin and slot connection j3 arranged between the bracket J3 and the collar j1 of the stud J1, serves to guide the latter during its endwise movements.

As best shown in Figs. 18 and 19, the means employed for effecting the vertical adjustments of the detector plate J, includes a horizontal rod J5 having a threaded engagement in one side wall of the bracket J3 and rotatably mounted in a bearing projection 9c secured to the stationary cross bar 9b of the machine frame. At one end the rod J5 is provided with a knurled thumb nut j4 and at its opposite end, is also provided with a slightly tapered cam element j5 normally engaging a correspondingly beveled cam surface j6 formed on the lower face of the offset lifting member J4 for the vertical stud J1. Between its ends, the rod J5 further is provided with a ratchet-like wheel J6 normally engaging a yieldable click pawl j7 which is appropriately formed of spring sheet metal and also fastened to the fixed cross bar 9b. The arrangement is such that by turning the rod J5 through a predetermined number of degrees, in one direction or the other, it may be advanced or retracted edgewise and through the engagement of the tapered cam element j5 with the beveled surface of the lifting member J4, the stud J1 will be raised or lowered to set the detector plate J in the proper position relatively to the underlying belt drive roller 7 and according to the thickness of the sheets to be collated.

The detector plate J for the individual transporters 3 is shaped near its lower end so as to present an upwardly inclined, sheet directing edge j8, and adjacent its upper end is equipped with an arm or projection j9 whereby the micro-switch J2 may be caused to function whenever said plate may be displaced in the manner already stated. In such instances and as indicated in dotted lines (Fig. 2), the projection j9 is adapted to actuate a vertically disposed rocking lever J7 which is attached to the cross bar 9b of the machine frame and arranged to directly control the operation of the switch J2.

Attention now is directed to Figs. 1, 3 and 20 wherein the mechanism hereinbefore mentioned, for automatically aligning and then releasing the sheets from the discharge ends of the transporters 3, is shown in detail for a better understanding of the parts involved and the precise manner in which they cooperate to bring about the results desired. Such mechanism (Fig. 1) includes a normally closed, vertically reciprocable, spring actuated gate member K for arresting the sheets by their leading edges before they leave the transporters, and which is operable during each machine cycle to permit their release simultaneously for collation into sets upon a conveyor L or other suitable support. As best shown in Fig. 3, the gate member K is slidably mounted at its opposite ends in fixed guide brackets 9d, and comprises horizontally disposed, spaced apart gate elements K located respectively adjacent the discharge ends of the transporters 3. The elements K of the gate member K (Fig. 3) are formed on their upper edges with equally spaced apart, sheet arresting projections K1; and to properly guide the sheets as they are released by the gate member, the machine is further equipped with a set of flat horizontal cross bars 9e also arranged respectively adjacent the discharge ends of the transporters 3 but secured at their opposite ends through the medium of small brackets 9f, to the upright side members 9 of the machine frame. Specifically, the cross bars 9e (Figs. 3 and 20) are formed with spaced apart apertures 9g to accommodate the upwardly projecting portions K1 of the gate elements K when the gate member K occupies its sheet arresting position; and as more clearly shown in Fig. 20, said bars transversely of their length, are inclined upwardly so as to direct the sheets as they are discharged from the transporters 3, toward a fixed deflector M adapted in turn to assist in the compilation of the sheets into sets of four upon the conveyor L. If desired, the conveyor L may be advanced a limited distance at the end of each machine cycle in order that the sets thus compiled may occupy positions offset from one another and in this way facilitate their removal from the conveyor L. The means employed for this purpose (Fig. 5) includes a ratchet device N controlled from a separate cam element N1 on the main shaft 15, through suitable linkage N2 operatively connected to said device.

In the improved machine, the transporters 3 (Fig. 1) preferably converge from their receiving ends toward the gate member K and terminate advantageously in juxtaposition thereto where they are provided with belt sustaining rollers 3a and yieldable sheet directing idlers 3b normally engaging said rollers. The idlers 3b (Fig. 17) are arranged in pairs (one pair for each transporter) and supported respectively between arms 3c freely mounted on horizontal rock shafts 9h journaled at their opposite ends in the upright frame members 9 as best shown in Figs. 5 and 6, leaf springs 3d secured to blocks 3e pinned to the rock shafts 9h, and engaging cross pins 3f connecting the supporting arms for the idlers 3b, serve normally to hold the latter yieldingly against displacement upon the belt sustaining rollers 3a. At one end, the rock shafts 9h (Fig. 17) extend sufficiently beyond the upright left-hand member 9 of the machine frame, to carry individual crank arms 9j which are connected to a common vertically disposed link 9k (Fig. 5), so that the rock shafts together with the blocks 3e, may be

turned collectively in opposite directions first to apply and then relieve the idlers 3b of the pressure imparted thereto—by the leaf springs 3d.

To carry out the invention, and in order that the rotation of the rock shafts 9h may properly be coordinated with the vertical movements of the gate member K, unitary means controlled from the main drive shaft 15 are provided for effecting the operation of the gate member as well as said rock shafts, in a predetermined order of succession. Such means (Figs. 1 and 20) includes a rocking lever P secured to one end of a separate horizontal rock shaft Q, and formed with three diverging arms P1, P2 and P3. The arm P1 of the rocking lever P projects forwardly from the rock shaft Q and is equipped with a vertically adjustable screw stud p located directly beneath and engaging the contiguous lower end portion of the gate member K; and a pull spring K2 attached to the gate member tends constantly to hold the latter in its lower position (Fig. 20), as determined by the engagement of the lowermost gate element K with the fixed underlying guide bracket 9a. At its opposite end, the rock shaft Q is provided with a similarly equipped supporting arm (not shown) for the gate member K so as to properly balance the spring pressure applied thereto and insure a smoothness in its operation.

The arm P2 of the rocking lever P projects rearwardly from the rock shaft Q and is operatively connected to a cam element P4 freely mounted on said shaft and which in turn controls the operation of the rock shafts 9h associated with the sheet directing idlers 3b already described. In order to properly synchronize the operation of the idlers 3b with the vertical reciprocative movements of the gate member K, provision is made whereby a relative movement between the arm P2 and the cam element P4 may take place as the lever P is actuated. For this purpose the cam element P4 is operatively connected to the rocking lever P by means of a pin and slot arrangement p1. Consequently, when the gate member K occupies its raised position as shown in Fig. 1, the idlers 3b will be sustained in their normal sheet directing position by a low concentric surface p2 of the cam element P4, through its engagement with an anti-friction roller p3 attached to the free end of a crank arm P5 depending from the lowermost rock shaft 9h. However, when the gate member K is allowed to descend under the control of the rocking lever P to its inactive position shown in Fig. 20, the cam element P4 then and through the pin and slot arrangement p1, will be turned sufficiently to locate a high portion p4 thereof, into engagement with the anti-friction roller p3. As a result spring pressure will be applied to the idlers 3b and enable them to completely perform their function in the discharge of the sheets from the transporters 3. Operation of the rocking lever P is effected by the reciprocal endwise movement of a relatively long, fore and aft link P6 which is pivotally connected at its front end to the third arm P3 of the rocking lever, and as indicated in dotted lines (Fig. 1), is similarly connected at its rear end to an oscillatory arm 34 located near the cam shaft 15 hereinbefore mentioned. The arm 34 is suspended from a stationary stud 35 and carries an anti-friction roller 34a arranged to engage an edge cam 15a mounted on the shaft 15.

To enhance simplicity and economy in the production and assemblage of the various parts identified with the sheet feed and belt drive mechanism, such parts as may be noted (Figs. 1 and 4), are identical in form and arrangement and directly controlled from the electric motor H before mentioned. Thus, the shaft 36 for the lowermost belt drive roller 7, is provided with a gear 7a driven from the motor H through a primary drive shaft 37, and sheave type belt pulleys 37a and 7b secured respectively to the shafts 36 and 37. Incidentally it may be mentioned that the primary drive shaft 37 is provided with a relatively small pinion 37b meshing with a much

larger gear 38 (indicated in dotted lines Fig. 1), for driving the shaft 15 already referred to, at the required speed of one complete revolution for each machine cycle of operation. The gear 7a however is adapted in its turn to drive the other three transporters by means of duplicate gearing which includes not only gears 7a for the remaining transporters, but larger intermediate idler gears 7c meshing respectively with the gears 7a. A brief recapitulation of the foregoing description and the order in which the various parts of the improved machine are adapted to perform their individual functions during a cycle, may prove helpful. Accordingly, sheets of a pre-selected thickness and size as they are fed from the several bins 2 to the transporters 3 by the intermittent rotation of the feed rollers 4, are adapted first to actuate the micro-switches A which as previously pointed out individually control two electrical circuits for automatically stopping the operation of the machine by releasing the lock-in switch D. One of these circuits (Fig. 14) is established from the transformer F through the medium of the contact switch C2, and by the closing of the pulse switch E3 so as to instantly stop the operation of the machine whenever the sheets should happen to travel out of phase; whereas, the other circuit is established by the closing of the pulse switches E1 and E2 whenever a sheet is missed and the corresponding micro-switch A is allowed to remain undisturbed in its normal position. As a result the operation of the stepping switch C is inaugurated through the energization of the solenoid C4 associated therewith, and thus delays the automatic stopping of the machine for the two additional cycles demanded. During this period the advance of the sheets along the other transporters 3 will be slowed down to a speed determined by the intermittent rotation of the sheet feed rollers 4 or specifically, to approximately two inches for each machine cycle of operation. In the meantime however if the presence of the missing sheet should be detected by a switch A, the magnetic coil b3 of the solenoid B would not be energized to perform its normal function (already described) or to close the electrical circuit from the transformer F to the solenoid C4 which controls the operation of the stepping switch C. Therefore the operation of the machine will be allowed to continue and the gate member K at such time will prevent the discharge of the three advanced sheets from the transporters until the missing sheet arrives, when all four sheets will be released simultaneously by said member in the proper registered condition. Incidentally and as indicated in Fig. 14, the circuit from the transformer F to the solenoid C4, is directly controlled by a switch plate b4 attached to the free end of the core member b2 of the solenoid B and disposed in engaging relation to a pair of spaced apart contacts c4 in said circuit.

After detecting the absence of a missing sheet for two successive cycles of the machine, the contact C1 will be closed, and when the switches E1 and E2 during the third cycle are closed, the pulse from switch E2 will pass through the switch plate b4 of the solenoid B to home the stepping switch C and at the same time stop the operation of the machine through the control contact C1 and the lock in switch D. A stop and start switch R located in this circuit so as to by-pass all safeties, is provided for joggling the mechanism around to any selected position as desired. It also may be mentioned that the closing of the lock-in switch D to start the motor H, will automatically connect a terminal of the secondary coil D2 of said switch to the rectifier F1; and that the circuit thus prepared includes a normally open stop switch F2 which is connected to the rectifier and whereby the coil D2 may be energized at any time to release the plunger d of the primary coil D1 and thus stop the operation of the machine.

The invention having been described, the following claims are made:

1. In or for the basic unit of a collating machine, in-

cluding in combination several inclined belt type, sheet transporters disposed in superposed relation to one another, belt sustaining rollers located at the discharge ends of the transporters, sheet directing idlers associated with said rollers, vertically movable sheet aligning means for arresting the sheets by their leading edges as they pass between the idlers and belt rollers, and means operable in synchronism with the sheet arresting means for pressing the idlers upon the belt sustaining rollers in order to insure a simultaneous discharge of the sheets from the transporters.

2. A combination according to claim 1, including rock shafts arranged respectively above the individual transporters and wherefrom the idlers are supported, and means whereby said shafts collectively may be turned in opposite directions so as first to apply and then release spring pressure upon the belt sustaining rollers through the medium of the idlers, for the purpose stated.

3. A combination according to claim 1, wherein the sheet arresting means includes a composite gate member slidably mounted at its opposite ends in the machine frame and comprising horizontally disposed spaced apart gate elements located respectively adjacent the discharge ends of the transporters.

4. In or for the basic unit of a collating machine, including in combination several gravity feed sheet bins spaced apart and arranged one directly above the other, a corresponding number of belt type sheet transporters associated respectively with the bins, intermediate sheet feed and belt drive rollers, spring actuated idlers engaging said rollers whereby the sheets are delivered one after another from the bins to the transporters, unitary means operable to effect rotation of the sheet feed rollers intermittently, and means operating in synchronism with the sheet feed rollers during each machine cycle for momentarily breaking the engagement between the belt drive rollers and the idlers associated therewith.

5. A combination according to claim 4, wherein the unitary means includes a vertically reciprocating rack bar, and wherein the shafts of the sheet feed rollers are provided respectively with a device operable by said bar during its active stroke for turning the rollers through a given number of degrees in the proper direction.

6. A combination according to claim 5, wherein the idlers for the belt drive rollers are supported respectively by an arm from a rock shaft, and including a vertically disposed, spring controlled link member similarly connected to the rock shafts and operable automatically during a machine cycle to raise and lower the idlers out of and into engagement with said rollers.

7. A combination according to claim 6, including a drive shaft, a crank disk keyed thereto for operating the rack bar, a rocking lever operatively connected to the link member, and an edge cam also keyed to the drive shaft for actuating said lever so as to raise the link member momentarily in opposition to its control spring and thus disengage the idlers from the belt drive rollers preparatory to the feeding of a sheet there between.

8. In or for the basic unit of a collating machine, including in combination several gravity feed bins spaced apart and arranged one directly above the other, a corresponding number of belt type sheet transporters associated respectively with the bins, intermediate sheet feed and belt drive rollers, spring actuated idlers normally engaging said rollers, means operable during a machine cycle for imparting a partial turn to the sheet feed rollers, means operating in synchronism with the sheet feed rollers for momentarily raising the idlers for the belt drive rollers out of engagement therewith to permit the delivery of a sheet by the respective feed rollers from the bins to the transporters, and means operative to sustain said idlers in their raised position during one or more succeeding cycles whenever a sheet feed roller should fail to perform its function completely.

9. A combination according to claim 8, wherein the

1 idlers for the belt drive rollers are carried by arms from individual rock shafts, and the means for momentarily raising the idlers out of engagement with said rollers, includes a cam controlled, spring actuated lever operatively connected to the rock shafts.

10. A combination according to claim 9, wherein the means for sustaining the idlers for the belt drive rollers in their raised position, includes an interponent movable automatically into and out of the path of the cam controlled lever for operating said rock shafts.

11. A combination according to claim 10, wherein the spring actuated lever is formed at one end with a protuberant extension, and the interponent is attached to the core member of a solenoid adapted when energized to project the interponent into the path of said extension so as to arrest the lever against the tension of its actuating spring and as permitted by the angular position of its control cam.

12. A combination according to claim 10, including a micro-switch associated with each of the belt drive rollers and operative by the leading ends of the sheets while the idlers occupy their raised position so that individually they may detect the absence of a sheet and at the same time close an electrical circuit to bring about a purposely delayed stoppage in the operation of the machine.

13. A combination according to claim 12, wherein the advance of the sheets while the idlers for the belt drive rollers are raised, is effected solely by the intermittent rotation of the sheet feed rollers during three successive cycles, and wherein the electrical circuit includes a stepping switch for stopping the operation of the machine automatically at the end of the third cycle.

14. In or for the basic unit of a collating machine, including in combination a plurality of inclined load-type, gravity feed bins equally spaced apart and arranged one directly above the other, a corresponding number of belt type, sheet transporters associated respectively with the bins, an electric motor, sheet feed mechanisms cyclically actuated by said motor for delivering sheets from said bins, belt drive mechanisms driven by said motor including rollers cyclically actuated to engage a delivered sheet and advance the same onto said transporters, sheet detector means associated with each of said feed bins which are actuated when a sheet is delivered from the associated bin, cam controlled switch contacts which are engaged after the sheet feed mechanism is actuated to deliver sheets, a solenoid actuated by engagement of said cam controlled switch and non-actuation of a sheet detector mechanism for interrupting the sheet advancing means of the belt drive mechanisms whereby the delivered sheets are intermittently advanced by the sheet feed mechanisms, and means responsive to the non-feeding of a sheet for a predetermined number of successive machine cycles for stopping said electric motor.

15. In or for the basic unit of a collating machine, including in combination several load-type, gravity feed bins equally spaced apart and arranged one directly above the other, a corresponding number of belt type, sheet transporters associated respectively with the bins, intermittently driven sheet feed mechanisms for delivering sheets from each of said bins, belt drive mechanisms including rollers actuated to engage the delivered sheets and advance the same onto said transporters, means for disabling said sheet advancing rollers in the event a sheet is not delivered from a bin whereby sheets delivered from the remaining bins advance onto the transporters under the intermittent drive of said sheet feed mecha-

nisms, means responsive to the delivery of a sheet previously missed for restoring said disabling means thereby actuating said belt drive mechanism to advance all of the delivered sheets onto said transporters, an electric motor for driving said mechanisms, a lock in switch adapted when energized to stop the motor, and electrically controlled safety equipment including sheet detecting switches associated respectively with the belt transporters, a stepping switch for delaying the energization of the lock in switch for three successive cycles in the event a sheet is missed by a detect switch, and a solenoid switch for controlling the circuit from the sheet detecting switches to the stepping switch so as to cause a homing of the latter if the missing sheet should be detected, and at the same time permit the collating unit to automatically resume its normal operation so that the missing sheet is advanced on the transporters with the other sheets fed from the bins during a previous machine cycle.

16. In or for the basic unit of a collating machine, including in combination several inclined load-type, gravity feed bins spaced apart and arranged one directly above the other, a corresponding number of belt type sheet transporters associated respectively with the bins, sheet feed and belt drive mechanisms disposed between the discharge ends of the bins and the receiving ends of the transporters, a composite gate member movable to and from active position during a machine cycle first to align the sheets in superposed relation to one another before they leave the transporters and then to permit their discharge simultaneously therefrom, a plurality of belt sustaining rollers located at the discharge ends of the transporters, yieldable sheet directing idlers normally engaging said rollers, and unitary means operable to lower the gate to its inactive position and at the same time apply spring pressure to the idlers in order to insure a simultaneous discharge of the sheets from the transporters.

17. A combination according to claim 14 including second cam controlled switch contacts which are engaged during each machine cycle after actuation of the sheet feed mechanism, stepping switch mechanism including a coil which is actuated upon engagement of said second switch contacts and actuation of the solenoid whereby a count of successive machine cycles during which a sheet is not fed is obtained, and means for restoring said stepping switch mechanism to the zero count position when prior to the predetermined count being reached and the electric motor stopped a sheet is delivered from a feed bin from which during the preceding machine cycle no sheet was fed.

18. A combination according to claim 16, including a main drive shaft and wherein said unitary means includes a rocking device operatively connected to the gate member as well as to the idlers, and controlled from a cam element of the machine driving mechanism.

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