Aug. 9, 1938. F. W. STORCK ET AL 2,126,514

SHEET SEPARATING AND FEEDING DEVICE

Filed Dec. 12, 1936 5 Sheets-Sheet 1

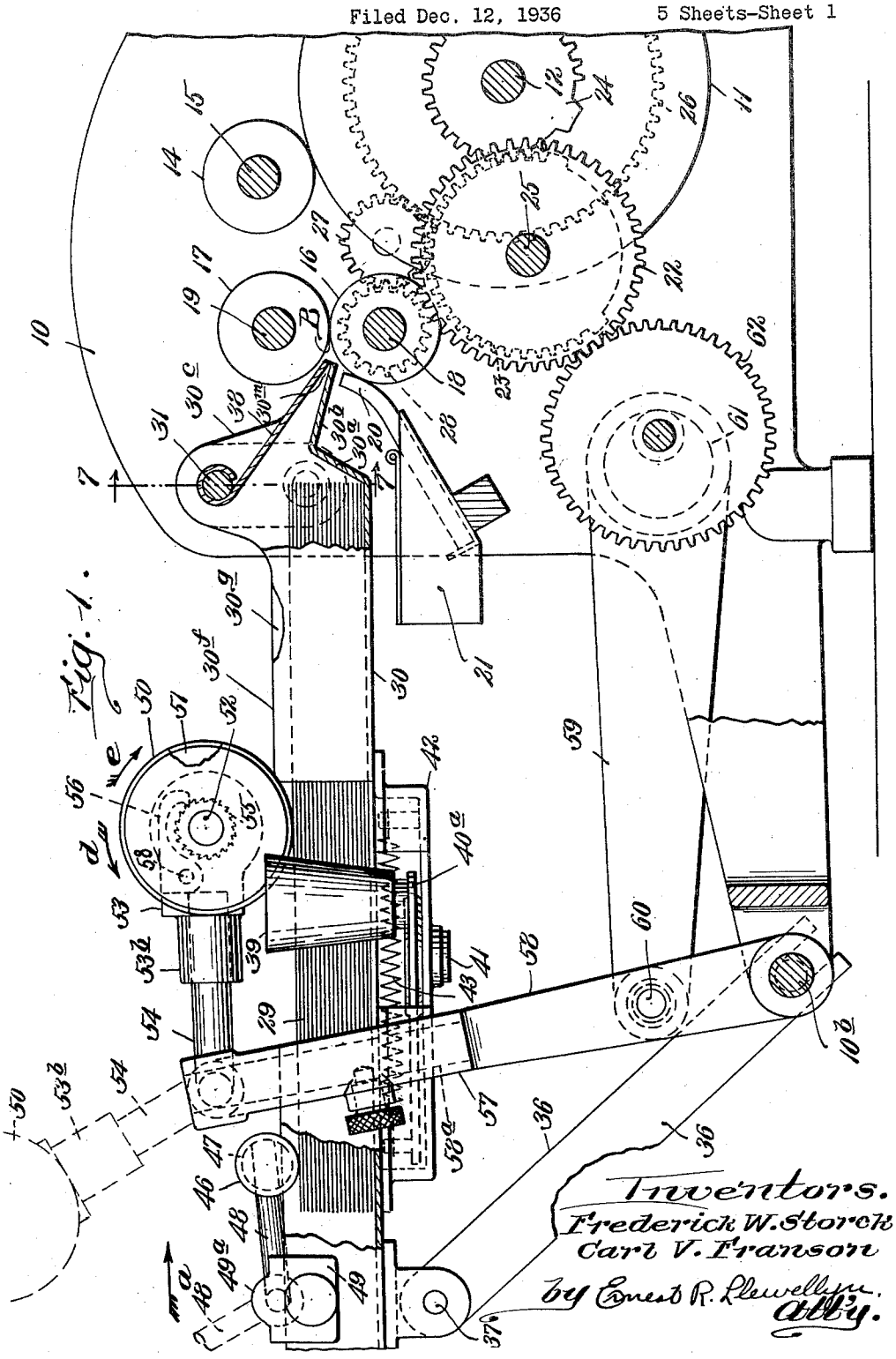


Fig. 1.

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SHEET SEPARATING AND FEEDING DEVICE

Filed Dec. 12, 1936 5 Sheets-Sheet 2

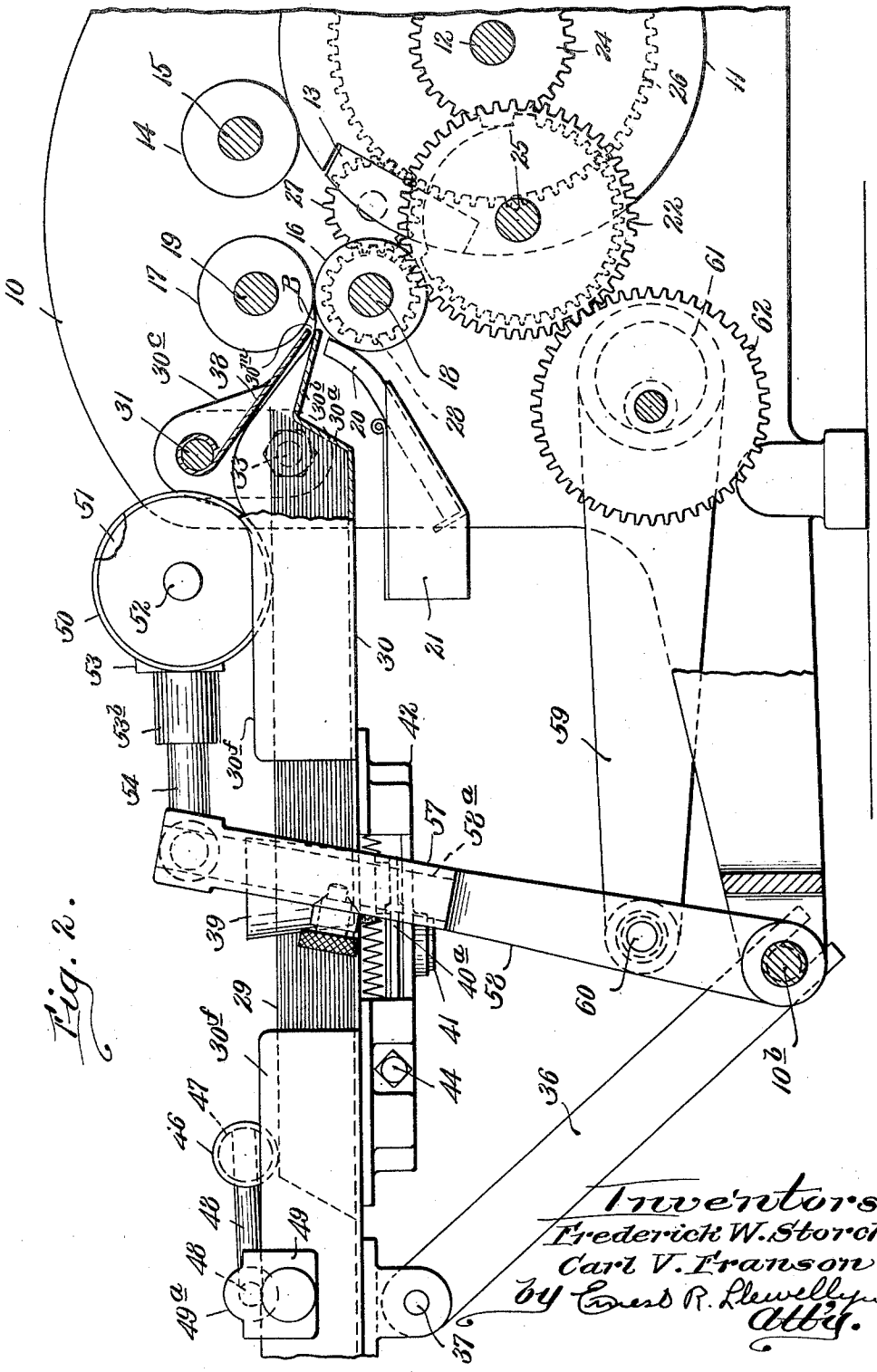


Fig. 2.

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SHEET SEPARATING AND FEEDING DEVICE

Filed Dec. 12, 1936 5 Sheets-Sheet 3

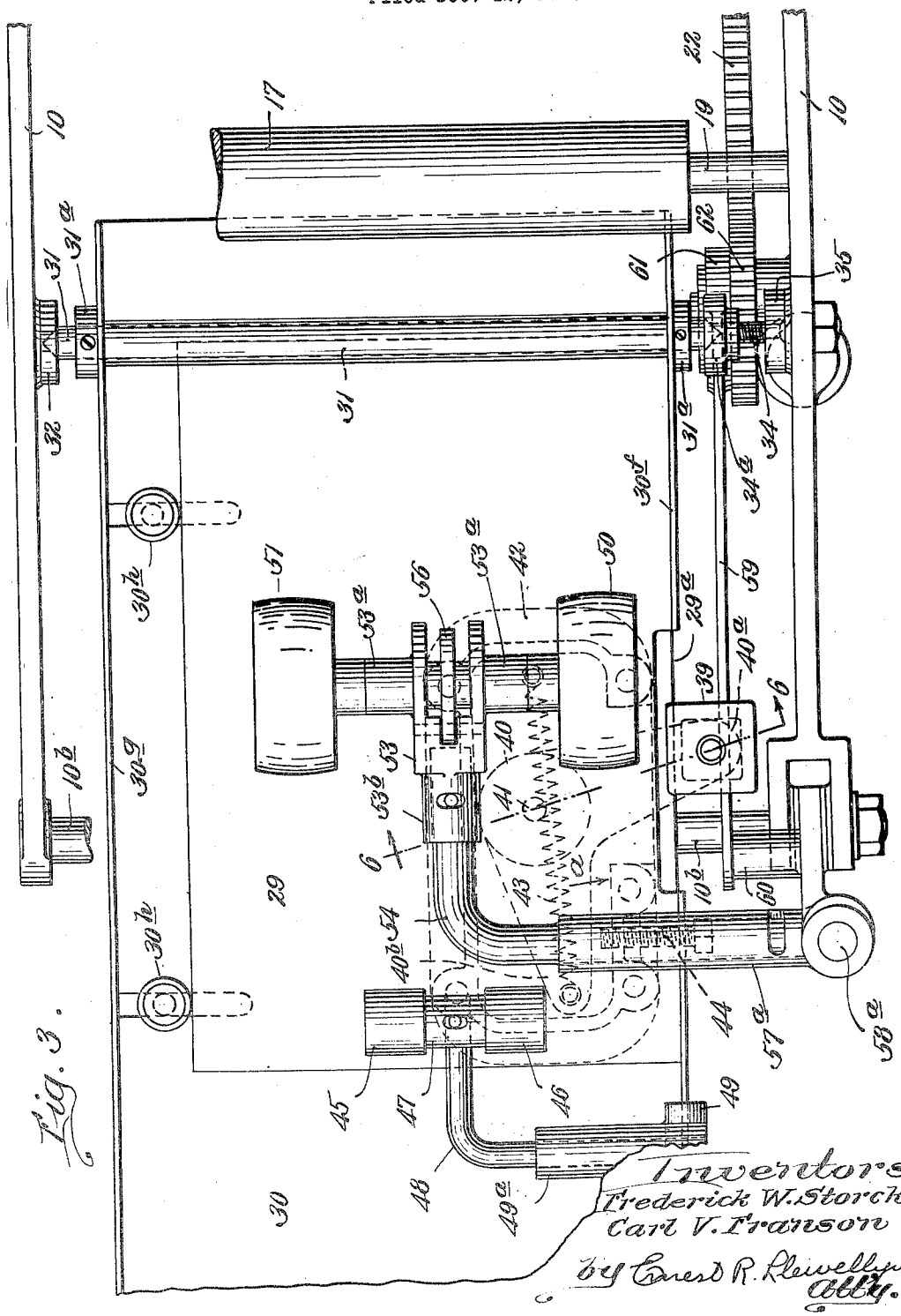


Fig. 3.

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SHEET SEPARATING AND FEEDING DEVICE

Filed Dec. 12, 1936 5 Sheets-Sheet 4

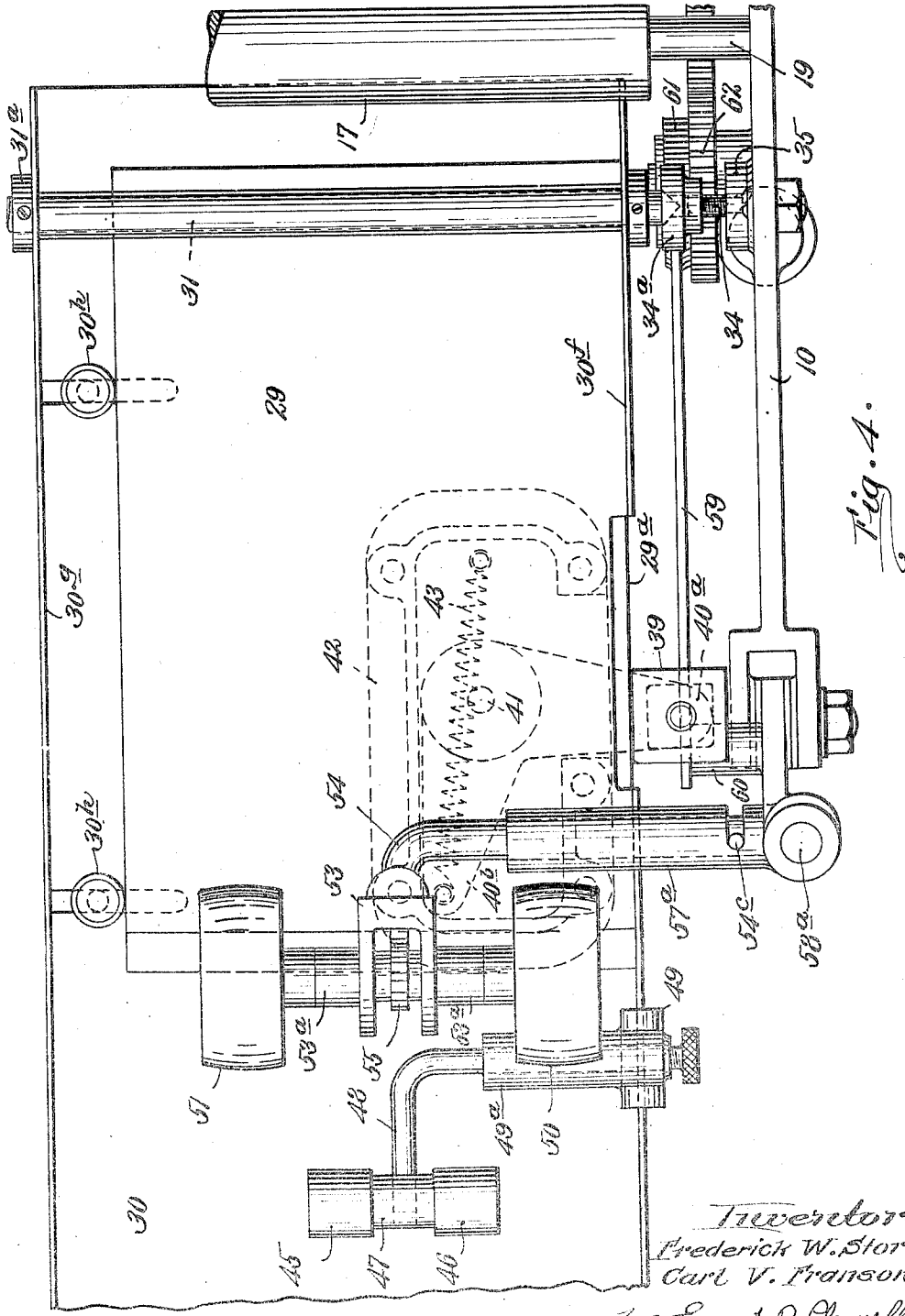


Fig. 4.

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SHEET SEPARATING AND FEEDING DEVICE

Filed Dec. 12, 1936 5 Sheets-Sheet 5

Fig. 6.

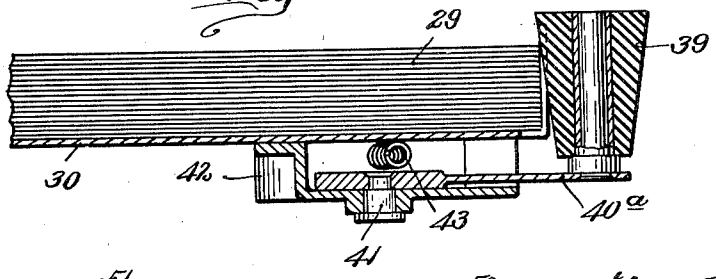


Fig. 5.

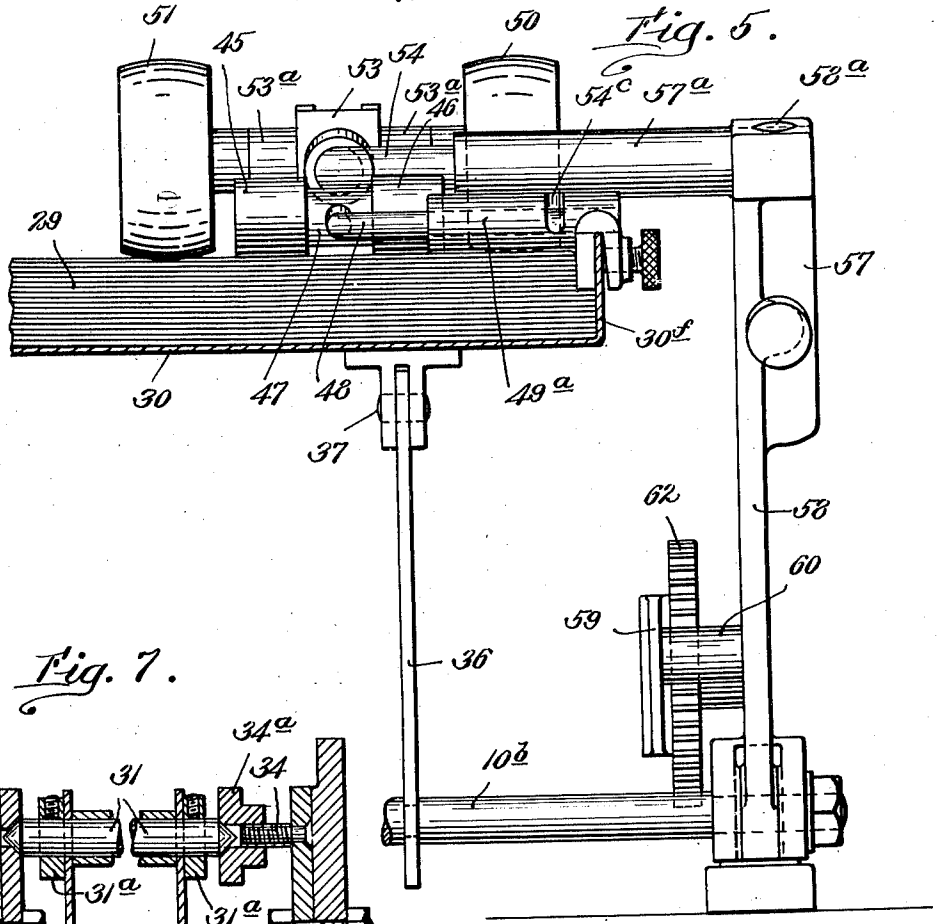
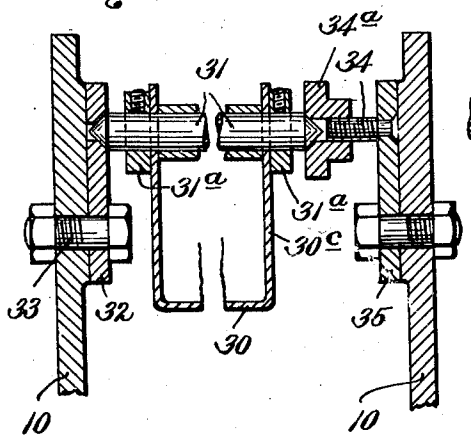


Fig. 7.



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Patented Aug. 9, 1938 2,126,514

UNITED STATES PATENT OFFICE

2,126,514

SHEET SEPARATING AND FEEDING DEVICE

Frederick W. Storck, Arlington, and Carl V. Franson, Dorchester, Mass., assignors to Standard Mailing Machines Company, Everett, Mass., a corporation of Massachusetts

Application December 12, 1936, Serial No. 115,548

14 Claims. (Cl. 271—42)

This invention relates to a device for feeding sheets singly from a stack of sheets to what may be conveniently termed a primary machine feed, and the invention more particularly relates to mechanical means for arresting advance movement of the stack and the uppermost sheets thereof when the top sheet is separated and advanced from the stack to a machine adapted to operate on sheets of paper and the like.

In the art of feeding sheets singly from a stack, it is well known that sheets having certain characteristics are more difficult to separate and feed than others. As an illustration, it may be said that coated and highly calendered stocks are among those which are difficult to mechanically separate and feed.

Again, sheets placed or commercially received in a stack formation may become slightly curled at their ends and this also presents problems in feeding the sheets from their support as in some instances the stack may be placed on its support with the curl extending downward, and in other instances the curl may extend upward. It has been customary, in view of these conditions to provide a stop for the front end of the stack itself to abut against but, to be effective, in the instance of the referred to curl extending upwardly, the stop must be disposed in a substantially straight or acute angle position while, with the curl extending downwardly, the stop is best positioned at a greater angle relative to the vertical end face of the stack. It is obvious that these stops for the front end of the stack are of assistance in feeding sheets, having certain characteristics, singly from the stack but their efficiency is limited and their practicability controlled by the above and other possible conditions of the sheets which comprise the stack.

Further, sheet feeding devices are required to operate on stacks made up of various numbers of single sheets, and, therefore, the feeding position of the uppermost sheet varies both in regard to the height of the original stack and as the stack is diminished through feeding the sheets therefrom.

In mechanical sheet feeding devices it has been the common practice to provide a support for the stack which may be adjusted automatically or otherwise to compensate for the variations in the stack height relative to the point to which the sheet is to be fed. It is obvious that such an arrangement requires a movable support for the stack, together with mechanism to actuate the support as required by various thicknesses of the sheets to be operated upon.

We have found that by providing retarding or friction elements, properly arranged to engage with the stack, a stationary stack support may be used effectively to support stacks within the variable height limits usually used and without consideration of the thickness of the sheets contained in the stack; and further, we have found that with a stack support having a properly constructed and arranged discharge end, in combination with our friction elements, we have eliminated the difficulties encountered in feeding sheets from stacks that embody the above enumerated characteristics and conditions.

Accordingly, one of the objects of the present invention is to provide a mechanical sheet separating and feeding device that will be effective on sheets of different grades and characteristics and operate to feed the sheets singly from a stack without a requirement for manual or other adjustments.

Another object of the invention is to provide a sheet separating and feeding device that is of a simple and inexpensive construction and which, while not limited thereto, is particularly adapted to operate upon a stack having a fixed stationary support.

A further object of the invention is to construct and arrange the elements of the sheets separating and feeding device so as to permit of a convenient loading of the stack upon its support.

These objects are intended as a general explanation and are not to be construed as limiting the invention thereto.

With the above and other objects in view, the invention comprises a novel combination and arrangement of parts hereinafter described and more specifically pointed out in the appended claims.

As an embodiment of the invention, in the accompanying drawings we have illustrated a preferred form of our sheet separating and feeding device associated with a duplicating machine. While the duplicating machine is shown for illustrative purposes only, it is sufficient to enable those skilled in the art to understand the construction and operation of the sheet separating and feeding device and its association with the feed of a primary machine adapted to operate upon sheets of paper and the like.

Referring to the drawings:

Fig. 1 is a sectional elevation of a portion of a duplicating machine with the sheet stack support and feeding device associated therewith; in this view the sheet stack is arranged in a preferred manner for sheets that are readily separated.

Fig. 2 is a view corresponding to Fig. 1, but shows the sheet feeding mechanism in a different position; in this view the sheet stack is arranged in a preferred manner for sheets that are not readily separated.

Fig. 3 is a plan view of the sheet stack support and feeding device substantially as shown at Fig. 1.

Fig. 4 is a partial plan view corresponding substantially to Fig. 3, but shows some of the parts in their inoperative position.

Fig. 5 is an end view of a portion of the stack support and feeding device as shown at Fig. 1, viewing in the direction of arrow *a*, same figure.

Fig. 6 is a transverse section of the stack friction device taken substantially along line 6—6, Fig. 3, and

Fig. 7 is a detail sectional view taken substantially along line 7—7, Fig. 1.

The machine for operating upon sheets of paper and the like

As a practical embodiment, we have shown the sheet separating and feeding device associated with a duplicating machine of the general character illustrated in U. S. Letters Patent No. Re. 19,951, issued to Frederick W. Storck. This duplicating machine is provided with opposed stationary side frames 10, only one of which is shown. These frames 10 are retained in spaced relation by suitable cross-members and support the operating elements of the duplicator.

The printing platen 11 is rotatably mounted upon a shaft 12 which, in turn, is secured against rotation in suitable bearings in the side frames 10. This printing platen 11 is provided with a suitable clamping device 13 for holding the end of a master copy.

A pressure roller 14 engages with the peripheral face of the platen 11 and is mounted upon a shaft 15 which is journalled at its ends in suitable bearings in the side frames.

The primary machine feed rollers 16 and 17 are each provided with shafts 18, 19 which are rotatably supported in suitable bearings. In this instance, the roller 16 is utilized as an intermediate moisture applicator and is supplied with moisture by a wick 20 which engages with fluid contained in the tank 21. This combined feed and moistening roller 16 applies moisture to the face of a sheet as the sheet is advanced by the feed rollers 16, 17.

The machine drive

The machine elements are intermittently rotated by mechanism which includes a primary gear 22 which is adapted to be continuously rotated as, for example, by means of a continuously driven pinion (not shown) which, in turn, may be actuated by a hand crank or power driven from a suitable source. An intermittent gear 23 is secured to the primary gear 22 and meshes with a coacting intermittent gear 24 secured to the drum or platen 11.

The gears 22 and 23 are rotatably mounted on a stud 25 secured to one of the side frames 10. The intermittent gears 23 and 24 are of the usual construction wherein a predetermined portion of the periphery of each is free from teeth and continued rotation of the driving gear will not rotate the driven gear until the blank space in the driving gear has passed the blank space in the driven gear and the teeth in both enmesh.

The feed rollers 16, 17 are intermittently rotated with the printing platen 11 by means of a gear 26 which is secured to one end of the platen 11. This gear 26 meshes with and drives an intermediate gear 27 which, in turn, meshes with and drives a pinion 28 adapted to rotate the feed roller 16, the coacting roller 17 being frictionally driven from the roller 16.

A machine for operating upon sheets of paper and the like, and which is of the above general character, is fully shown and described in the aforesaid patent, therefore further detailed description of the parts of the machine and the operation thereof is thought to be unnecessary. It will be obvious from the following description that the present invention and modifications thereof may be adapted to and operate with machines having a primary machine feeding device.

The sheet stack support

The stack of sheets 29 to be fed singly to the primary machine feed rollers 16, 17 is supported upon a base 30, which, in this instance, is provided with opposed upwardly extending side flanges 30*f*, 30*g*. The advance end of each of these flanges is provided with an extension 30*c* adapted to engage with a transverse rod 31. One end of the rod 31 has a pivot point bearing in a bracket 32 adjustably secured to the side frame by means of a screw 33, see Fig. 7. The opposite end of the rod 31 is pivotally engaged by the end of an adjustable nut 34*a* on a threaded member 34 supported in a bracket 35 that is adjustably secured to the opposite side frame. By means of the adjustable brackets 32, 35, the stack support may be adjusted for proper alignment with respect to the axis of the primary machine feed rollers 16, 17 and the bight formed therebetween; and by means of the adjustable collars 31*a*, the stack support may be positioned longitudinally on its supporting rod 31. The nut 34*a* permits of a ready removal and replacement of the stack support by the simple expedient of backing off the nut 34*a* onto its supporting member 34 and this construction insures the replacing of the support in its original position and alignment.

The rear end of the base 30 is supported by a knee brace 36 pivoted at 37 to the base and engaging cross-rod 10*b* disposed in and between the opposed side frames of the machine.

In its preferred form, the advance end of the base 30 is provided with an angularly disposed stop 30*a*, provided with a forwardly extending guide plate 30*b*. This stop 30*a* is preferably positioned at an angle of substantially 30° from the end face plane of the stack or at an angle so disposed that sheets having advance ends inclined to curl downwardly will not buckle against this stop 30*a* as the sheet is advanced from the stack. The advance end of the stack support is also provided with a second guide plate 38 which is supported by the cross-rod 31 and is disposed above the stop 30*a* and guide plate 30*b* and together this construction forms a substantially V-shaped end of the stack support with a longitudinal discharge opening 30*m* positioned in close proximity to a stop associated with, and in this instance, formed by, the primary machine feed rollers 16, 17. This second guide plate 38 also assures that sheets in a stack having advance ends inclined to curl upwardly will be deflected and properly guided to the discharge opening 30*m*.

The stack side friction device

One of the opposed side flanges 30*f* is cut away so as to permit of a contact with the side edge of the stack 29. In our preferred construction we

have provided a friction contact member 39 in the form of an inverted cone composed of a suitable rubber or like friction material. The cone member 39, in this instance, has a substantially rectangular cross-section which will present a straight face in a direction parallel to the horizontal edge of the stack and the vertical plane of the face will be angularly disposed relative to the side face of the stack. This inverted cone member 39 is pivotally supported on the outer end of one arm 40*a* of an angle lever 40 which, in turn, is pivoted at 41 to a casing 42 secured to the under face of the base 30.

As illustrated at Fig. 3, the lever 40 and cone member 39 are operatively positioned with the cone member 39 in engagement with a portion of the stack edge 29*a*. It is to be observed that when the member 39 is in this operative position, its pivotal center is disposed in advance of the transverse center line position of the lever pivot 41 for a purpose hereinafter more fully described. The opposite arm 40*b* of the angle lever 40 has pivotally secured thereto one end of a tension spring 43, the opposed end of said spring being pivotally secured in a manner which urges the lever arm 40*b* in a direction to either side of its spring controlled dead center. Again referring to Fig. 3, the spring 43 is positioned to urge the angle lever arms in the direction of the arrow *a*, and thus the cone friction member 39, when in this operative position, is urged in this same direction in its arc of movement and in a direction toward the plane center of the stack.

We have found that by positioning a friction element, such as the cone friction member 39, as aforesaid, any forward movement of the stack will cause the member 39 to effect a wedging of the stack between said member 39 and the guides 30*h* at the opposite side edge of the stack.

An adjusting screw 44, which is supported in the casing 42, is adapted to engage with the angle lever arm 40*b* and, in this manner, limit the movement of the angle lever in the direction of the arrow *a*. This limiting of the angle lever movement prevents the cone friction member exerting sufficient pressure to buckle the sheets transversely as the stack is reduced to a small number of remaining sheets which, in themselves, would not present a stiffness sufficient to overcome the pressure of the friction member 39 effected by the lever tension spring 43.

The stack rear end friction

To further assure the feeding of sheets of various characteristics singly from a stack of sheets, we have provided a simple friction device that may be adjustably positioned relative to the length of the sheets comprising the stack. To obtain the most desired results, the stationary friction members 45, 46 of the device are positioned to contact with the uppermost of the stack and, preferably, closely adjacent the rear end thereof. These friction members 45, 46 are provided with a bearing 47 mounted with a limited free rotative movement on one end of an angle rod 48. This bearing mounting permits the friction members 45, 46 to self-align with the plane of the sheet stack. The opposed end of the rod 48 is supported for rotative movement in a bearing 49*a* forming part of a bracket 49 which is adapted to be adjustably secured to the base flange 30*f*.

The friction elements 45, 46 are preferably arranged for operative movement so that, as the rear end of the uppermost sheet of the stack is advanced only a short distance from under the friction elements 45, 46, the elements will be immediately effective on the rear end margin of the next succeeding sheet and prevent its being advanced to any undesirable degree by friction from the uppermost advancing sheet.

We have found that the exact positioning of the friction elements 45, 46 is not critical, but their action in trapping movement of the second or underlying sheet is quicker when the friction elements operate in a margin close to the rear end of the sheet.

The sheet feeding device

The mechanism for advancing a sheet from the stack 29 includes, in this instance, a pair of rollers 50, 51 formed of a suitable rubber or like friction material. These rollers 50, 51 are secured on a shaft 52 that is rotatably supported in suitable bearings 53*a* of a bracket 53 which, in turn, has a bearing 53*b* mounted with a limited rotative movement upon one end of an angle rod 54. This limited rotative movement of the bearing 53*b* permits the slightly crowned faces of the rollers 50, 51 to align themselves with the upper face plane of the stack.

The roller shaft 52 has a ratchet wheel 55 also secured thereto which is adapted for engagement by a ratchet dog 56 pivoted in the roller shaft bracket 53. This ratchet wheel 55 and its coacting dog 56 are of a conventional design and are adapted to permit free rotative movement of the roller shaft 52, and its attached elements, in the direction of arrow *d*, Fig. 1, and to arrest rotative movement of these elements in the direction of arrow *e*.

The opposite end of the angle rod 54 is mounted with a limited rotative movement in a bearing 57*a* of a member 57 which, in turn, is adjustably secured on a trunnion 58*a* forming part of the sheet feed oscillating lever 58. The lower end of the lever 58 is pivotally mounted on the cross-rod 10*b* and this lever 58 is oscillated by means of a pitman 59 having one end pivoted at 60 to the lever 58 and its opposed end pivoted to a crank disc 61 which is associated with a drive gear 62. This drive gear 62 meshes with and is continuously rotated by the primary drive gear 22 and thus the lever 58 and feed rollers 50, 51 are oscillated in a direct and timed relation to the primary machine feed rollers 16, 17.

Operation

As a matter of convenience, we have provided for readily displacing the sheet feeding rollers 50, 51 and the stack friction elements 39, 45, and 46 from their operative positions while a stack 29 is being positioned on its base support 30, see Figs. 1 and 4. As aforesaid, the rod 54 may be rotated in its bearing 57*a* and a stop pin 54*c* is provided for retaining the rod 54 and its associated elements in an elevated, inoperative position. The inverted cone member 39 is manually moved to the left until the angle lever arm 40*b* passes its spring controlled dead center and in which instance the spring 43 urges the lever arm against a stop formed by the casing 41, see Fig. 4, and retains the cone member in an inoperative position. The rod 48 supporting the stack rear end friction members 45, 46 is merely rotated in its bearing 49*a* to inoperatively position the friction members as illustrated at Fig. 4.

With the elements positioned as above stated, the stack of sheets 29 may be conveniently positioned on its support with one edge of the stack

abutting against the side flange 30*f* with the advance end of the stack positioned adjacent the front stop 30*a*. The adjustable guides 30*h* are then positioned in engagement with the opposite side edge of the stack.

After the stack 29 has been properly positioned, the displaced friction elements and sheet feeding device are then returned to their operative position in relation to the stack and to function in the manner previously described. To obtain the utmost efficiency, when using stacks of sheets having the well known characteristic or tendency to cling and adhere to one another to an excessive degree, it is preferable to use a stack comprised of a limited number of sheets so that a major portion of the front end of the stack will abut against the stop 30*a*, see Fig. 2, and in this manner the friction elements will be assisted by this stop 30*a* during the advance movement of the sheet feeding mechanism. When using stacks of sheets having substantially free moving characteristics, the stack may be positioned upon the support in its usual formation as illustrated at Fig. 1.

Feeding a single sheet

As aforesaid, the feed rollers 50, 51 are moved forward and backward along the face plane of the stack and in contact with the uppermost sheet thereof. As the feed rollers 50, 51 are moved in their forward direction, toward the primary machine feed rollers 16, 17, their rotative movement is arrested, through the action of the ratchet wheel 55 and its coacting dog 56, as previously described. When locked, these rollers 50, 51 act as friction elements and grip the uppermost sheet and, as the rollers advance the sheet, the rear end of the sheet is withdrawn from under the rear end friction members 45, 46, which permits these members 45, 46 to immediately engage with the rear end of the next underlying sheet and it may be conveniently said that this underlying sheet is trapped to prevent friction from the uppermost advancing sheet from carrying the trapped sheet forward.

As the uppermost sheet of the stack is advanced, its forward end abuts against the upper guide plate 38 and is deflected downwardly into the V-shaped discharge end of the stack support and guided by the plates 30*b*, 38 through the discharge opening 30*m* and forced into contact in the bight B formed by the primary machine feed rollers 16, 17 which are at rest when the sheet engages therewith. As the feed rollers 50, 51 are rotated in their rearward direction, preparatory to feeding the next sheet from the stack, they are free to rotate along the plane of and in engagement with the uppermost of the stack.

Effect of the stack side friction device

Obviously a degree of downward pressure is required in advancing the sheets singly from the stack and this pressure has a primary tendency to move or displace a group of the uppermost sheets of the stack in the advancing direction and also, this same pressure in a degree urges the entire stack forward. These actions are particularly noticeable in stacks of sheets having the certain well known characteristics as above mentioned.

The side friction member 39 exerts its greatest pressure on this uppermost group of sheets of the stack and we have found that with a side friction member, substantially as illustrated and arranged, any effort to move the stack forward will cause a wedging action upon the opposed sides of the stack in a direct relation to the effort exerted to advance the stack.

Having thus described our invention, what we claim is:

1. In combination, a machine adapted to operate on sheets of paper and the like, intermittently actuated sheet feeding rollers in continued engagement with one another and forming the primary machine feed, sheet feeding mechanism associated with said rollers and adapted to advance sheets singly from a stack of sheets to a bight formed by said rollers, a support for a stack of sheets, said support including guides for the opposed sides of the stack together with pivoted pressure means adapted to frictionally engage with a portion of the side edge of said stack.

2. In combination, a machine adapted to operate on sheets of paper and the like, intermittently actuated sheet feeding rollers forming the primary machine feed, sheet deflecting and guiding means disposed adjacent said rollers, sheet feeding mechanism associated with said rollers and adapted to advance sheets singly from the stack to said stop and to be advanced by said rollers, a support for the stack which includes guides for the opposed sides thereof together with pivotal pressure means adapted to engage with a portion of the side edge of the stack.

3. In combination, a machine adapted to operate on sheets of paper and the like, opposed rollers forming the primary sheet feed of the machine, a sheet positioning stop associated with said rollers, sheet feeding mechanism in association with said rollers and adapted to advance sheets singly from a stack of sheets to said sheet positioning stop to be advanced by said primary sheet feed rollers, a support for the stack, said support including a base having an integral angularly disposed combined stop and guide plate and a second juxtapositioned guide plate angularly disposed relative to said stop and first guide plate and forming a substantially V-shaped terminating end for said support with a longitudinally extending discharge opening therein.

4. In combination, a machine adapted to operate on sheets of paper and the like, opposed rollers forming the primary sheet feed of the machine, a sheet positioning stop associated with said rollers, sheet feeding mechanism in association with said rollers and adapted to advance sheets singly from a stack of sheets to said sheet positioning stop to be advanced by said primary sheet feed rollers, a support for the stack, said support including a substantially V-shaped advance end portion with a longitudinally extending discharge opening therein, said end portion and opening being adapted to be positioned in close proximity to the stop associated with said rollers.

5. In combination, a machine adapted to operate on sheets of paper and the like, opposed rollers forming the primary sheet feed of the machine, a sheet positioning stop associated with said rollers, sheet feeding mechanism in association with said rollers and adapted to advance sheets singly from a stack of sheets to said sheet positioning stop to be advanced by said rollers, a support for the stack, said support including a substantially V-shaped advance end portion with a longitudinally extending discharge opening therein with adjustable means for retaining said support in a fixed relation to the axis of said rollers with the advance terminating end of said support adjacent said sheet positioning stop.

6. In combination, a machine adapted to operate on sheets of paper and the like, opposed rollers forming the primary sheet feed of the machine, a sheet positioning stop associated with said rollers, sheet feeding mechanism in association with said rollers and adapted to advance sheets singly from a stack of sheets to said sheet positioning stop to be advanced by said rollers, a support for the stack of sheets, said support including a base having an upwardly extending guide with an opening therein, a member angularly disposed relative to the side edge of the stack and adapted to engage in said opening with yielding means urging said member into said opening and into engagement with the side of the stack.

7. In combination, a machine adapted to operate on sheets of paper and the like, opposed rollers forming the primary sheet feed of the machine, a sheet positioning stop associated with said rollers, sheet feeding mechanism in association with said rollers and adapted to advance sheets singly from a stack of sheets to said sheet positioning stop to be subsequently advanced by said rollers, a support for said stack, said support including guides for the opposed sides of the stack, a substantially conical member engaging a portion of one side edge of the uppermost of the stack with pressure means urging said member against said portion.

8. A sheet feeding device which includes a support for a stack of sheets, an arm pivoted to said support, a vertically extending tapering element supported by said arm and adapted to engage with the side edges of a limited number of the uppermost sheets of the stack, with pressure means urging said elements against said edges.

9. A sheet feeding device having a support for a stack of sheets which includes a member supported on a pivoted arm and relative to the side edge of the stack said member being disposed to press against the side edges of only a limited number of the uppermost sheets of the stack with means urging said member inwardly in a horizontal plane as the stack is diminished.

10. A sheet feeding device having a support for a stack of sheets which includes a member pivotally supported relative to the side edge of the stack, said member supporting an inverted, substantially cone-shaped member, said first member having a dead center with resilient means urging said member from said center and, when in operative position, pressing said cone-shaped member into contact with a side edge portion of the stack and in a direction toward the center of the plane of the stack.

11. A sheet feeding device which includes a stationary base for supporting a stack of sheets thereon, guides for the side edges of the stack, an inclined angle abutment and guide for the advance end of said stack, a member adjustably secured relative to said base and having a pivoted friction member for engagement with the rear end face plane of the stack, said member being pivoted to swing in an arc corresponding substantially to the angle of said abutment and whereby said friction member continues in operative engagement with the uppermost of said stack as the height of the stack is reduced.

12. A sheet feeding device which includes a substantially fixed base for supporting a stack of sheets thereon, guides for the side edges of the stack, an inclined angle abutment and guide for the advance end of said stack, a member adjustably secured relative to the base and having a friction weight member for engagement with the rear end of the stack, said member being adapted for movement in a line corresponding substantially to the angle of said abutment and whereby said friction member continues in operative engagement with the uppermost of said stack as the height of said stack is reduced.

13. A sheet feeding device which includes a substantially fixed base for supporting a stack of sheets thereon, guides for the side edges of the stack, an inclined angle abutment and guide for the advance end of said stack, a member adjustably secured relative to said base and having a friction gravity actuated weight member adapted to engage the uppermost sheet of the stack adjacent the rear end thereof as sheets are fed from the stack and the height of the stack reduced.

14. A sheet feeding device which includes a stationary base for supporting a stack of sheets thereon, guides for the side edges of the stack, an inclined angle abutment and guide for the advance end of said stack, a gravity actuated friction weight member adapted to engage the upper most sheet of the stack and closely adjacent the rear end thereof as the height of said stack is varied.

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