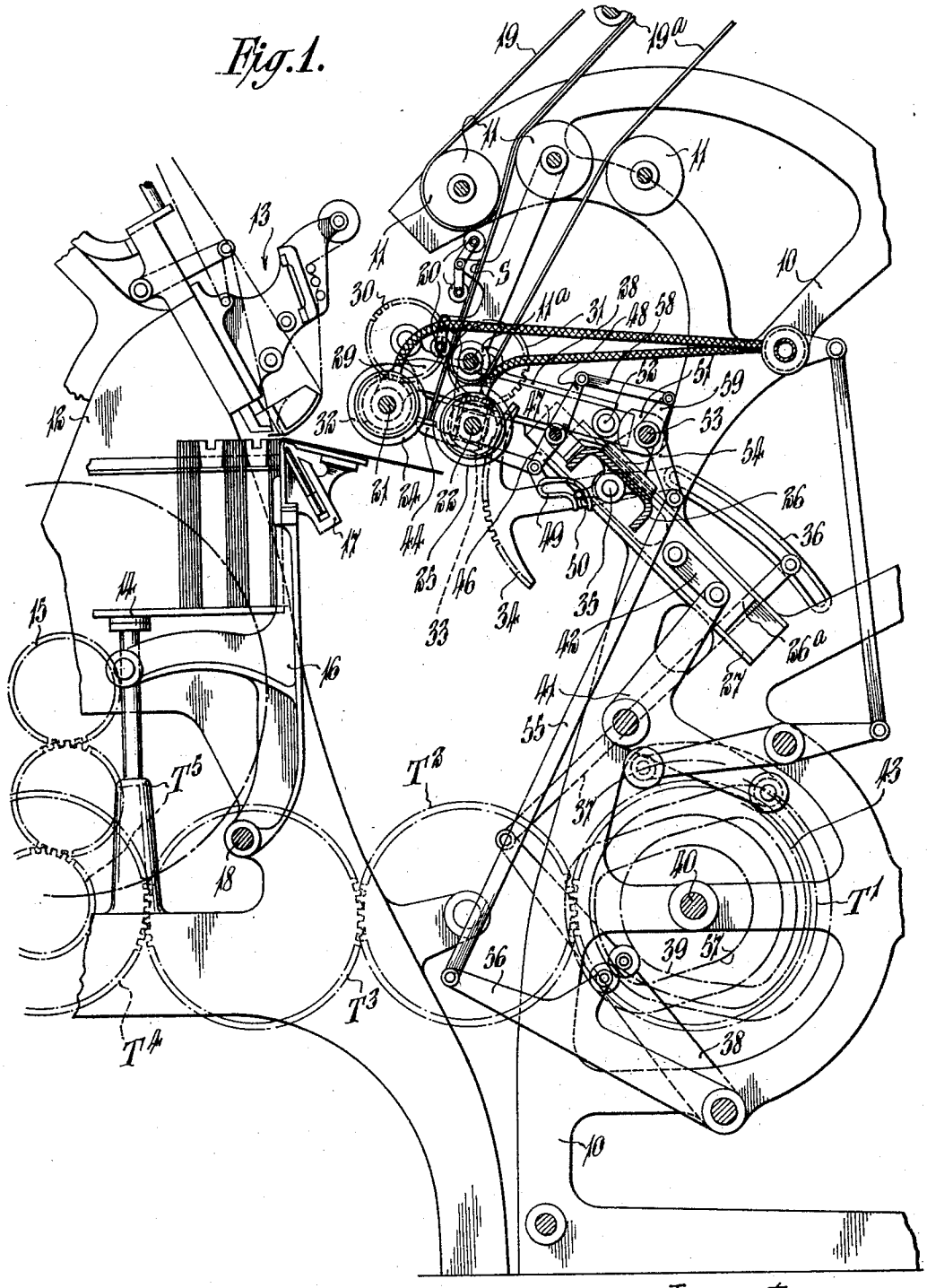
Nov. 29, 1932. O. KLEINSCHMIT ET AL. 1,889,364

METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET HANDLING MACHINES

Filed Dec. 15, 1931 5 Sheets-Sheet 1

Fig. 1.



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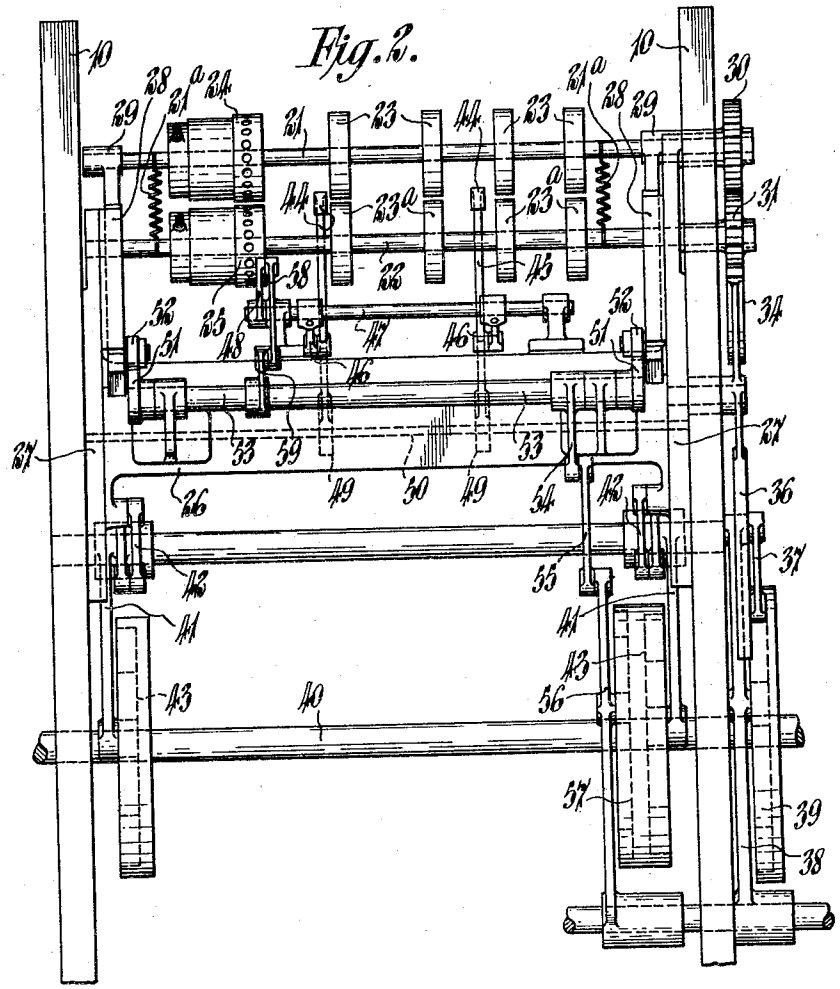
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METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET HANDLING MACHINES

Filed Dec. 15, 1931 5 Sheets-Sheet 2

Fig. 2.



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METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET HANDLING MACHINES

Filed Dec. 15, 1931 5 Sheets-Sheet 3

Fig. 3.

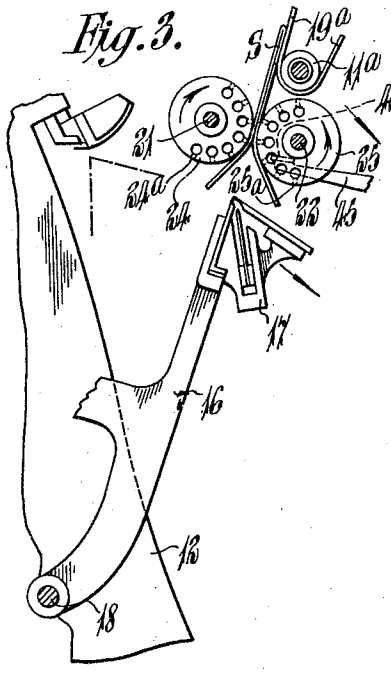


Fig. 4.

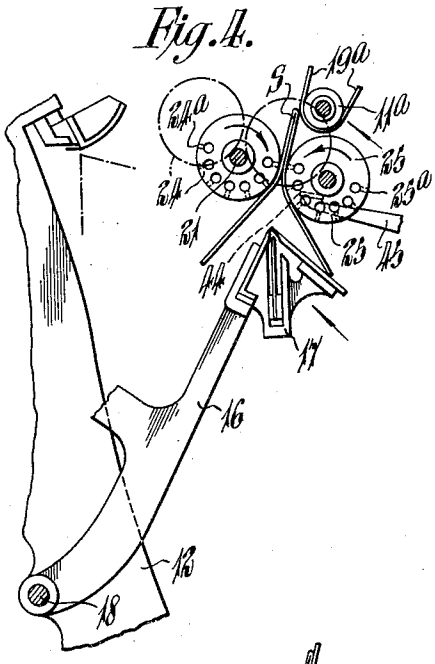


Fig. 5.

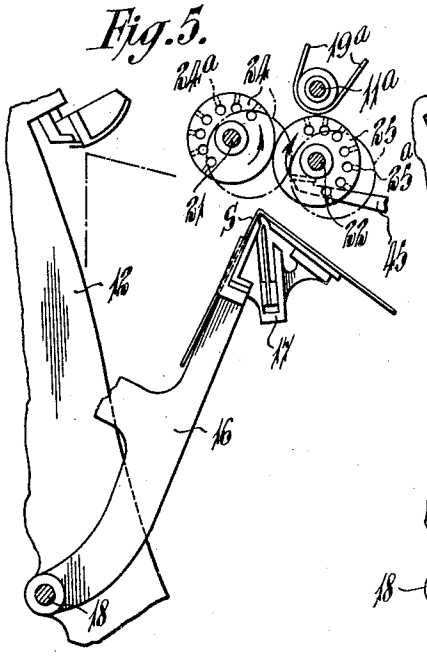
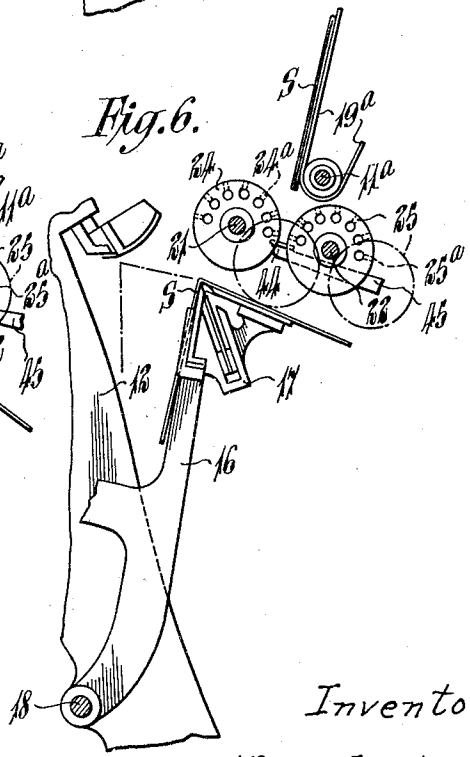


Fig. 6.



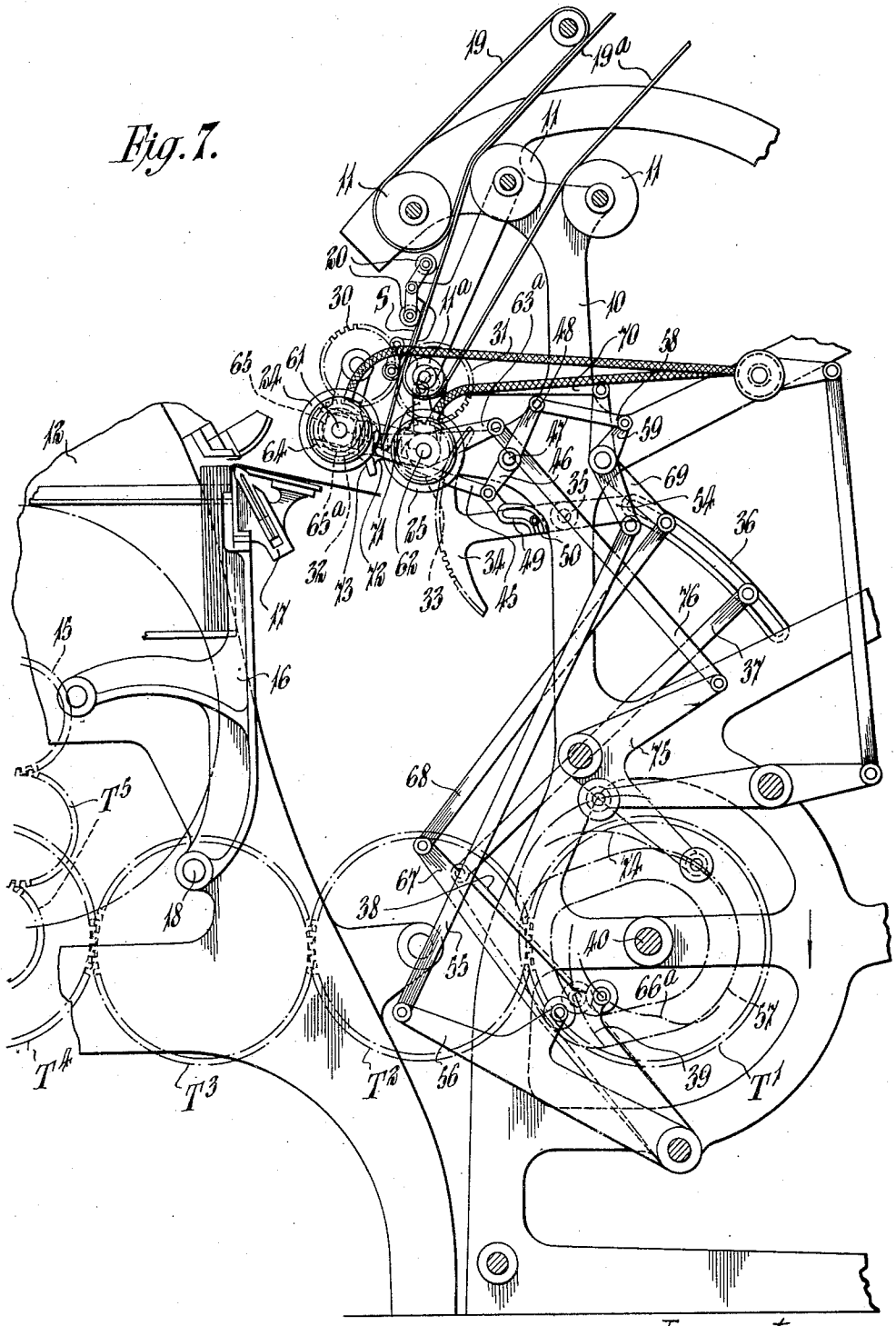
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METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET HANDLING MACHINES

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Fig. 7.



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METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET HANDLING MACHINES

Filed Dec. 15, 1931 5 Sheets-Sheet 5

Fig. 8.

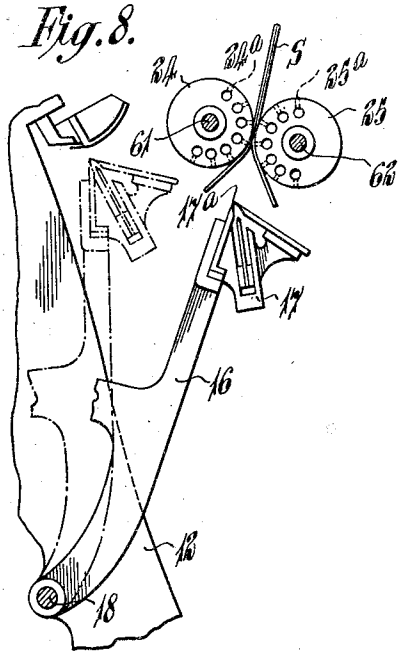


Fig. 9.

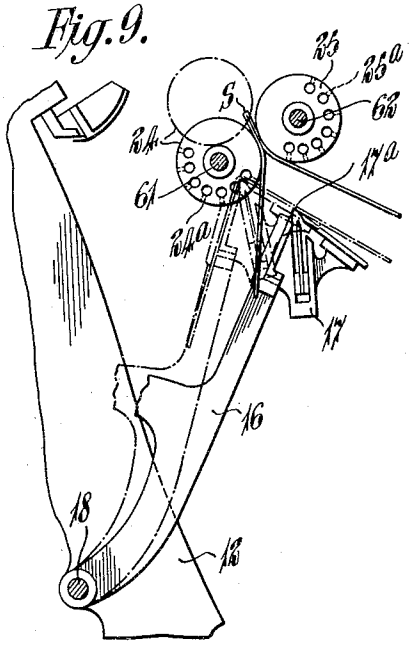
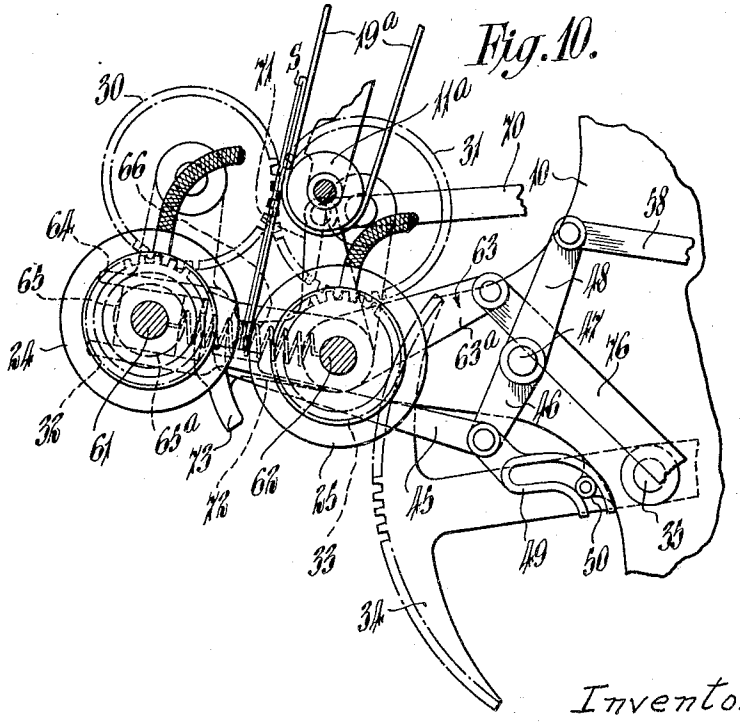


Fig. 10.



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UNITED STATES PATENT OFFICE

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METHOD OF AND MECHANISM FOR OPENING SHEETS IN SHEET-HANDLING MACHINES

Application filed December 15, 1931, Serial No. 581,230, and in Germany February 7, 1931.

The present invention relates to sheet-handling machines and more particularly concerns such machines in which inversely rotating suction rolls are used to open folded sheets and deposit the said opened sheets straddlewise upon a carrier or conveyor.

When such sheet feed devices are used in sheet-handling machines of the swinging carrier type, it is necessary to pass the sheets between the suction rolls at a high speed which renders the sheet opening device useless for practical and efficient operation of the machine. That is to say, the swinging sheet carrier remains in the feed position beneath the suction rolls for a comparatively short period of each sheet handling operation and consequently the sheets must needs be fed thereto at a high speed, thereby causing the sheets to be thrown too rapidly and comparatively haphazardly on to the conveying saddle. Moreover, when folded sheets are conveyed to such feed devices, the forward or open edges of the sheet are apt to register with the suction rolls in a slightly inaccurate manner which causes faulty work as is well known in the art.

The object of this invention is to provide means for obviating these disadvantages when utilizing inversely rotating suction rolls for the purpose above described.

According to the method of this invention of opening and feeding folded sheets to the movable sheet carrier of a book-binding machine, a sheet-opening and feeding device during each operative period thereof is caused to move with the sheet carrier through some part of the travel of the latter.

In order to carry this method into effect in a sheet-handling machine of the swinging sheet carrier type mechanism may be provided whereby the entire sheet-opening device is arranged to move with the sheet carrier as the latter travels towards the requisite sheet-handling means. To this end, the sheet-opening operation is timed to commence just before the sheet carrier is returned to the initial feed position and the lateral movement thereof commences with the return or working movement of the sheet carrier and is reversed immediately after the folded sheet is opened and placed upon the sheet carrier. Alternatively the sheet-opening device may be arranged to alter, about a fixed point, its position relative to the swinging sheet carrier and so extend or prolong the sheet-feeding period of each reciprocatory movement of the swinging sheet-carrier.

This arrangement enables the sheet to be fed to the sheet carrier at a slower speed and thus ensures that the transfer of the sheet is smoothly executed. In order that the folded sheets may be accurately registered with and seized by the inversely rotating suction rolls, means may be provided to oscillate the suction rolls instead of completely rotating them while, at the requisite moment, the suction rolls are caused momentarily to move apart and thus allow the lower edges of the folded sheet to rest upon an appropriate registering stop interposed in the path of movement of the sheet.

In order that the above described invention may be more clearly understood two constructional embodiments thereof will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 shows in part sectional side elevation, an automatic sheet-feeding device comprising inversely rotating suction rolls arranged to operate according to this invention and associated with a book-binding machine of the swinging sheet-carrier type.

Fig. 2 is a plan view of the sheet-feeding device shown in Fig. 1.

Figs. 3, 4, 5 and 6 are diagrammatic side elevational views showing the varying relative positions of the moving sheet-feed device and the swinging sheet-carrier during a complete sheet-feeding operation.

Fig. 7 is a part sectional side elevational view of a sheet feeding unit similar to that shown in Fig. 1 but provided with an alternative arrangement of the inversely rotating sheet opening rolls.

Figs. 8 and 9 show, diagrammatically, different operative positions of the sheet opening rolls and sheet carrier when operating according to the alternative arrangement shown in Fig. 7, while

Fig. 10 is a detail view of the sheet opening rolls and associated mechanism drawn to a larger scale.

Referring to Fig. 1, it will be seen that the book-binding machine shown is of the usual swinging sheet-carrier type wherein the side frames 12 serve to support a stitcher head 13 or a plurality of such stitcher heads mounted above a book-pad trough 14 and associated with a swinging sheet carrier 17 supported by oscillable arms 16 which are mounted on a shaft 18 journaled in the side frames 12 and actuated in the usual manner through cam timed mechanism generally indicated by the reference 15.

The sheet-feeding device which, in the present construction, is a separate entity positioned adjacent the front or stitching side of the book-stitching machine, as shown in Fig. 1, comprises side frames 10 in the upper part of which are journalled the usual sheet conveyor pulleys 11 around which pass the sheet conveyor belts 19, 19*a* which latter, with the aid of friction rolls 20, serve to convey the folded sheets or signatures S to sheet-opening suction rolls 24, 25. The conveyor belt 19*a* passes from the usual sheet feeding station (not shown) and around a further guiding pulley 11*a* which is mounted as hereinafter described adjacent the suction rolls 24, 25. The latter, of which one pair are shown, may extend in a plurality of such pairs across the machine horizontally of and immediately above the path of travel of the swinging sheet-carrier 17. In the present construction, however, only one pair of suction rolls 24, 25 are provided and are fixedly mounted on transverse shafts 21, 22 respectively which also serve to carry pairs of guiding or tensioning rolls 23, 23*a*, Fig. 2, of equal diameter to that of the suction rolls 24, 25.

The shaft 22, common to the suction roll 25 and the guiding rolls 23*a*, is journalled in bearing brackets supported by a transverse slidable carrier-bar 26 formed at its extremities with slides 26*a* adapted to engage in the oblique slide bearings 27 which latter are formed integral with or attached to the side frames 10. The slide bearings 26 serve to support guides 28 in which are mounted slidable bearing members 29, which latter have journalled therein the shaft 21 common to the suction roll 24 and guiding rolls 23. The shafts 21, 22 also have fixedly mounted thereon pinion wheels 32, 33 which mesh with the intermeshing gear wheels 30, 31 respectively. The latter are journalled in bearing brackets supported by the guides 28. The conveyor belt pulley or pulleys 11*a* are also journalled in brackets mounted on the guides 28 and so partake of the linear movement of the suction rolls 24, 25.

Oscillatory motion is imparted to the suction rolls 24, 25 by a toothed segment 34 which is pivoted on a shaft 35 mounted on the carrier bar 26 and adapted to engage with the pinion 33 mounted on the shaft 22. The toothed segment 34 is rigidly attached to a slotted curved lever 36 to which is adjustably secured a connecting rod 37 linked to a rocking lever 38 which is actuated from a cam 39 mounted on a machine drive shaft 40. Through the cam 39 and interconnecting linkage above described, the suction roll 25 is oscillated and through the gear train 33, 31, 30 and 32, the suction roll 24 is also oscillated in the inverse direction.

The displacement of the sheet-opening suction rolls during their operative movement is arranged as follows: As above described, the suction rolls are supported indirectly by the carrier-bar 26. To each of the slides 26*a* thereof, one arm of a corresponding bell-crank lever 41 is linked by means of pivotal links 42. Each bell-crank lever 41 is pivoted to the machine frame and carries at the free extremity of its other arm a cam follower roller which is engaged by a cam 43 mounted on the shaft 40.

The shaft 40 is in geared driving connection with the sheet carrier drive 15 through the interposed gear train T1, T2, T3, T4 and T5 and, therefore, by imparting sliding movement to the carrier-bar 26 through the cams 43, bell-crank lever 41 and links 42, the suction rolls 24, 25 are caused to move with the sheet-carrier through some part of the travel of the latter. Sheet registering stops 44 are associated with the rolls 24, 25 and positioned between the various pair of guide rolls 23, 23*a*. The stops 44 in their operative position are placed in the path of travel of a sheet passing between the rolls and are adapted to be in this position to act as registering stops for the sheet when the suction rolls are moved apart as hereinafter described.

The stops 44 are mounted at the free extremities of arms 45 which are pivotally secured to crank levers 46, the latter being rigidly mounted on a shaft 47 journalled in bearings carried by the carrier-bar slides 26*a*. The arms 45 are provided with rigid cam slotted extensions 49 which engage a rigid bar 50 in order to control the movement of the registering stops 44.

Relative auxiliary movement between the suction rolls 24, 25 is imparted thereto by the displacement of the roll 24. For this purpose, cam faced members 51, pivotally supported on the slide bearings 27 are adapted to engage cam follower rollers 52 rotatably mounted on the slidable bearings 29. The cam-faced members 51 are rigidly mounted on a shaft 53 which is journalled in brackets mounted on the slide bearings 27. The shaft 53 is rocked, by means of a cam 57 mounted on the shaft 40, through the linkage 54, 55 and 56. Thus, as the cam-faced member 51 is oscillated, the slidable bearing 29 together

with the suction roll 24 supported thereby is moved so that at intervals, i. e. at the commencement of the feed of each sheet or signature S, the suction rolls and guide rolls are moved apart to allow the sheet or signature to drop upon the registering sheet stops 44. Spiral springs 21*a*, Fig. 2, are anchored to the shafts 21, 22 and hold normally in engagement the suction rolls and guide rolls mounted on the shafts.

The movement of the registering sheet stops 44 is imparted thereto through levers 48 rigidly attached to the shaft 47 and connected by means of pivotal links 58 to similar levers 59 rigidly mounted on the shaft 53. The movement of the registering stops 44 is thus in accordance with the relative movement of the suction sheet-opening rolls 24, 25.

The crank levers 46 are adapted to be adjustably mounted on the shaft 47 so that they may be adjusted according to the length of the book-sheet or signature while by reason of the slotted lever 36 the position of its connection with the connecting rod 37 may be adjusted to vary the throw or oscillatory movement of the suction rolls 24, 25 in accordance with the width of the sheets to be handled.

The operation of this embodiment of the invention is as follows:

The folded sheet or signature S which is to be opened placed upon the sheet-carrier 17 and then stitched, is fed by the conveyor belts 19, 19*a* to the suction feed rolls or sheet-opening rolls 24, 25. The latter have, at this period of the operation, been spaced apart by the timed movement of the cam 57, and through the interconnecting linkage 48, 58 and 59, the sheet-registering stops 44 are at the same time moved to their operative position as shown in Fig. 6. The folded sheet S is released by the conveyor belts and passes between the spaced suction rolls and lodges its open edges on the registering stops 44 whilst the sheet carrier 17 is in the stitching position as shown in Fig. 1. The suction rolls, by reason of the continued movement of the cam 57, now close together and so contact with and seize the sheet thus registered therebetween. When the latter is seized by the suction rolls the registering stops 44 are withdrawn from the path of travel thereof, being guided in their movement by the cam slotted guides 49 on the rigid bar 50. The suction rolls, by means of the toothed segment 34 and the associated cam actuated mechanism, commence their inverse operative movement in order to open the sheets as the sheet-carrier is registering in the initial sheet feeding position during its idle return stroke, Fig. 3.

Immediately the sheet-carrier reaches the end of its idle return stroke, its direction of movement is reversed and it commences to move towards the stitching position. When the sheet carrier registers with the suction rolls at the commencement of this next feeding movement, linear movement in the same direction is imparted to the suction rolls, by the cam actuated movement of the carrier bar 26, and the suction rolls and sheet fed thereby are moved in concert with the moving sheet carrier as shown in Fig. 4.

Owing to the relative positions of the pivot 18 of the swinging sheet carrier 17 and the carrier bar slide bearings 27, the line of movement of the suction rolls 24, 25 intersects the arcuate path of travel of the sheet carrier so that at the moment when the sheet is finally released from the suction rolls and placed on the sheet carrier the suction rolls and the folded edge of the sheet are close to the apex of the sheet carrier as shown in Fig. 5. The sheet is thus placed gently upon the sheet carrier at a comparatively high speed without incurring the risk of displacement, the path of the suction rolls now leads away from the path of the sheet carrier as the latter carries the sheet to beneath the stitcher heads 13 as shown in Fig. 1.

During the completion of the feeding movement of the sheet-carrier, the registering stops are moved to their operative position and the suction rolls moved apart as shown in Fig. 6 so that by means of the sheet conveyor belts 19*a* and friction rollers 20 which have moved with the suction rolls, the feed to the latter of the next sheet or signature is commenced before the return movement of the suction rolls to the initial sheet feed position as shown in Fig. 3.

The oscillatory movement of the suction rolls 24, 25 is so timed by the actuating cam 39 that the suction orifices 24*a*, 25*a* are located above the contact line of the suction rolls when the latter first engage the sheet as described, Fig. 6.

In the description of the above embodiment of the mechanism, the component parts have been referred to for the sake of clarity as single members, but it will be readily appreciated that in practice, a series of such members, arranged for preference, on common operating shafts transversely of the machine, may be utilized. If so desired, the sheet opening device can be adapted to travel parallel to the path of movement of the swinging sheet carrier and along the full distance thereof. It will be appreciated that the method of selecting, separating and/or feeding the folded sheets to the sheet opening devices is not material to the invention above described and moreover, the method of suction control and/or rotation of the suction rolls may be any one of those commonly known in the art.

Referring to Figs. 7, 8 and 9, a second embodiment of the invention comprises a sheet-feeding arrangement adapted for use with a

book-binding machine of the swinging sheet-carrier type including a suction roll 24, forming one of an inversely rotating pair of such rolls 24, 25, which in addition to its usual operative rotation is given an arcuate movement about the pivot of the associated suction roll 25.

The rolls 24, 25 or a plurality of such rolls are mounted on shafts 61, 62 respectively of which the shaft 62 may be journalled in the side frames 10 of the machine while the shaft 61 is preferably mounted in pivotal arms, pivoted for instance on the shaft 62.

The shaft 62, journalled in the frame 10, has rotatably mounted thereon in addition to the suction roll 25 guide rolls (not shown) similar to the rolls 23*a* shown in Fig. 2. Also freely mounted on the said shaft are bell-crank levers 63 each of which has one arm 64 thereof forked to receive a slidable bearing block 65 in which block is journalled the shaft 61 carrying the suction roll 24 and guide rolls corresponding to those carried by the shaft 62. The suction rolls and guide rolls carried by the shafts 61, 62 are held in resilient engagement by means of spiral springs 66 which are anchored to and extend between the said shafts, while rollers or discs 65*a* for a purpose hereinafter to be described are mounted also on the shaft 61.

A driving connection between the suction rolls 24, 25 is provided by the gear wheels 32, 33 fixedly mounted on the shafts 61, 62 respectively and the intermediate gears 30, 31, the latter being journalled in brackets mounted on the arm 64 of a bell-crank lever 63 and so partaking of the displacing movement of the said lever and roll 24.

In this arrangement, the parting of the suction rolls 24, 25 to receive the sheet fed thereto, is effected by displacing the roll 24 in the following manner:

A pivotal lever 67, pivoted at one extremity to the machine frame 10 and provided with a cam follower adapted to engage a cam 66*a* mounted on the drive shaft 40, is connected at its further extremity by means of a connecting rod 68 to one arm of a bell-crank lever 69 the latter being pivoted to the machine frame 10. The second arm of the bell-crank lever 69 is connected by means of a pitman 70 to one arm of a further bell-crank lever 71 which is pivotally mounted on the shaft 62. The arm 72 of the bell-crank lever 71 is formed with a suitably shaped cam-faced segment 73 which latter is positioned to engage the rollers 65*a* carried on the shaft 61 and so serves, when the cam 66*a* is rotated, to displace the roll 24 against the action of the springs 66.

The arcuate movement of the roll 24 about the pivot of the roll 25 is imparted thereto by the cam 74 mounted on the driven shaft 40. A bell-crank lever 75 pivoted to the machine frame 10 carries a cam follower adapted to engage the cam 74 and is connected by means of a pitman 76 to the arm 63*a* of the bell-crank lever 63 which serves to support the suction roll 24. It will be obvious that by the arrangement described the roll 24 is moved about the roll 25 in timed relation to the rotation of the shaft 40. As described in reference to the first embodiment the shaft 40 is driven from the main drive shaft of the associated stitching machine.

As denoted by the corresponding references on Fig. 7 of the drawings, the arrangement of the mechanism for actuating the sheet stop 44 and imparting rotary movement to the sheet opening rolls 24, 25 and associated guide rolls is similar to that above described in reference to Figs. 1 to 6 and therefore does not require further description in reference to the present embodiment.

The operation of the feed device is as follows:

The suction rolls are positioned above and intermediate of the path of travel of the sheet carrier 17 and when moved into the sheet receiving position by the movement of the cam 66*a* and the associated mechanism above described are as shown in Fig. 7. When the suction rolls are so positioned and prepared to receive a folded sheet therebetween the sheet carrier 17 is in the stitching position as shown. During the return or idle stroke of the sheet-carrier, and the continued rotation of the cam 66*a*, the suction rolls are brought into engagement by the spiral springs 66 and commence to feed downward and open the folded sheet now held thereby as shown in Fig. 8.

The rotation of the cam 74 is timed so that when the sheet-carrier 17, in its idle or return movement, passes beneath and beyond the suction rolls, the roll 24 is swung about the pivot of the roll 25 as above described and thus, whilst continuing to feed the sheet also follows the moving sheet-carrier as shown in Fig. 9.

The effect of this movement of the roll 24 is to cause the right-hand leaf of the signature S to feed in an oblique direction while keeping above the apex of the sheet carrier, and the left-hand leaf of the signature to move in a downward and approximately vertical direction in front of the sheet-carrier, i. e. between the sheet-carrier and the stitcher heads.

Thus, the feed of the sheet is enabled to take place during a considerable part of the return or idle movement of the sheet-carrier and when the movement of the latter is reversed the suction roll 24 is returned to the normal position shown in Figs. 7 and 8 and the right-hand leaf of the signature S thereupon drops down upon the carrier 17 and the latter, now moving forward in a sheet-feeding movement engages the left-hand leaf of the signature as will readily be understood.

The feed of the signature S is completed as the apex 17*a* of the sheet-carrier, in its arcuate path of movement, approaches the suction rolls as indicated by the chain-dotted lines shown in Fig. 9. The sheet is thus released to lodge upon the sheet-carrier when the apex 17*a* of the sheet carrier 17 is near to the folded edge of the sheet so released, and the sheet-carrier then conveys the sheet to the stitching mechanism as above described and shown.

It is not desired to limit the invention to the specific constructions above described, the ambit of the invention being that as defined in the appended claims.

We claim:

1. A method of opening and feeding folded sheets to the movable sheet-carrier of a book-binding machine, which includes causing a sheet-opening device during each operative period thereof to move with the said sheet-carrier through some part of the travel of the latter.

2. A method of opening and feeding folded sheets to the movable sheet-carrier of a book-binding machine, which includes passing the folded sheet between inversely rotating feed rolls and causing the said feed rolls to move in concert with a swinging sheet carrier during the feed to the latter of the folded sheet opened by the said rolls.

3. Sheet feed apparatus for use in a book binding machine, comprising a movable sheet carrier, a folded-sheet opening and feeding device, means for movably suspending the said device above the path of travel of the said sheet carrier, and means for imparting a displacing movement to the said device relative to the movement of the said sheet-carrier.

4. Sheet feed apparatus for use in a book-binding machine, comprising a travelling sheet-carrier, a folded-sheet opening and feeding device, means for movably suspending the said device above the path of travel of the said sheet carrier, means for displacing the said device relative to the travel of the said sheet-carrier so that the distance therebetween is varied during the said relative movements.

5. Sheet feed apparatus for use in a book-binding machine, comprising a movable sheet-carrier, a folded-sheet opening and feeding device, and means for moving the said device in a path intersecting to the path of movement of the said sheet-carrier.

6. Sheet feed apparatus for use in a book-binding machine, comprising a swinging sheet-carrier, inversely rotating sheet-feeding rolls associated with said sheet-carrier, means for actuating said rolls to feed a folded sheet or signature to said sheet-carrier, and means for moving said sheet-feeding rolls with said swinging sheet carrier during their feeding movements.

7. Sheet feed apparatus for use in a book-binding machine, comprising a sheet carrier, inversely rotating sheet-opening and feeding rolls associated with said sheet carrier, means for moving said rolls apart to receive a folded sheet therebetween, and means for rotating said rolls to open and feed said sheet to the said sheet-carrier.

8. Sheet feed apparatus for use in a book-binding machine, comprising a sheet-carrier, inversely rotating sheet opening and feeding rolls associated with said sheet carrier, means for moving said rolls apart to receive a folded sheet therebetween, means for registering the said sheet in a predetermined position between said parted feed rolls, means for causing said rolls to engage said sheet, and means for rotating said rolls to open said sheet and feed it to the said sheet-carrier.

9. Sheet feed apparatus for use in a book-binding machine, comprising a movable sheet carrier, inversely rotating sheet opening and feeding rolls associated with said sheet carrier, means for moving said rolls apart to receive therebetween a folded sheet, means for rotating said rolls to open and feed said sheet to the said carrier, and means for imparting to at least one of said rolls a displacing movement relative to the movement of the said sheet carrier.

10. Sheet feed apparatus for use in a book-binding machine, comprising a movable sheet carrier, inversely rotating sheet opening and feeding rolls associated with said sheet carrier, means for moving said rolls apart to receive therebetween a folded signature, means for registering the sheet in a predetermined position between said parted feed rolls, means for causing said rolls to engage said sheet, means for rotating said rolls to open said sheet and feed it to the said sheet carrier, and means for imparting to at least one of said rolls a displacing movement relative to the movement of the said sheet carrier.

11. Sheet-feed apparatus for use in a book-binding machine, comprising a movable sheet carrier, inversely rotating sheet opening and feeding rolls associated with said sheet carrier, means for feeding a folded sheet to said rolls, means for holding said rolls in resilient engagement, means for parting said rolls to receive therebetween the folded sheet, means for registering the said sheet in a predetermined position between said rolls, means for restoring said rolls to the sheet engaging position, means for oscillating said rolls to feed the sheet to the said movable sheet carrier, and means for imparting to at least one of said sheet feeding rolls a displacing movement relative to the movement of the said sheet carrier.

12. A sheet feed device for use with a book-binding machine of the swinging sheet carrier type, comprising in combination a supporting frame, inversely rotating sheet feed

rolls slidably mounted in said frame, sheet conveyor belts associated with said feed rolls, means for oscillating the said feed rolls to open the folded sheet seized thereby, means for imparting linear movement to the said sheet opening rolls in a path intersecting the path of movement of the swinging sheet carrier, and means for timing the operative movements of the said feed rolls in accordance with the movement of the said sheet carrier.

13. A sheet feed device for use with a book binding machine of the swinging sheet carrier type, comprising in combination, a supporting frame, a driven timing shaft journalled in said frame slide bearings attached to said frame, slide members mounted in said bearings, a transverse bar secured to said slide members, a guideway mounted on said transverse bar, a bearing bracket mounted on said guideway, a rotary suction roll journaled in said bearing bracket, an auxiliary slide member mounted in said guideway, a second rotary suction roll journalled in said auxiliary slide member and adapted to co-operate with said first suction roll, means for feeding a folded sheet to the said suction rolls, means for registering a folded sheet in a predetermined position between said rolls, means for actuating from said timing shaft the rolls to open and feed said sheet to the swinging sheet carrier, and means actuated from said timing shaft for moving the said slide members and auxiliary slide member in accordance with the movement of the said sheet carrier.

14. A sheet feed device for use with a book binding machine of the swinging sheet carrier type, comprising in combination a supporting frame, a cam shaft journalled in said frame, timing cams mounted on said shaft, slide bearings attached to said frame, slide members mounted in said bearings, a transverse bar secured to said slide members, guideways mounted on said slide bearings, bearing brackets mounted on said guideways, a shaft journalled in said bearing brackets, a suction roll mounted on said shaft, guide rolls mounted on said shaft, auxiliary slide members mounted in said slide bearings, a second shaft journalled in said auxiliary slide members, a second suction roll mounted on said second shaft and associated with the first suction roll, guide rollers mounted on the second shaft and associated with the first guide rolls, means operated from one of said cams for inversely oscillating said suction rolls, means similarly operated for imparting linear movement to said oscillating rolls, and means for timing from the associated book-binding machine the actuation of the said sheet feeding device.

15. A sheet feed device for use with a book binding machine of the swinging sheet carrier type, comprising in combination, a frame, a cam shaft journalled in said frame, timing cams mounted on said shaft, slide bearings attached to said frame, slide members mounted in said bearings, a transverse bar secured to said slide members, guideways mounted on said slide bearings, bearing brackets mounted on said guideways, a shaft journalled in said bearing brackets, at least one suction roll mounted on said shaft, guide rolls mounted on said shaft, auxiliary slide members mounted in said guideways, a second shaft parallel to and adjacent said first shaft and mounted in said auxiliary slide members, a second suction roll associated with said first suction roll and mounted on said second shaft, guide rolls mounted on said second shaft and associated with said first guide rolls, means operated from said cam shaft and linked to said auxiliary slide member for moving apart said suction rolls, movable sheet registering stops associated with said suction rolls, conveyor belts adapted to feed a folded sheet between the parted suction rolls and on to the said sheet registering stops, adjustable means operated from said cam shaft for inversely oscillating said suction rolls, means operated from said cam shaft for moving said sheet registering stops in and out of the path of the said sheet, means operated from said cam shaft and linked to said main slide bearings for moving the said inversely rotating sheet-feed rolls relatively to the movement of the said sheet carrier, and means for timing the operation of the said device from the associated book-binding machine.

16. A sheet feed device for use with a book-binding machine of the swinging sheet-carrier type, comprising in combination, a frame, a cam shaft journalled in said frame, timing cams mounted on said cam shaft, a shaft journalled in said frame, a suction roll fixedly mounted on said shaft, guide rolls fixedly mounted on said shaft, forked levers freely mounted on said shaft, slidable bearing blocks mounted in said forked levers, a second shaft journalled in said bearing blocks, a second suction roll fixedly mounted on said second shaft, guide rolls mounted on said second shaft, means for holding said suction rolls in resilient engagement, means for parting said rolls, means for feeding a folded sheet between said parted rolls, means for inversely oscillating about their pivots the said suction rolls, means for rocking said forked levers to move the second suction roll about the pivot of the first suction roll, and means for timing the operative movements of the said suction rolls in accordance with the movement of the said sheet carrier.

17. A sheet feed device for use with a book binding machine of the swinging sheet carrier type, comprising in combination, a frame, a cam shaft journalled in said frame, timing cams mounted on said cam shaft, a

shaft journalled in said frame, a suction roll fixedly mounted on said shaft, guide rolls fixedly mounted on said shaft, a pinion fixedly mounted on said shaft, an arcuate toothed rack pivoted to said frame and adapted to engage said pinion, bell-crank levers freely mounted on said shaft and each having one arm thereof forked, slidable bearing blocks mounted in the forked arms of said bell crank levers, a second shaft journalled in said bearing blocks, a second suction roll fixedly mounted on said second shaft, guide rolls mounted on said second shaft, means for holding said suction rolls and guide rolls in resilient engagement, cam follower rollers mounted on said second shaft, a cam faced member mounted on said first shaft and adapted to engage said cam follower rollers, means actuated from one of said cams whereby said cam faced member is rocked, means actuated from said timing cams whereby said arcuate rack is rocked about its pivot to oscillate said suction rolls, means actuated from one of said timing cams whereby said bell-crank levers together with the suction rolls and guide rolls supported thereby are rocked about the said first shaft, and means for controlling the operative movements of the said timing cams in accordance with the movement of the said sheet-carrier.

18. A sheet feed device as claimed in claim 17, which includes sheet conveyor belts to direct a folded sheet between the parted suction rolls, friction rollers associated with said sheet conveyor belts, sheet registering stops adapted to register said sheet in a predetermined position between said parted rolls, and means actuated from said cam shaft to remove said stops from the path of the registered sheet.

19. Means for feeding a folded sheet to the suction rolls claimed in claim 13 comprising belt pulleys mounted on the frame, a belt pulley slidably mounted on the guideway, continuous conveyor belts passed around said pulleys, and friction or sheet gripping rolls associated with said conveyor belts.

In testimony whereof we affix our signatures.

OSCAR KLEINSCHMIT.
RUDOLF KLEMM.