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2,926,909

SHEET TRANSFER MECHANISM

Filed March 17, 1959

2 Sheets-Sheet 1

FIG. 2

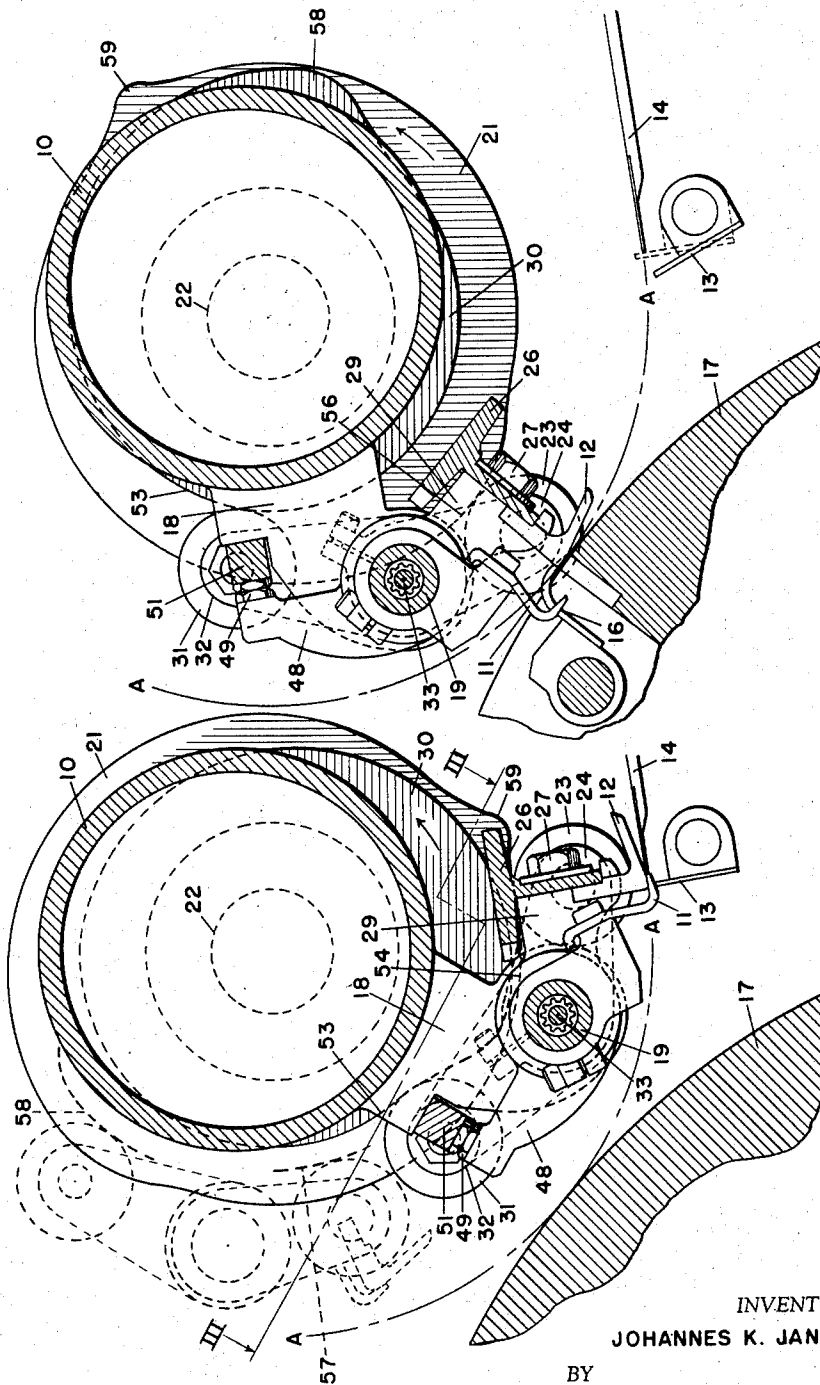


FIG. 1

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FIG. 3

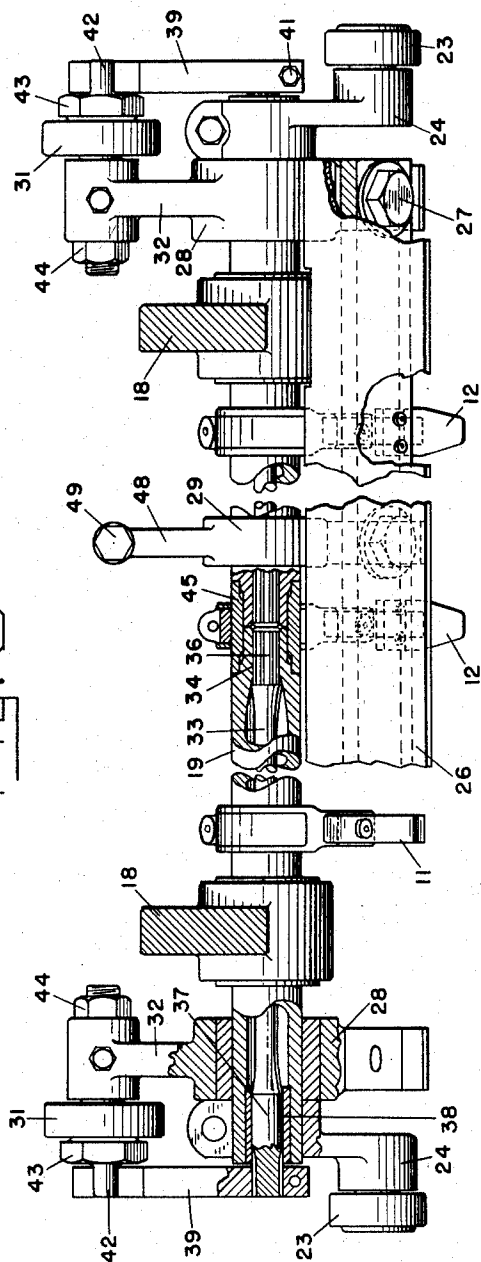
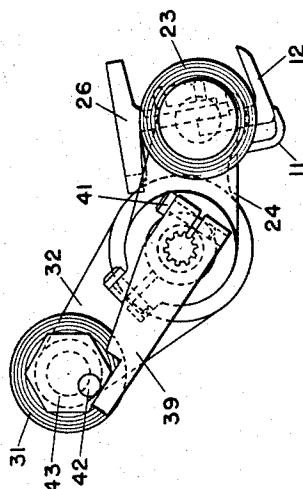


FIG. 4



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1

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SHEET TRANSFER MECHANISM

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9 Claims. (Cl. 271—51)

This invention pertains to mechanisms for feeding sheets to a printing press or the like machine. More specifically, it is directed to an improved stop gripper mechanism for transferring sheets from a position at rest on a feed table to the grippers of a continuously rotating impression cylinder.

It is common practice in the printing industry to feed sheets to a sheet fed printing press by means of an automatically operated, oscillating sheet transfer or stop gripper mechanism which is provided with gripper fingers and coating pads to engage and transfer successive sheets from a position at rest on the feed table of the press to the grippers of the continuously rotating impression cylinder. On the feed stroke of the cycle, the transfer grippers and pads swing in an arc substantially tangent to the feed table and to the periphery of the impression cylinder at the transfer point so that each sheet is transferred in register to the impression cylinder grippers. During the return stroke, the grippers and pads preferably are withdrawn or retracted within the radius of their normal path of travel so as to preclude interference with and possible damage to the trailing portion of the transferred sheet which is still being withdrawn as the transfer grippers return to engage the leading edge of the next sheet.

Heretofore control of the transfer gripper fingers and pads has been effected by means of rotating cams provided at each end of the mechanism which are effective to move the pads between their operative and withdrawn positions and to control the opening and closing action of the gripper fingers at predetermined intervals to engage and release the sheets. In combination with the cams, relatively large compression spring assemblies are provided to maintain the respective cam rollers against their actuating cams and to effect the return movements of the grippers and pads and these assemblies are mounted for bodily movement with the grippers and pads, as illustrated for example in Patent 1,790,457. In most instances a corresponding spring assembly is provided at each end of the mechanism to control the movement of the gripper pads and an additional spring assembly is provided, usually at one end only of the device, to effect the closing action of the gripper fingers.

These external spring assemblies, not only require considerable space in a relatively confined area of the printing press, but the mass of the respective elements associated therewith, such as the supporting brackets, the sliding pins, and the springs themselves, adds materially to the total inertia which must be accelerated, retarded, and reversed rapidly during each cycle of operation. Consequently, it has been necessary to employ relatively heavy structural members to withstand the stresses imposed thereon and the ability to maintain positive control of such a heavy unit has constituted a limiting factor in determining the maximum speed at which the mechanism can safely be operated. Moreover, because of the rather extensive movement imparted to the grippers and pads and the resultant constant flexing of the springs, they

2

are relatively short lived and must be replaced at frequent intervals.

It is an object of this invention, therefore, to provide a transfer mechanism of improved design which is considerably lighter in weight, more efficient in operation and which will permit higher operating speeds.

A further object is to provide a transfer mechanism wherein the multiple external compression spring assemblies are eliminated and the force necessary to maintain the respective actuating members in contact with their control cams is provided by a single, fully enclosed, resilient spring member.

Another object is to provide a sheet transfer mechanism wherein the tension of the resilient spring member is maintained substantially constant during the complete cycle of operation.

A still further object is to provide adjustable means for preloading the resilient member and whereby the tension at each end thereof can be equalized.

Other objects and advantages of this invention will be apparent from the following description and the accompanying drawings wherein:

Figure 1 is a view, partly in section showing the improved transfer mechanism in its sheet engaging position with respect to the register table;

Figure 2 is a view similar to Figure 1 showing the position of the respective elements immediately after passing the sheet transfer point with respect to the impression cylinder;

Figure 3 is a plan view, partly in section, taken substantially along the line III—III of Figure 1; and

Figure 4 shows the mechanism for preloading and equalizing the tension on the torsion bar.

With reference now to the drawings the sheet transfer mechanism in which the invention is embodied for purposes of illustration comprises a main supporting shaft 10, having gripper fingers 11, and coating pads 12 mounted thereon for transferring sheets from a register position against the front guides 13 on the feed table 14 to the grippers 16 on the impression cylinder 17.

The shaft 10 is journaled for rotation about an axis parallel with the impression cylinder and above the leading edge of the feed table and is adapted to be oscillated in timed relation with the rotary motion of the impression cylinder so that a sheet will be presented to the impression cylinder grippers for each revolution of said cylinder. The mechanism for oscillating the shaft has not been shown because it forms no part of the present invention and any well known mechanism, such as that disclosed in Patent 1,764,104, may be used for the purpose. It will be understood, however, that the motion of the shaft is such that the transfer grippers, after they have engaged a sheet at rest on the feed table, will be gradually accelerated until they are traveling at the same speed as the impression cylinder when they reach the transfer point and release the sheet to the impression cylinder grippers.

As shown in Figures 1 and 2, the gripper fingers 11 and pads 12 are mounted on the shaft 10 by means of brackets 18, a series of which are fixed to said shaft in spaced relation and which project radially therefrom to provide support for a gripper shaft 19. The latter is rotatably mounted in the brackets and provides support for the gripper fingers 11 a series of which are clamped securely to said shaft so that they will move in unison therewith when the shaft is oscillated for the purpose of opening and closing the grippers at predetermined positions in the cycle of operation.

Rocking motion of the gripper shaft 19 about its axis in the brackets 18 is effected by means of a cam 21 which is mounted for rotation about the axis of the supporting shaft journal 22 and engages a cam roller 23 on the lever 24 which is secured to the end of the gripper shaft,

The cam 21 is mounted for rotation in a counter clockwise direction as viewed in Figures 1 and 2 and as said cam rotates, the gripper shaft will be rocked intermittently whereby to open and close the gripper fingers at predetermined intervals during the cycle of operation. The mechanism for driving the cam has not been shown, but it will be understood that it is driven preferably at a constant rate of speed, by any suitable means such as for example by the cylinder driving gear, so as to make one complete revolution for each cycle of operation.

Whereas the gripper fingers 11 are fixed to the gripper shaft 19 so as to move in unison therewith, the coacting gripper pads 12 are mounted for relative oscillating motion about the axis of the gripper shaft, so they can be rocked between their operative and retracted positions during their respective feed and return strokes. Accordingly the pads are fixed to a T-shaped supporting bar 26 which extends transversely across the feed table parallel to the gripper shaft and which is mounted by means such as the bolts 27 to the respective ends of a series of levers 28 and 29 which are rotatably mounted on the gripper shaft.

During the feed and return strokes of the transfer cycle the angular position of the gripper pads is controlled by a cam 30 which is mounted to rotate with the gripper finger control cam 21 through one complete revolution for each cycle of operation and which actuates a cam roller 31 on the lever 32, see Figure 3, which is formed integral with the gripper pad supporting levers 28, one of which is provided at each end of the gripper pad assembly.

From the description thus far it will be evident that when the shaft 10 is oscillated, the gripper fingers 11 and pads 12 will swing back and forth between the feed table and the impression cylinder and the cam 21, which rotates constantly in the direction indicated by the arrows in Figures 1 and 2, will open and close the gripper fingers at predetermined intervals to engage a sheet on the feed table and to release it to the impression cylinder grippers at the transfer point. In a similar manner, the cam 30 will maintain the gripper pads 12 at a radius coincident with the normal plane of transfer, indicated by the broken line A—A in Figures 1 and 2, until they have passed the transfer point and have reached the end of the feed stroke which position is indicated by broken lines in Figure 1. At this point the cam 30 is effective to retract or withdraw the pads and therewith the gripper fingers within their normal radius of travel as the direction of movement of the shaft 10 is reversed and the grippers and pads return to engage the next succeeding sheet.

The force required to maintain the cam follower rollers 23 and 31 in contact with their respective cams is provided by a single, resilient spring member in the form of a torsion bar 33 which is mounted coaxially within the hollow gripper shaft 19. As shown best in Figure 3, the gripper shaft is formed with a reduced diameter neck portion 34 substantially at the center thereof which is provided with grooves to receive the enlarged splined portion 36 of the torsion bar. In this way the two members are locked securely together so that any rotary motion of the gripper shaft will be transmitted to the torsion bar at this point. At its outer ends, however, the torsion bar is arranged to rotate relative to the gripper shaft and each end is formed with an enlarged bearing portion 37 which is rotatably mounted in a bearing 38 inserted into each end of the gripper shaft.

In order to transmit the force of the torsion bar to the gripper pad control levers 32, which are rotatably mounted on the gripper shaft, each end of the torsion bar which extend beyond the ends of the gripper shaft is provided with a lever 39. These levers have internally grooved openings to fit securely onto the splined end of the torsion bar and they are clamped in position by means such as the bolts 41. The free end of each lever 39 extends laterally from the torsion bar, as shown in

Figure 4, and engages an eccentric pin 42 formed integral with the respective cam roller studs 43 which are carried at the free ends of the levers 32 and support the cam rollers 31. Thus it will be evident that the torsion bar is connected between the respective cam levers and will exert a constant, equalized force against each one to maintain the cam followers against their respective control cams.

At assembly the levers 39 are affixed to the torsion bar at an angular position which is such that when the cam rollers 23 and 31 are placed in operative position on their respective cam surfaces, the torsion bar will be placed under a predetermined preload tension. For efficient operation this tension must be sufficient to overcome the forces exerted against the respective cam levers and it must be substantially equal at each end of the assembly.

After the initial preload tension has been imposed on the torsion bar by appropriate positioning of the levers 39, any differential in the tension at each end thereof can be corrected by varying the angular position of the pins 42. As shown in Figures 3 and 4 the pins are formed integral with the studs 43 and these are secured to the levers 32 by means of locking nuts 44. By loosening the locking nuts the pins may be adjusted angularly about the axis of the studs 43 to thereby increase or relieve the tension at the respective ends of the torsion bar until it is precisely equal to each end of the assembly.

Obviously the gripper shaft 19 and torsion bar 33 may each be of one piece construction so that each extends across the full width of the device with the torsion bar being connected to the gripper shaft at its center portion as heretofore explained. However, for convenience of assembly and subsequent servicing the gripper shaft preferably is formed of two separate sections which are coaxially aligned. In such case the inner end of each section is provided with splines which fit into a coupling 45 which locks the two sections together against any relative motion. The torsion bar likewise may be composed of two separate sections which, as shown in Figure 3, are adapted to butt together at the center of the gripper shaft and thus each section, in effect, controls its respective half of the transfer gripper assembly.

In order to maintain the register position of the sheet as it is being transferred, the transfer gripper assembly must be maintained relatively rigid and in precise alignment from the moment that the transfer grippers close on a sheet on the feed table and until it is released to the impression cylinder grippers at the transfer point. To insure accurate alignment and positioning of the gripper pads during this critical portion of the transfer cycle, the clockwise movement of the pad assembly about the axis of the gripper shaft 19 is limited by a series of stops 49, see Figures 1 and 2, which are provided at spaced intervals across the full length of the transfer mechanism. These stops are carried at the free ends of the arms 48 formed integral with the center pad bar supporting levers 29 and are arranged to engage coacting fixed stops 51 provided on the brackets 18. Corresponding stops are also provided on the arms 32 of the levers 28 as shown in Figure 3.

By appropriate adjustment of the stops 49 when the pads are in the sheet transfer position, as shown in Figure 1, the pad supporting bar 26 can be accurately aligned throughout its full length to preclude any distortion or twist therein which would adversely affect the register of the sheet. The stops are preferably set so that the pad cam roller 31 is maintained slightly spaced from the cam 30 during the sheet transfer portion of the cycle during which time the force exerted by the torsion bar maintains the respective stops in intimate contact and the register of the sheet is precisely maintained. The stops 49 also serve to position the pads 12 radially, relative to the feed table and the impression cylinder, so that they swing in an arc having a radius tangent

5

to both members. These stops need only be adjusted when the device is first assembled and under normal circumstances will remain fixed thereafter.

With reference to Figures 1 and 2, it also will be noted that the main shaft 10 is mounted eccentrically with respect to its journals 22. This is done in order to counter balance the mass of the gripper finger and pad assembly and to avoid the need for adding counter balancing means which otherwise would be necessary and which obviously would increase the overall weight of the mechanism and thus add to the inertia which must be controlled efficiently at high speeds.

Having thus described the various elements of the invention a brief description of its operation is as follows:

As illustrated in Figure 1 the gripper fingers and coacting pads have engaged a sheet on the feed table in a register position against the front guides 13. In this position the gripper pad cam roller 31 is on the low portion 53 of its cam 30 and the gripper finger cam roller 23 is on the low part 54 of its cam 21.

At this point the guides 13 swing down out of the path of the sheet as indicated in Figure 2 and the shaft 10 is rocked in a clockwise direction to swing the transfer grippers in a circular path indicated by the broken line A—A from the feed table to the impression cylinder.

The movement of the shaft 10 is such that the transfer grippers are rapidly accelerated until they are traveling at the same speed as the impression cylinder when they reach the transfer point as illustrated in Figure 2. At this point the high portion 56 of cam 21, which is rotating constantly in a counter clockwise direction, will engage the gripper cam roller 23 thereby rocking the gripper shaft 19 to open the gripper fingers and release the sheet to the impression cylinder grippers. It will be noted that during the travel from the feed table to the transfer point the gripper pad cam roller 31 traverses a concentric portion of the cam 30 so that the pads remain precisely in the plane of transfer with the adjustable stops 49 in intimate contact with the fixed stops 51.

After the sheet is released to the impression cylinder grippers at the transfer point, the transfer gripper assembly continues to move in a clockwise direction, but at a decelerating rate, until it reaches the position indicated by the broken lines in Figure 1. At this point the gripper finger cam roller 23 engages the low portion 57 of its actuating cam so that the fingers close on the pads as the latter move to a retracted position within the radius of the normal plane of transfer by virtue of the pad cam roller 31 engaging the high portion 58 of its control cam 30.

The direction of movement of the shaft 10 is reversed at this point and the grippers and pads move counter clockwise in their retracted position until they approach the leading edge of the feed table. During this portion of the cycle, the gripper assembly moves in the same direction and at substantially the same speed as the control cams 21 and 30 and thus the fingers and pads remain in the retracted position. The gripper assembly decelerates as it approaches the feed table, however, whereupon the high part 59 of cam 21 engages the roller 23 to open the gripper fingers as the tail end of the transferred sheet clears the front guides 13. Cam roller 31 subsequently engages the low portion 53 of its cam 30 causing the pads 12 to be projected to their sheet engaging position over the leading edge of the feed table. Continued rotation of cam 21 after the transfer grippers come to rest in their sheet engaging position causes the high portion 59 to move out from under the cam roller 23 thereby permitting the gripper fingers to close on the next registered sheet and the cycle is then repeated.

It will be noted that during the complete cycle of operation, the tension on the torsion bar remains substantially constant although the positions of the gripper fingers and pads are varied substantially. This is due to the fact that during the travel between the feed table and

6

the impression cylinder, the cam rollers engage relatively concentric portions of their respective actuating cams and this condition remains constant until the gripper fingers 11 are opened at the transfer point. As the transfer mechanism continues on past the transfer point the gripper finger cam roller moves to a low portion of its actuating cam as the pad cam roller 31 engages a high portion of its cam to retract the grippers within the normal path of travel. Thus the tension on the torsion bar remains substantially constant at this point because the assembly, in effect, merely pivots about the axis of the gripper shaft as a unit with little or no relative motion between the respective control levers.

On the return stroke also the respective cam rollers maintain relatively fixed positions until they approach the feed table at which time the gripper fingers are opened as the cam roller 23 engages a high portion of the cam 21 and the gripper pads move substantially in the same direction as they are projected to their sheet taking position when the pad cam roller 31 moves to a low portion of its actuating cam. Thus it will be evident that during the complete cycle of operation the fingers and pads pivot substantially as a unit about the axis of the gripper shaft and the only substantial relative motion between the respective control levers takes place at the points where the gripper fingers are opened to engage and release sheets.

This is a definite advantage because it permits the use of relatively light weight elements in the transfer gripper assembly without danger of imposing excessive strains on the operating members and, moreover, because of the minimum relative motion required, a light weight torsion bar can be employed which in turn can be preloaded to any degree necessary to insure efficient and accurate operation without danger of exceeding its modulus of elasticity.

While we have herein disclosed a torsion bar as the preferred means for supplying the force necessary to maintain the gripper finger and pad bar actuating levers in contact with their respective cams, it will be evident that similar results may be obtained by using suitable coil spring means for this purpose. Therefore, the invention is not to be limited to specific details because other modifications will be apparent to those skilled in the art without departing from the spirit of the invention and which it is intended to include within the scope of the appended claims.

What is claimed is:

1. In a sheet transfer device for feeding sheets from a support to a continuously rotating sheet carrying member the combination comprising, a shaft mounted for oscillation in an arcuate path between said support and said member, gripper fingers and coacting pads mounted for bodily movement with said shaft, actuating means for imparting relative motion to said fingers and pads respectively in opposite directions about the axis of said shaft, and a single resilient member connected between said fingers and pads for exerting a substantially constant, equalized force against said respective actuating means.

2. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder, the combination comprising a hollow shaft mounted for oscillation in an arcuate path between said support and said cylinder, gripper fingers and coacting pads mounted for bodily movement with said shaft, actuating means for imparting relative motion to said fingers and pads respectively, in opposite directions about the axis of said shaft, and a resilient member mounted coaxially within said shaft for exerting a substantially constant, equalized force against said respective actuating means.

3. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a hollow shaft mounted for oscillation in an arcuate path between said support and said cylinder, gripper fingers and coacting pads

mounted on said shaft for bodily movement therewith, cam means for imparting relative motion to said fingers and pads respectively in opposite directions about the axis of said shaft, a resilient member connected between said fingers and pads for exerting a substantially constant, equalized force against said respective cam means, lever means for applying a preload tension to said resilient member, and adjustable means having coaction with said lever means for equalizing the tension at each end of said member.

4. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a rotatable shaft, a series of gripper fingers fixed to said shaft, an assembly of coating gripper pads rotatably mounted on said shaft, means for swinging said shaft and therewith said fingers and pads in an arcuate path between said support and said cylinder, actuating means for rocking said pad assembly about the axis of said shaft whereby to withdraw the pads and therewith the fingers within said arcuate path during the return stroke of their oscillating cycle, additional actuating means for rocking said shaft and therewith said fingers relative to said pads at predetermined intervals to engage and release sheets, and a single resilient member connected between said shaft and said pad assembly for exerting a substantially constant, equalized force against both said actuating means.

5. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a rotatable hollow shaft, a series of gripper fingers fixed to said shaft, an assembly of coating gripper pads rotatably mounted on said shaft, means for swinging said shaft and therewith said fingers and pads in an arcuate path between said support and said cylinder, actuating means for rocking said pad assembly about the axis of said shaft whereby to withdraw the pads and therewith the fingers within said arcuate path during the return stroke of their oscillating cycle, additional actuating means for rocking said shaft and therewith said fingers relative to said pads at predetermined intervals to engage and release sheets, and spring means mounted coaxially within said hollow shaft and connected between said shaft and said pad assembly for exerting a substantially constant, equalized force against both said actuating means.

6. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a rotatable hollow shaft, a series of gripper fingers fixed to said shaft, an assembly of coating gripper pads rotatably mounted on said shaft, means for swinging said shaft and therewith said fingers and pads in an arcuate path between said support and said cylinder, actuating means for rocking said pad assembly about the axis of said shaft whereby to withdraw the pads and therewith the fingers within said arcuate path during the return stroke of their oscillating cycle, additional actuating means for rocking said shaft and therewith said fingers relative to said pads at predetermined intervals to engage and release sheets, and a torsion rod mounted coaxially within said hollow shaft and connected between said shaft and said pad assembly for

exerting a substantially constant, equalized force against both said actuating means.

7. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a rotatable hollow shaft, a series of gripper fingers fixed to said shaft, an assembly of coating gripper pads rotatably mounted on said shaft, means for swinging said shaft and therewith said fingers and pads in an arcuate path between said support and said cylinder, cam actuated means for rocking said pad assembly about the axis of said shaft whereby to withdraw the pads and therewith the fingers within said arcuate path during the return stroke of their oscillating cycle, additional cam actuated means for rocking said shaft and therewith said fingers relative to said pads at predetermined intervals to engage and release sheets, a torsion bar mounted within said hollow shaft, said bar and shaft being interconnected substantially at the centers thereof, a lever fixed to each end of said torsion bar for preloading said bar and to transmit the force thereof to said pad actuating means, and adjustable stops having coaction with said levers for equalizing the tension at each end of said torsion bar.

8. In a sheet transfer device for feeding sheets from a support to a continuously rotating impression cylinder the combination comprising, a supporting member rotatably mounted parallel to said cylinder, a series of brackets fixed to said member, a hollow shaft rotatably mounted in said brackets, a series of gripper fingers fixed to said shaft, an assembly of coating gripper pads mounted for rotary motion about the axis of said shaft, drive means for oscillating said supporting member whereby to swing said fingers and pads in an arcuate path between said support and said cylinder, cam actuated means for rocking said pad assembly about the axis of said shaft whereby to retract said pads and fingers within said arcuate path during the return stroke of their oscillating cycle, additional cam actuated means for rocking said shaft relative to said pads whereby to open said gripper fingers at predetermined intervals, and a resilient member mounted coaxially within said shaft and having a connection between said pads and fingers for effecting the return movements of both said fingers and said pads.

9. In a device for transferring sheets from a support to a rotatable sheet carrying member the combination comprising, a shaft mounted for movement between said support and said member, gripper fingers and coating pads mounted for bodily movement with said shaft, actuating means for imparting relative motion to said fingers and pads respectively about the axis of said shaft, and a single resilient member connected between said fingers and pads for exerting a substantially constant, equalized force against said respective actuating means.

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