

June 24, 1941.

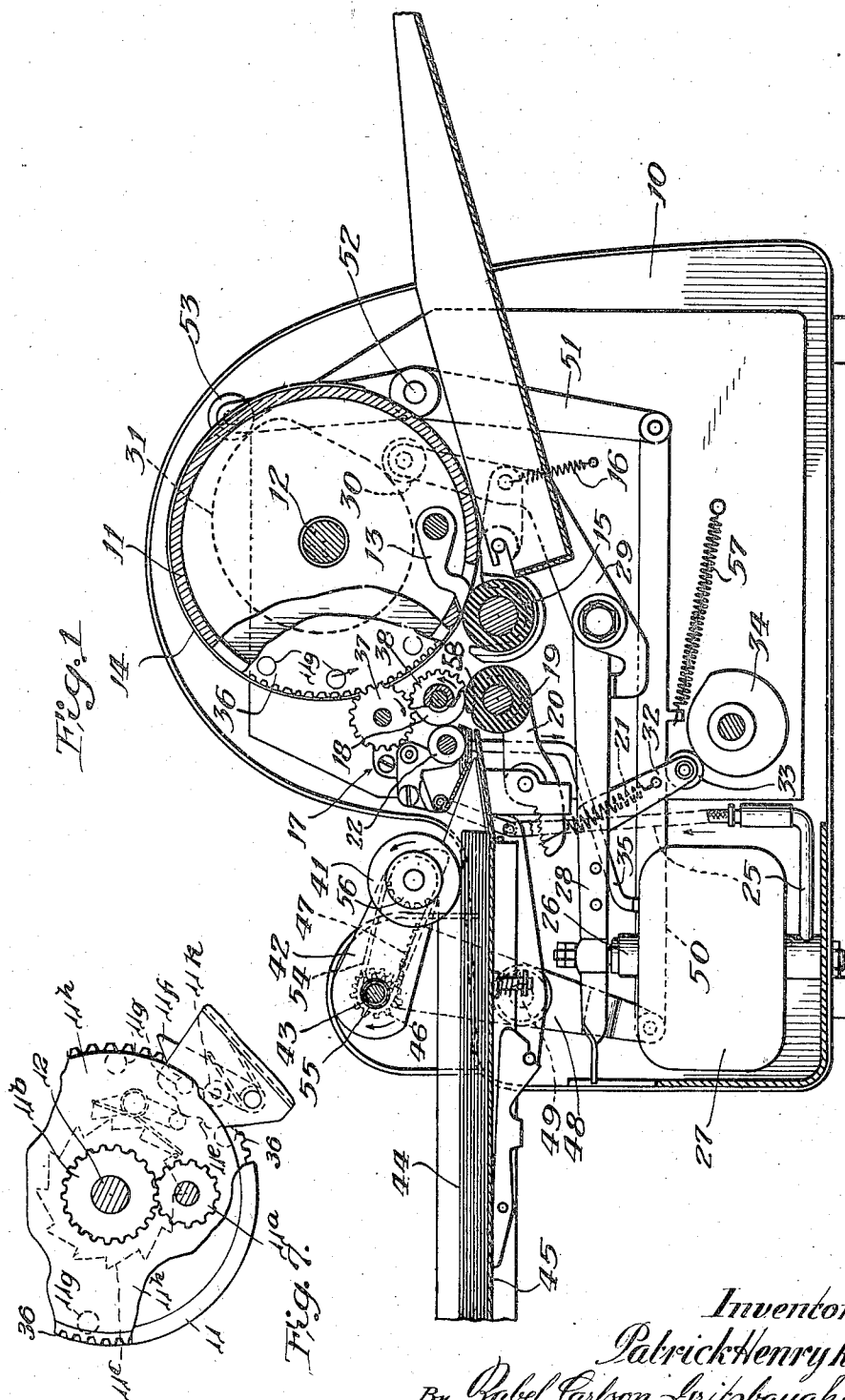
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2,247,134

METHOD OF AND MEANS FOR FORWARDING SHEETS

Filed Oct. 18, 1939

4 Sheets-Sheet 1



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Fig. 2.

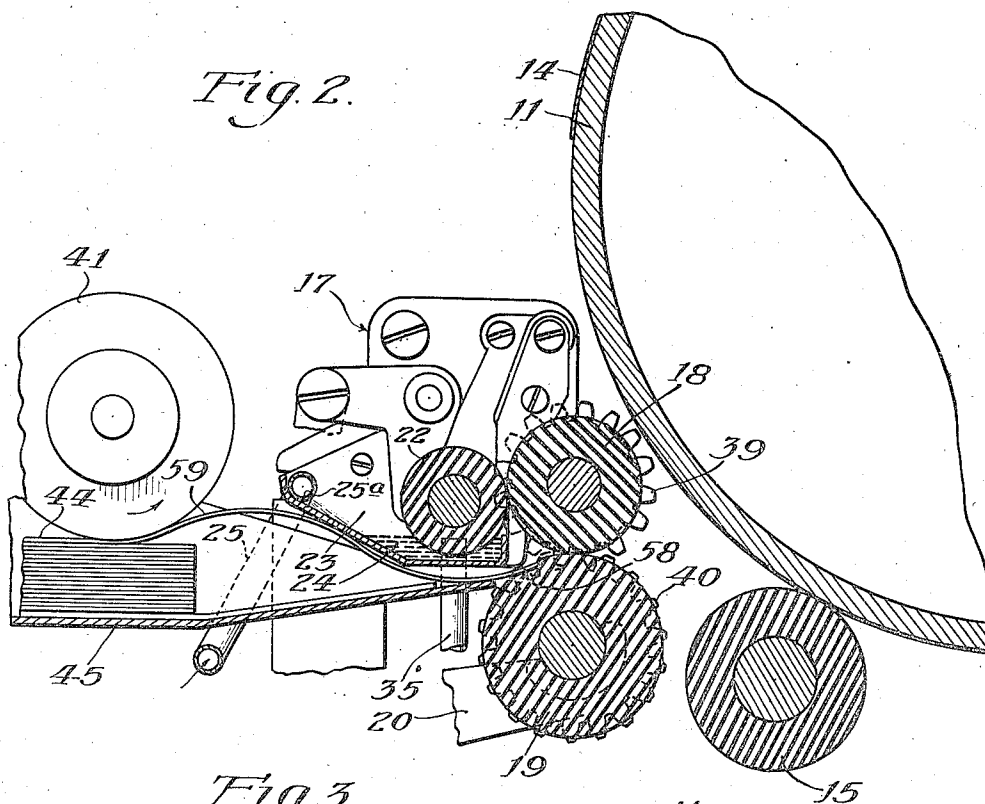
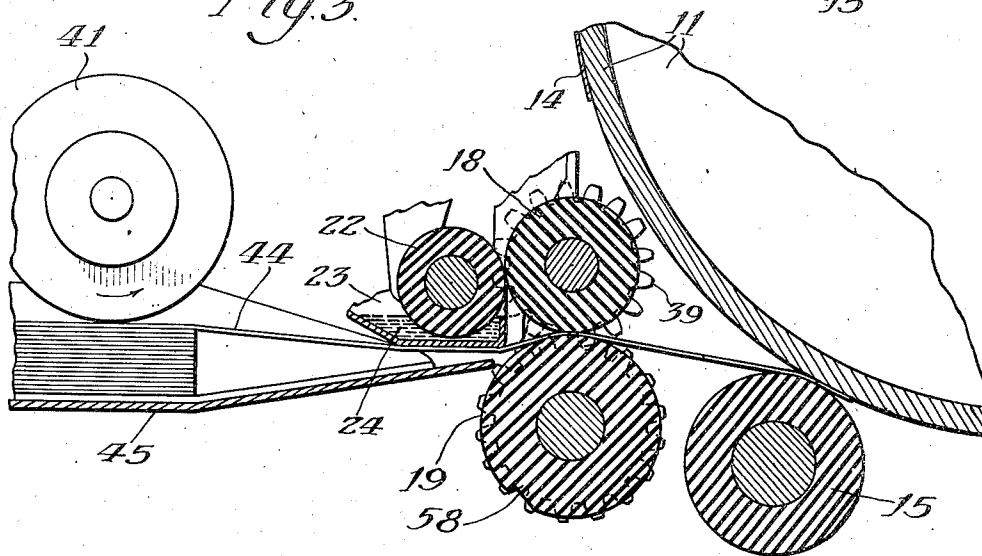


Fig. 3.



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4 Sheets-Sheet 3

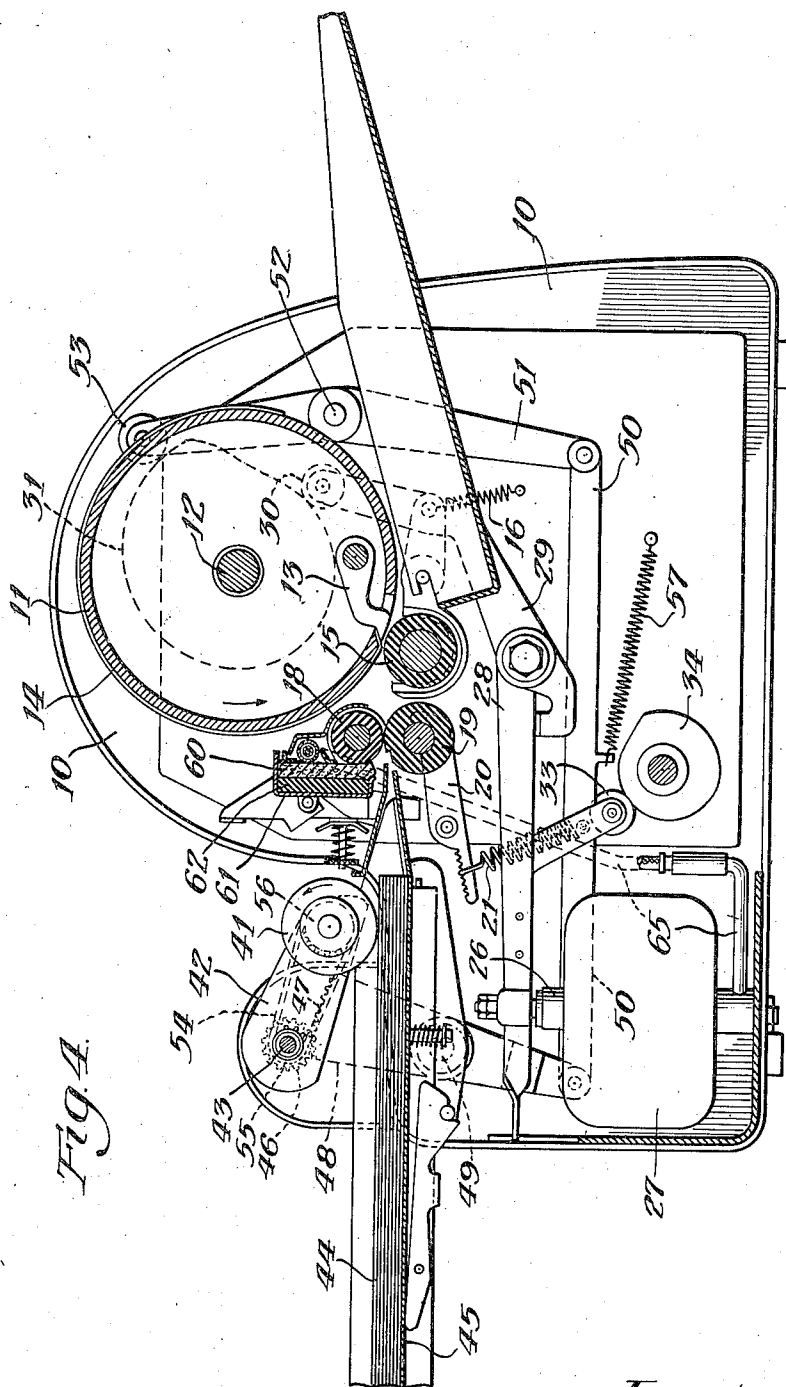


Fig. 4.

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Fig. 5.

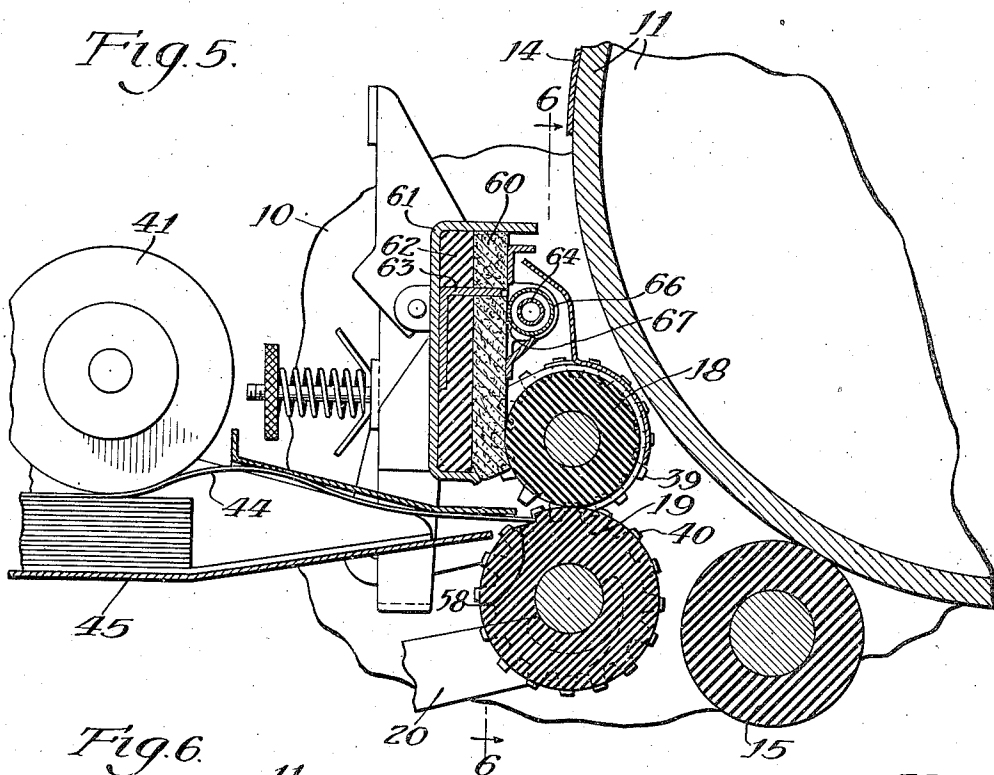
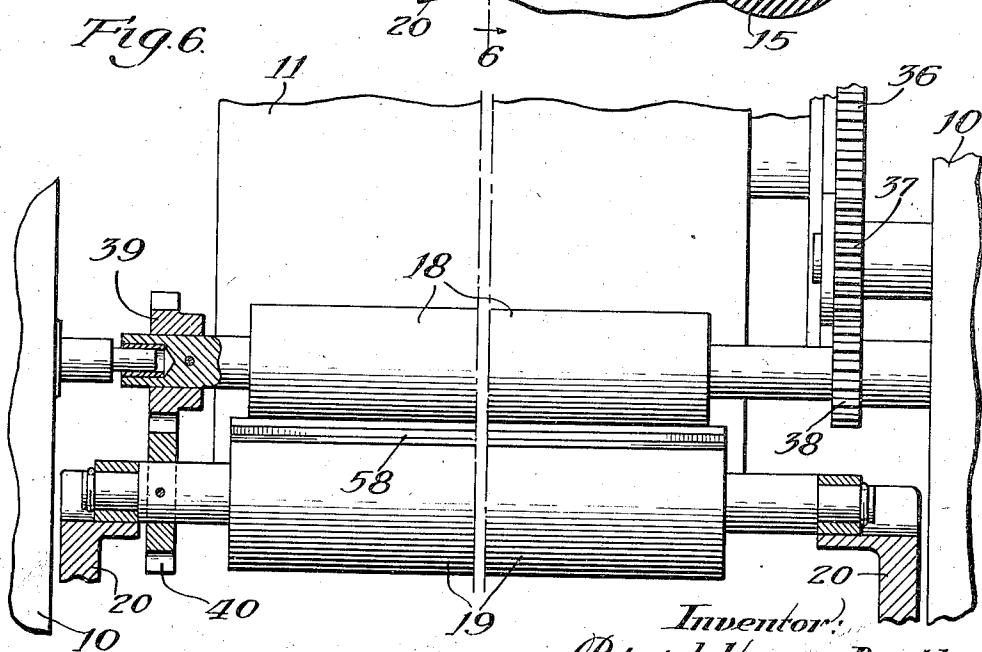


Fig. 6.



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UNITED STATES PATENT OFFICE

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METHOD OF AND MEANS FOR FORWARDING SHEETS

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Application October 18, 1939, Serial No. 299,927

8 Claims. (Cl. 271—53)

This invention relates to improved means for forwarding sheets, and particularly to such means in connection with a liquid process duplicating machine. It is the object of the invention to provide an improved form and arrangement of parts by the use of which a more positive stop is afforded for the leading edge of a copy sheet closely adjacent to the bite of the usual forwarding rollers so as to insure that the edge of the sheet shall be brought always to the same aligned position across the machine without the necessity for relying upon the interengaging face portions of the rollers which form a sharp angle with respect to each other for establishing the alignment.

In the preferred form of improved mechanism forming the subject matter of this application, the lower one of the two forwarding and moistening rollers is provided with a groove in its face having a square shoulder at its leading edge, the arrangement of the driving means for the rollers being such that the groove is always moved into the same position spaced from the bite of the rollers at the time when the copy sheet is presented to the rollers, with the result that the leading edge of the copy sheet is directed into engagement with the shoulder on the lower roller rather than into the sharp angle between the faces of the rollers. Feeding means is provided for the copy sheets adapted by engagement with the body portions of the sheets to feed the sheets one at a time toward the forwarding rollers in advance of the normal forwarding time for the sheet in each instance, so as to bring the body portion of the sheet into such position that the leading edge portion of the sheet is buckled into the form of a loop of such size that the leading edge of the sheet would normally extend beyond the zone of contact between the two rollers. The arrangement is such that when a copy sheet is fed to the forwarding rollers the leading edge portion of the copy sheet engages the groove of the lower forwarding roller so as to cause the sheet to be buckled upwardly into a loop against the inherent resiliency of the sheet, with the result that the leading edge of the sheet presses yieldingly against said shoulder. This arrangement provides substantially a positive assurance that the sheet shall be aligned squarely in the machine, since the leading edge portion of the sheet moves forwardly with the forwarding rollers as they rotate after the formation of the loop until the sheet is gripped normally between the forwarding rollers, the size of the loop in the sheet being such that the leading edge of the

sheet is gripped between the forwarding rollers before the initially buckled sheet is completely straightened out.

It is another object of this invention to improve devices of this type in sundry details hereinafter pointed out. The preferred means by which the several objects have been attained are illustrated in the accompanying drawings, in which—

Fig. 1 is a longitudinal vertical sectional view through a preferred embodiment of the invention;

Fig. 2 is an enlarged detail view of a portion of the machine substantially as shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2 but with some of the parts omitted and with some of the parts in changed position;

Fig. 4 is a view similar to Fig. 1 but showing a modified form of structure;

Fig. 5 is an enlarged detail view of a portion of the machine substantially as shown in Fig. 4;

Fig. 6 is a vertical sectional view taken substantially at the line 6—6 of Fig. 5; and

Fig. 7 is a longitudinal vertical sectional view through a portion of the machine of Fig. 1 showing conventionally a portion of the driving apparatus.

Referring now to the several figures of the drawings, in which corresponding parts are indicated by the same reference characters, 10 indicates a frame formed at least partially of housing members pressed into form out of sheet metal for supporting a duplicating drum 11 rotatably mounted in position by means of a shaft 12. In the arrangement shown, the drum 11 is provided with grippers 13 movably mounted in position so as to hold a master sheet 14 removably in position on the drum as is well understood in the duplicating machine art.

In the arrangement illustrated a platen roller 15 is rotatably mounted in position for applying pressure upon the master sheet 14 in the usual manner, a coiled spring 16 in the arrangement shown serving to press the platen roller 15 upwardly toward the drum 11.

The arrangement illustrated comprises also a moistening mechanism 17 of any approved type by which a film of solvent may be applied to each copy sheet in turn as it is fed forwardly. In the arrangement shown, the moistening mechanism comprises a roller 18 rotatably mounted in position a short distance in rear of the platen roller 15, a second roller 19 being rotatably mounted in position below the roller 18 so as to cooperate therewith for forwarding copy sheets

as hereinafter described to the bite of the drum 11 and the platen roller 15. In the arrangement shown, the roller 19 is rotatably mounted upon arms 20, each of which is in the form of a lever pivotally mounted in position with a spring 21 bearing upon the lever for pressing the roller 19 yieldingly upward. Immediately in rear of the moistening and forwarding roller 18 a roller 22 is rotatably mounted in position in engagement with said roller 18 so as to be rotated thereby, such roller 22 extending at its lower face into a receptacle 23 adapted to hold a quantity of solvent 24 so that upon the rotation of the roller 22 a film of the solvent is applied to the face of the roller 18.

The solvent 24 is fed to the receptacle 23 by means of a pipe 25 perforated at 25a at intervals therealong so as to direct the solvent into the bottom of the receptacle as shown in Fig. 2. The solvent is forced upwardly through the pipe 25 by means of a pump 26 from a supply of the solvent in a tank 27, the pump 26 being actuated by a lever 28 pivotally mounted below the drum 11 and given a series of operative strokes at timed intervals by means of an arm 29 and a roller 30 bearing upon a cam 31 adapted to rotate with the drum 11. The lever 28 is provided at an intermediate point with an arm 32 provided at its lower end with a roller 33 bearing against a cam 34 adjustably mounted in position. As will be readily appreciated, when the cam 34 is rotated the arm 32 and the lever 28 are moved upwardly for limiting the downward stroke of the lever 28 whereby the effectiveness of the pump 26 is controlled.

An overflow pipe 35 is provided connecting the receptacle 23 and the tank 27 for limiting the depth of the solvent in the receptacle 23.

Means is provided for driving the forwarding rollers 18 and 19 by power from the drum 11 which in turn is driven by means illustrated only conventionally since it forms in and of itself no part of the present invention. As illustrated in Fig. 1, the drum 11 is provided with a large gear 36 at the near side of the machine as shown in said figure, said gear being in mesh with an idler pinion 37 which meshes with a pinion 38 carried by the moistening and forwarding roller 18. At the far side of the machine, the roller 19 is provided with a pinion 39 which meshes with a pinion 40 carried by the forwarding roller 19. The arrangement of the parts is such that the rollers 18 and 19 are driven at the same surface speed as that of the drum 11 and that the lower forwarding roller 19 is brought always to the same position at the start of each cycle of operations. This result is effected by making the number of the teeth on the gear 36 a multiple of the number of the teeth on the pinion 38.

The means illustrated for driving the drum 11 comprises gears 11a and 11b adapted to rotate a ratchet 11c which engages a pawl 11d carried by the drum. The pawl 11d is effective for driving except when moved out of engagement with the ratchet by a cam 11e at a predetermined point in the rotation of the drum, the arrangement being such that the gear 36 gains a tooth distance upon the ratchet and drum in each revolution of the drum, the rollers 18 and 19 being held stationary while such gain is being effected. For insuring that the gear 36 shall be held stationary when disconnected from the driving means, a latching pawl 11f is provided normally engaging pins 11g carried by the gear

36. A cam 11h serves to control the position of said pawl 11f by contact with a roller 11k carried by the pawl, said cam 11h being adapted to rotate with the gear 36.

The driving means as above briefly described is disclosed and claimed by an application filed on September 16, 1938, by Morris P. Neal, Serial No. 230,172, and forms in and of itself no part of the present invention.

In the machine as shown, means is provided for feeding copy sheets automatically to the forwarding rollers 18 and 19 in proper timed relation for movement to the bite of the drum 11 and the platen roller 15 for proper registration with the master sheet 14 on the drum. This means comprises one or more rollers 41 rotatably mounted on the lower end of an arm 42 which is adapted to swing with respect to a drive shaft 43 so as to keep the roller 41 by gravity in contact with the top face of the uppermost sheet 44 of a pile of sheets upon a table 45. The shaft 43 is provided with a gear 46 which meshes with teeth 47 in concentric position upon the upper end of a lever 48 pivotally mounted on a pin 49. The lower end of the lever 48 is connected by a link 50 with a lever 51 pivotally mounted upon a pin 52 and provided at its upper end with a roller 53 engaging the cam 31. The shaft 43 is connected with the roller 41 by means of a sprocket chain 54 and sprocket pinions 55 and 56. The arrangement is such that at one point in each revolution of the drum 11 the lever 48 is given a swinging movement for driving the shaft 43 and the roller 41 in the direction for forwarding the top sheet 44 toward the right in Fig. 1 toward the forwarding rollers 18 and 19. A spring 57 is provided in connection with the link 50 for returning the link toward the right after a stroke of the link toward the left under the influence of the cam 31.

As is clearly shown in Fig. 2, the receptacle 23 is located directly opposite to the zone of contact of the rollers 18 and 19, the rear face of the receptacle being disposed obliquely so as to serve as a guide for the sheet 44 fed forward by the roller 41. The inner edge of the table 45 is also obliquely disposed so that the forward edge of a copy sheet being fed forward by the roller 41 is directed always toward the upper portion of the roller 19.

The drive for the rollers 18 and 19 from the drum 11 and the drive for the roller 41 from the cam 31 rotating with the drum 11 are such that the forward edge of a copy sheet in moving toward the rollers 18 and 19 is always brought into engagement with the square leading face of a groove 58 in the face of the roller 19 as shown in Fig. 2 for causing the formation of a loop in the sheet at 59. The roller 41 is arranged for advancing the body portion of a copy sheet after its leading edge engages the groove 58 for causing its body portion to gain substantially upon the forward edge portion of the sheet and thus causing the sheet to be buckled upwardly at 59. With the sheet 44 engaging squarely against the shoulder provided by the groove 58, which groove is positioned squarely across the roller longitudinally thereof, the perfect alignment of the sheet is assured. The parts are arranged and timed so that the forward feed of the copy sheet 44 by the roller 41 is stopped before the leading edge of the sheet passes into the normal grip of the rollers 18 and 19. The loop 59 in the forward edge portion of the sheet is of such size that the sheet if straightened out after the completion of

the loop would extend well past the zone of engagement of the rollers 18 and 19 without additional movement of the body portion of the sheet. The result is that as the rollers 18 and 19 again rotate after the completion of the loop 59 and after the termination of the period through which the rollers are stationary, the forward edge of the sheet 44 is permitted to move forwardly toward the right in Fig. 2 by the resiliency of the loop until the sheet is gripped normally between the rollers 18 and 19 with the groove 58 displaced forwardly with respect to such point of gripping. When the sheet has been gripped normally by the rollers 18 and 19 with the groove 58 displaced forwardly out of the way and with the sheet in correctly aligned position, the rollers 18 and 19 then begin to exert a forward pull on the sheet for carrying it still farther forward toward the right into the bite of the drum 11 and the platen roller 15. The roller 41 is arranged to run freely in counter clockwise direction in Fig. 2 for permitting the top sheet 44 to be drawn toward the right in this manner.

For insuring the formation of the loop 59, the stoppage of the rollers 18 and 19 upon each cycle of operation takes place when the rollers are in the position as shown in Figs. 1 and 2 while the feed of the paper continues.

The arrangement of the feeding means comprising the roller 41 and the swingingly mounted arm 42 upon which the roller is mounted is such that the arm and roller can be swung upwardly and backwardly out of position for engaging the sheets 44 so as to provide for a manual feeding of the sheets whenever desired. When the sheets are fed manually, they are pushed forwardly so as to buckle the sheets upwardly to form loops therein just as described above in connection with the automatic feeding, the body portions of the sheets being held by hand in position until their leading edges are engaged in the bite of the rotating forwarding rollers 18 and 19.

In the arrangement shown in Figs. 4, 5 and 6, the construction is substantially the same as that above described except with respect to the moistening mechanism by which a film of solvent is applied to the upper moistening and forwarding roller. The parts are accordingly indicated by the same reference characters so far as the parts correspond in construction and operation, the description herein being restricted substantially to the changes in the construction.

As is best shown in Fig. 5, the moistening mechanism comprises a strip of felt 60 mounted in a carrier 61 with a strip 62 of sponge rubber provided as a support for the felt, such two strips being removably held in position upon the support 61 by tongue means 63 positioned in suitable openings through the strips. A perforated pipe 64 is provided connected by a pipe 65 with the pump 26, said pipe 65 corresponding with the pipe 25 of the construction first described. The pipe 64 is surrounded by a second pipe 66 provided with openings 67 in its wall in position for spraying solvent directly upon the face of the felt strip 60 as it comes from the pump 26. Inasmuch as the arrangement of the moistening mechanism corresponds substantially with what is shown by Morrison application Serial No. 285,492, filed July 20, 1939, and since such construction forms in and of itself no part of the present invention, it is believed to be unnecessary to describe the same in further detail herein.

It will be understood that the forms of con-

structions as shown in the drawings are preferred. The invention is not however to be limited to the arrangements shown except so far as the claims may be so limited, it being understood that changes might well be made in the form and arrangements of parts without departing from the spirit of the invention.

I claim:

1. In a sheet forwarding means, the combination of a pair of cooperating rollers one above the other adapted by engagement with a copy sheet to move it forward, stop means carried by one of said rollers in fixed position with respect to the roller adapted by engagement with a sheet fed thereto to cause said sheet to be buckled to provide a resilient loop in the sheet with its leading edge in rear of the zone of contact between said two rollers, means for guiding a sheet directly to said stop means, and means for rotating said rollers for carrying said stop means past the zone of contact of said rollers so as to permit the sheet to straighten out into position with its leading edge gripped by the rollers.

2. In a sheet forwarding means, the combination of a pair of rollers one above the other adapted by engagement with a copy sheet to move it forwardly, one of said rollers being provided with a groove extending lengthwise thereof with its leading edge face in the form of a shoulder adapted to serve as a means for stopping the movement of the forward edge portion of a sheet fed toward said rollers so as to cause said sheet to be buckled to provide a resilient loop in the sheet, means for guiding a sheet directly to said shoulder, and means for rotating said rollers for carrying said shoulder past the zone of contact of said rollers and for permitting the sheet to straighten out into position with its leading edge gripped by the rollers.

3. A liquid process duplicating machine, comprising in combination a pair of cooperating rollers adapted by engagement with a copy sheet to move the sheet forwardly, stop means carried by one of said forwarding rollers in fixed position with respect to said roller adapted by engagement with a sheet fed thereto to cause said sheet to be buckled to provide a resilient loop in the sheet with its leading edge in rear of the zone of contact between said two rollers, and means for rotating said forwarding rollers intermittently in timed relation to the movement of the sheet into looped position adapted to permit said rollers to stand stationary during the formation of the loop and adapted to carry said stop means past the zone of contact of said rollers while the sheet straightens out into position with its leading edge portion gripped by the rollers.

4. A machine of the type described in which a copy sheet is forwarded into impression relationship with a master sheet carried around by a drum, comprising in combination a platen roller in impression relationship to said drum, two forwarding rollers one above the other in rear of the platen roller adapted by engagement with a copy sheet to move the sheet forwardly into the bite of the drum and the platen roller, moistening means for applying a film of solvent to the face of the upper one of said two forwarding rollers for transfer to the face of the copy sheet as the sheet moves forward to the drum and platen roller, the lower one of said two forwarding rollers being provided with a groove extending lengthwise thereof with its leading edge face in the form of a shoulder adapted to serve as a means for stopping the movement of the for-

ward edge portion of a sheet fed toward said rollers so as to cause said sheet to be buckled to provide a resilient loop in the sheet, and means for rotating said forwarding rollers in timed relation to the movement of the sheet into looped position for carrying said shoulder past the zone of contact of said forwarding rollers and for permitting the sheet to straighten out into position with its leading edge portion gripped by the forwarding rollers.

5. In a sheet forwarding means, the combination of a pair of rollers one of which is provided with stop means independently of the other roller adapted normally by engagement with the leading edge of a sheet fed thereto to cause the body portion of the sheet to gain on the leading edge portion and thus to cause said sheet to be buckled to provide a resilient loop in the sheet, means for rotating said rollers for forwarding a sheet between them, and means driven in timed relation to the rotation of said forwarding rollers effective at predetermined intervals of time for feeding a sheet forward toward said rollers so as to form a loop in said sheet in backwardly spaced relation to the zone of contact of said rollers and of such size that upon the continued rotation of the rollers after the completion of said loop the sheet passes into the normal grip of the rollers before the loop is completely straightened out.

6. In a sheet forwarding means, the combination of a pair of rollers one of which is provided with stop means independently of the other roller adapted normally by engagement with the leading edge of a sheet fed thereto to cause the body portion of the sheet to gain on the leading edge portion and thus to cause said sheet to be buckled to provide a resilient loop in the sheet in backwardly spaced relation to the zone of contact of said rollers, means for rotating said rollers for forwarding a sheet between them, guide means adjacent to said rollers adapted to direct a copy sheet into position for normal engagement with said stop means and arranged for expediting the formation of a loop in backwardly spaced relation to said rollers, and means driven in timed relation to the rotation of said forwarding rollers effective at predetermined intervals of time for feeding a sheet forward toward said rollers so as to form a loop in said sheet of such size that upon the continued rotation of the rollers the sheet passes into the normal grip of the rollers before the loop is completely straightened out.

7. In a sheet forwarding means, the combination of a pair of rollers rotatably mounted in cooperative relation one above the other for forwarding

warding a sheet between them, with the lower roller provided with a groove extending lengthwise thereof with its leading edge face in the form of a shoulder adapted to serve as stop means adapted by engagement with the leading edge of a sheet fed thereto to cause the body portion of the sheet to gain on the leading edge portion and thus to cause said sheet to be buckled to provide a resilient loop in the sheet, means for driving said rollers in cooperative relation for forwarding a sheet, guide means adjacent to said rollers adapted to direct a copy sheet into position for normal engagement with the groove of said lower roller for preventing the sheet from extending initially to the bite of the rollers, and means driven in timed relation to the rotation of said rollers effective at predetermined intervals of time for feeding a sheet forward toward said rollers so as to form a loop in said sheet with its forward edge portion in backwardly spaced relation to the zone of contact of said rollers and of such size that upon the continued rotation of the rollers after the completion of said intermittent feed of a sheet the sheet passes into the normal grip of said rollers before the loop is completely straightened out.

8. In a sheet forwarding means, the combination of a rotatably mounted drum, a platen roller rotatably mounted in cooperative relation to said drum, means for driving said drum, a pair of forwarding rollers rotatably mounted in cooperative relation one above the other a short distance in rear of said platen roller for forwarding a sheet to the bite of said drum and platen roller, with the lower one of said forwarding rollers provided with a groove extending lengthwise of the roller with its leading edge face in the form of a shoulder adapted to serve as stop means for slowing up the movement of the leading edge portion of a sheet fed thereto, means for driving said forwarding rollers in cooperative relation for forwarding a sheet at substantially the same surface speed as that of the drum, and means driven in timed relation to the rotation of said drum effective at predetermined intervals of time for feeding a sheet forward toward said forwarding rollers so as to form a resilient loop in said sheet with its forward edge portion in backwardly spaced relation to the zone of contact of said forwarding rollers and of such size that upon the continued rotation of the forwarding rollers after the completion of the drive of said sheet feeding means the forward edge portion of the sheet passes into the normal grip of said rollers before the loop is completely straightened out.

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