

Nov. 5, 1940.

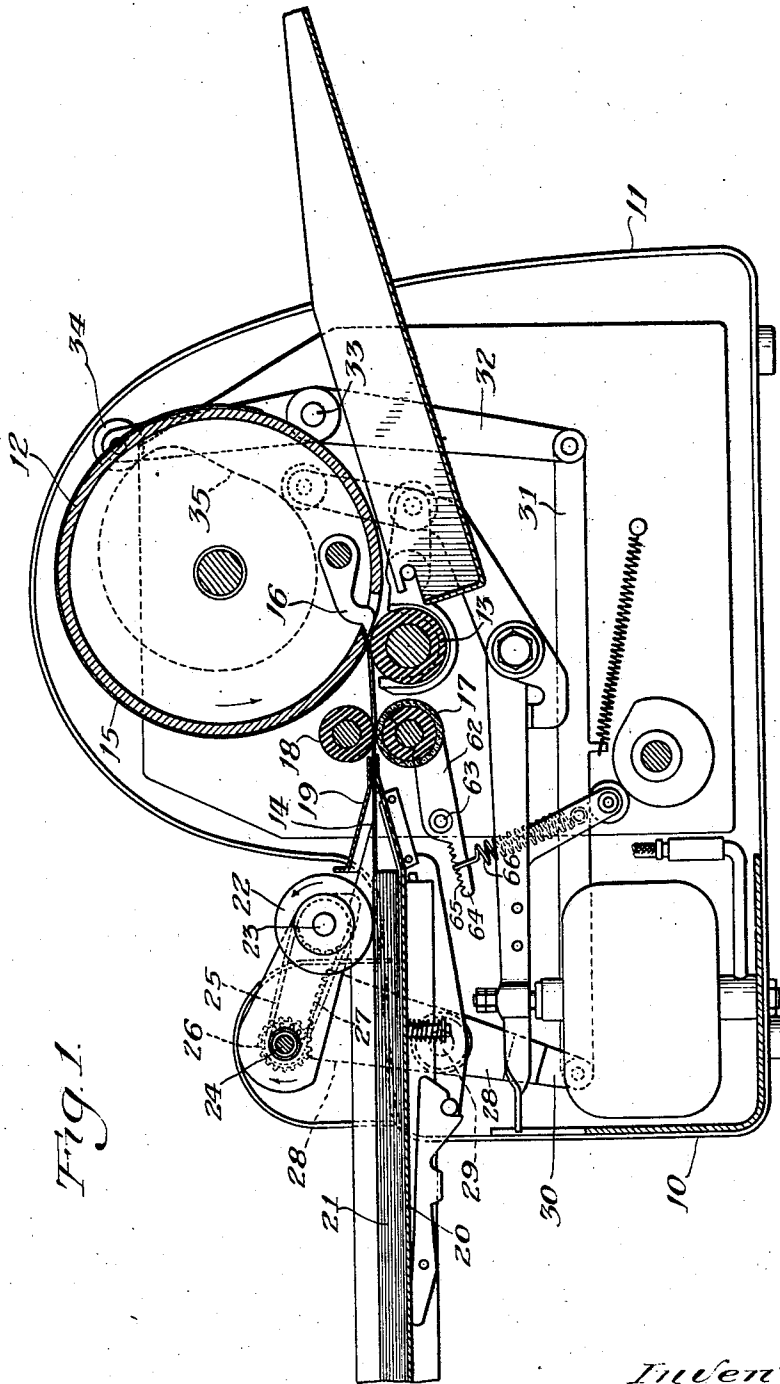
R. F. MORRISON ET AL

2,220,264

INTERMITTENT SHEET FORWARDING APPARATUS FOR DUPLICATING MACHINES

Filed April 7, 1939

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 2.

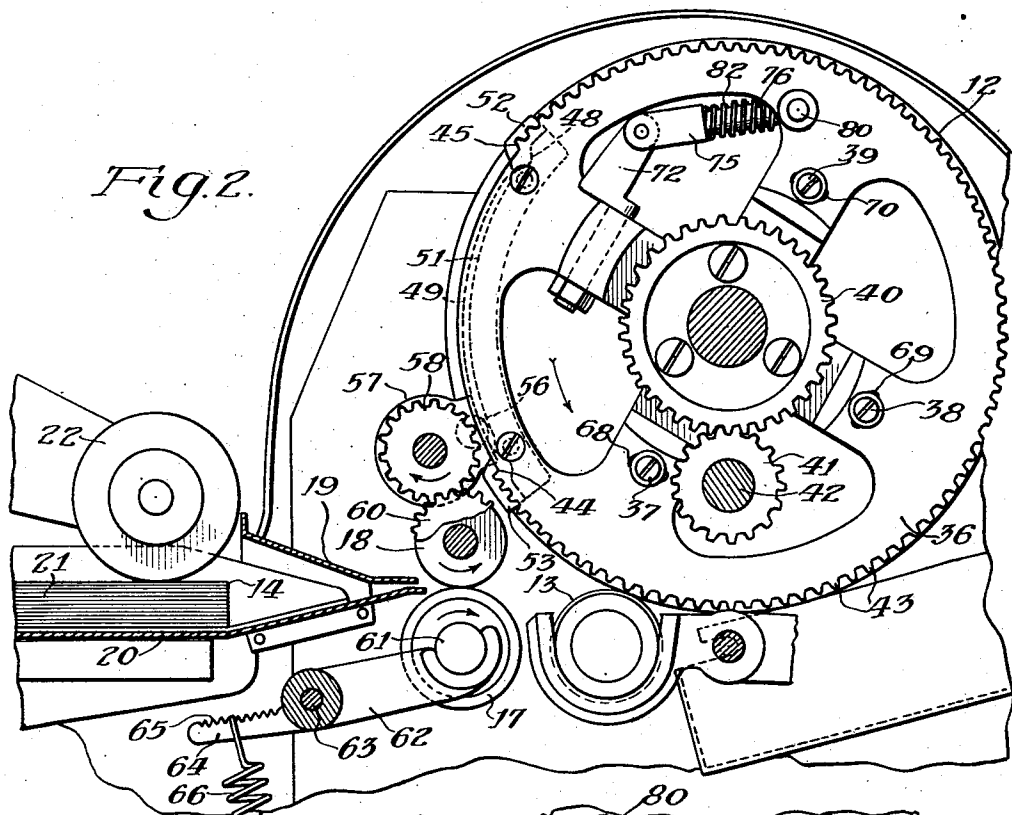
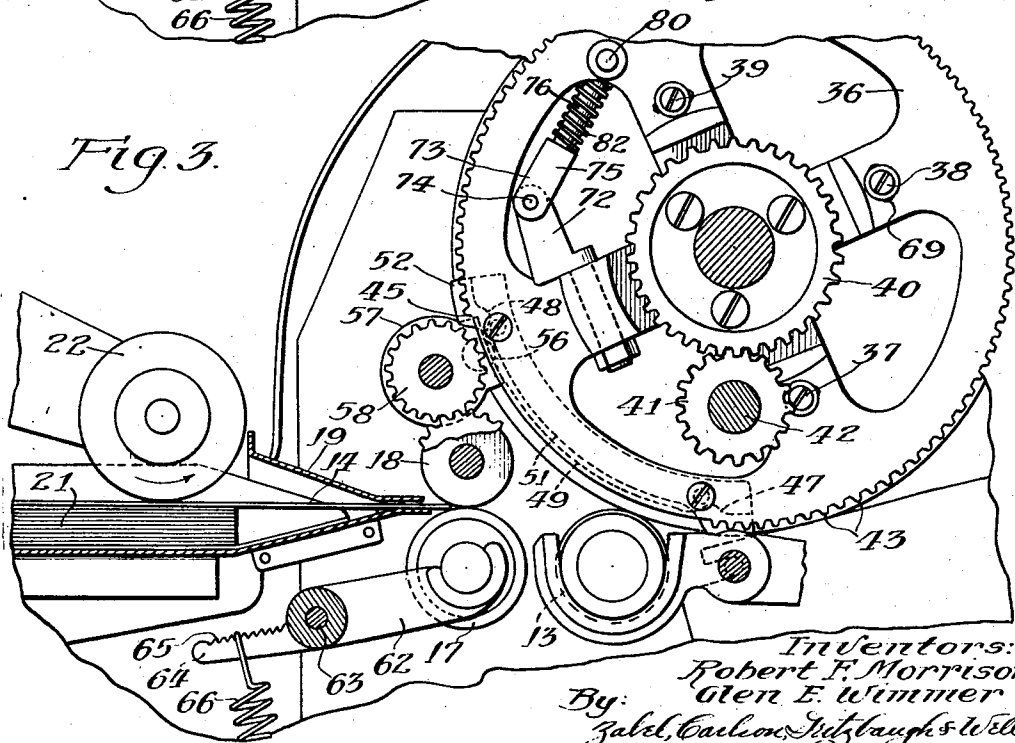


Fig. 3.



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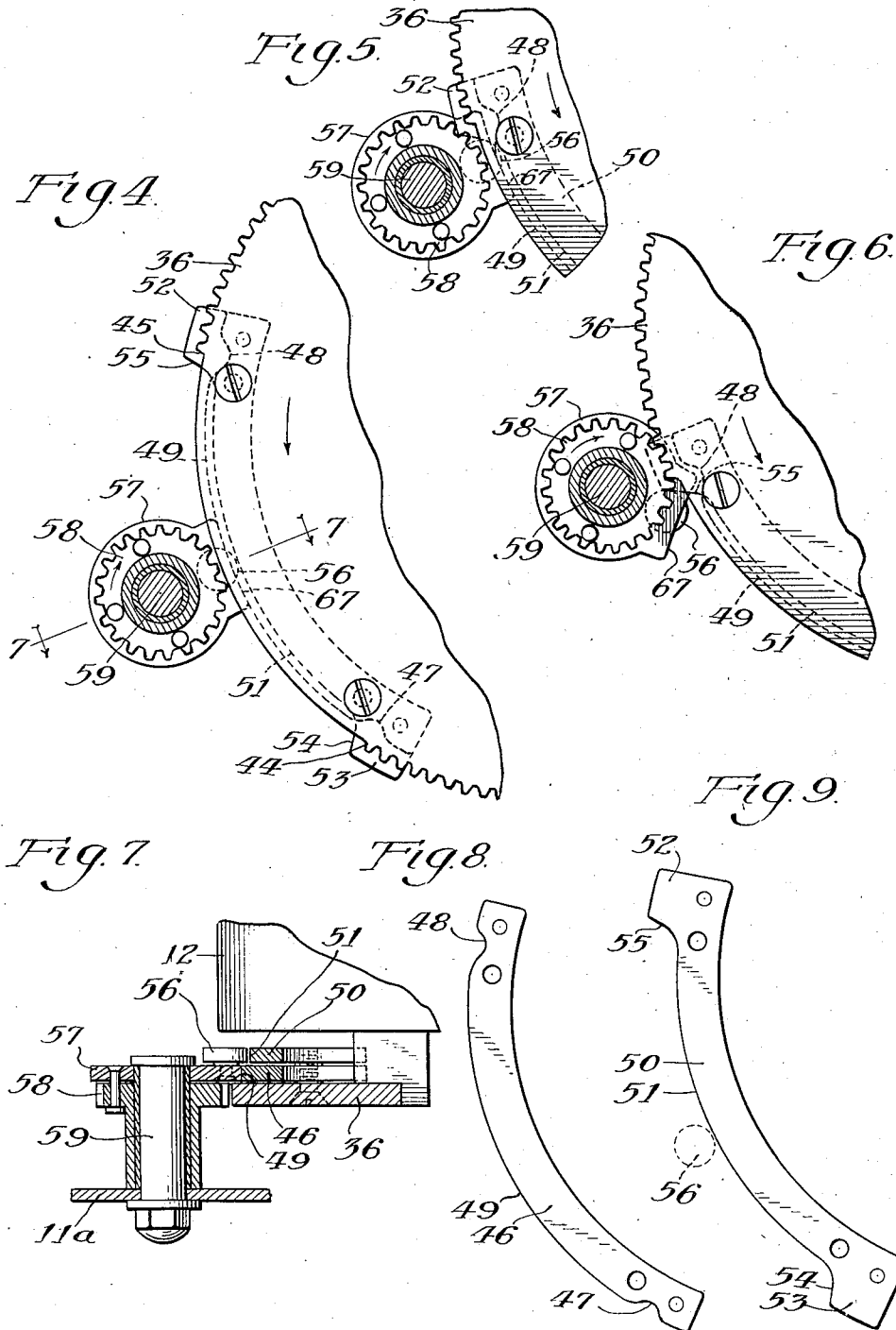
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4 Sheets-Sheet 4

Fig. 10.

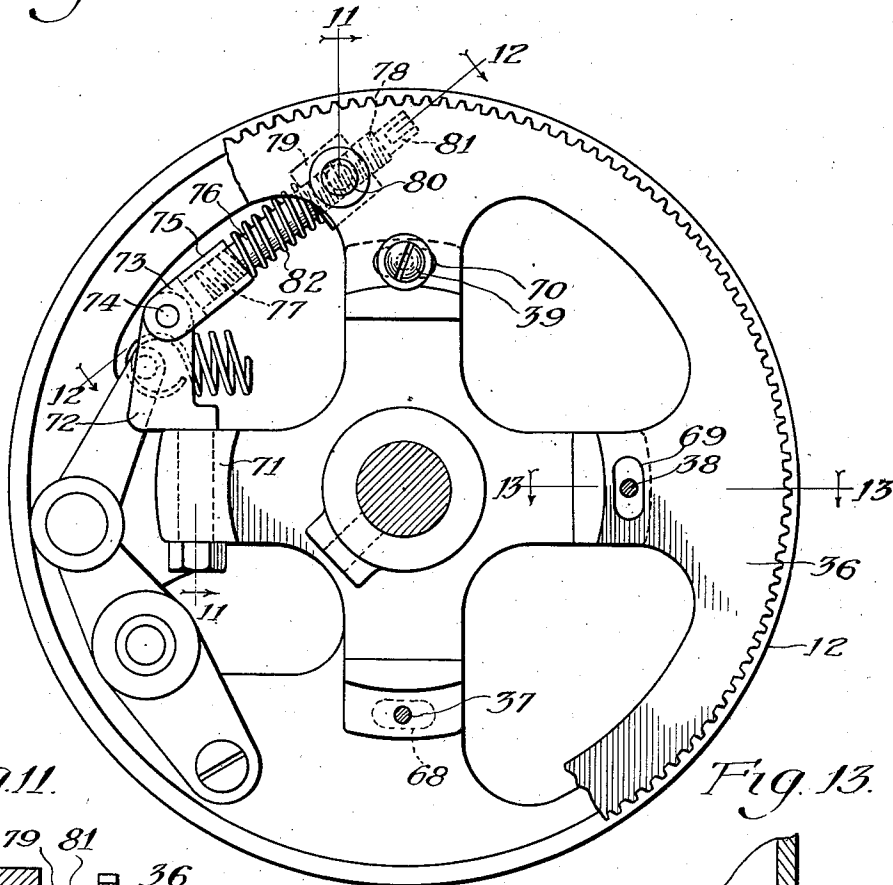


Fig. 11.

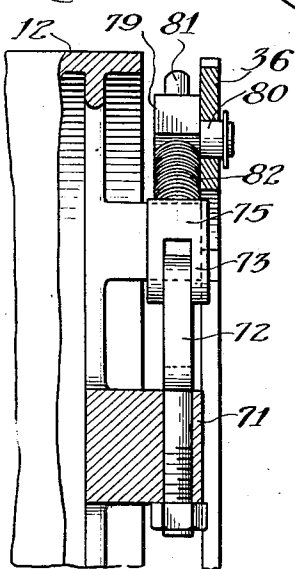


Fig. 12.

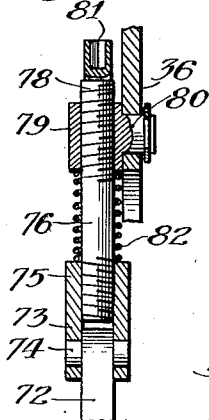
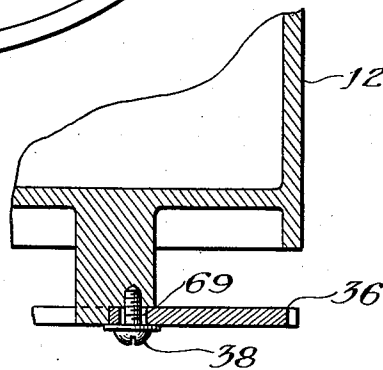


Fig. 13.



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UNITED STATES PATENT OFFICE

2,220,264

INTERMITTENT SHEET FORWARDING APPARATUS FOR DUPLICATING MACHINES

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Application April 7, 1939, Serial No. 266,470

8 Claims. (Cl. 101—132)

The present invention relates to duplicating machines of the type wherein copy sheets are fed by means of feed rolls into position to be pressed against a master copy that is mounted upon a rotating drum or platen. The invention is applicable to duplicating machines of the type wherein the copy sheets are moistened with a solvent for carbon or ink and are then brought into contact with a master sheet upon which the data to be duplicated appears in reverse. The invention, however, is not limited to this type of machine, as it is also applicable to machines of the type wherein the master copy may be in the form of the usual hectograph band.

An object of the invention is to provide improved means in a duplicating machine of the character described whereby the feed rolls may be stationary at the time a copy sheet is fed to them and may thereafter be rotated in synchronism with the drum carrying the master copy with a minimum of shock and wear in the starting and stopping of the feed rolls.

Another object of the invention is to provide in a duplicating machine of the character described a novel cam and mutilated gear construction whereby continuous rotation of a drive element is translated into intermittent rotation of the feed rolls with a gradual acceleration and deceleration of the feed rolls.

It is also an object of the invention to provide a duplicating machine of the character described wherein a sheet advancing device and a pair of feed rolls, which act as a margin stop means to determine the advance of the sheet, are alternately operated in proper timed relation to each other and to a rotating drum by means of a mutilated gear rotating with the drum.

Other objects and advantages will become apparent as the following detailed description progresses, reference being had to the accompanying drawings wherein:

Fig. 1 is a longitudinal sectional view through a duplicating machine of the character described to which the present invention is applied;

Fig. 2 is an enlarged fragmentary sectional view taken on one side of the machine;

Fig. 3 is a view like Fig. 2 but showing the parts in a changed position;

Figs. 4, 5 and 6 are fragmentary detailed views showing the cooperation between the drive gear on the drum, the pinion driving the feed rolls, and the elements carried thereby;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 4;

Fig. 8 is a detail view of one of the cams mounted on the drive gear;

Fig. 9 is a detail view of another cam mounted on the drive gear;

Fig. 10 is a view of one end of the duplicating drum illustrating the manner of mounting the drive gear thereon;

Fig. 11 is a fragmentary sectional view taken on the line 11—11 of Fig. 10;

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 10, and

Fig. 13 is a sectional view taken on the line 13—13 of Fig. 10.

Referring now in detail to the drawings, and particularly to Figs. 1—3 inclusive wherein a duplicating machine embodying the preferred form of the invention is illustrated, the reference numeral 10 designates generally the frame of the machine which comprises right and left hand side frames such as indicated at 11. These side frames are joined in the usual manner. Rotatably mounted between the side frames is a duplicating drum 12 which has a platen roller 13 cooperating with it. The platen roller 13 is adapted to press copy sheets 14 against a master sheet 15 which is carried by the duplicating drum 12. Gripping means 16 secures the master sheet to the drum 12. The master sheet usually comprises a sheet of paper upon which the data to be duplicated is typewritten or printed in reverse so that when copy sheets are pressed against it with a suitable solvent for the ink, the data will appear in positive upon the copy sheets. The drum 12 may carry the usual hectograph sheet, as the present invention is not limited in any respect to the type of machine wherein the copy sheets are moistened and applied to a master sheet of paper.

Copy sheets are fed to the drum 12 by feed rolls 17 and 18. The roll 18 is adapted to be driven from the drum 12 in a manner which will be presently described. The roll 17, however, is driven by its contact with the roll 18.

Copy sheets 14 are fed to the feed rolls 17 and 18 through a guide 19 from a copy sheet tray 20. The copy sheets are advanced from a stack 21 on the tray 20 by means of a sheet advancing roller 22. The roller 22 is adapted to be intermittently driven so as to advance a sheet from the top of the stack 21 to the bite of the rolls 17 and 18. Once the sheet is caught and advanced by the rolls 17 and 18, the roller 22 is free to turn and permit the copy sheet to be withdrawn. The roller 22 is mounted on a shaft 23 which is driven from a second shaft 24 by a drive

connection 25 shown in the present instance as a flexible drive chain or belt connecting the two shafts. The shaft 24 is, in turn, driven by a gear 26 that is connected to it through an over-running clutch, not shown, of a well-known design. The overrunning clutch is arranged to permit the roller 22 to turn in the direction of the arrow independently of the gear 26. This over-running clutch also permits the gear 26 to turn in the direction indicated by the arrow associated therewith independently of the roller 22. The gear 26 is adapted to be driven by a segmental gear 27 mounted upon a rocker arm 28 that is pivoted to the side frame 11 at 29. The rocker arm 28 has its lower end 30 connected by a link 31 to a lever 32. The lever 32 is fulcrumed on a shaft 33 and has a roller 34 engaging a cam 35 that is fixed to the drum 12. The cam 35 is shaped to impart a rocking operation to the lever 32 and through it to the rocker arm 28, whereby to actuate the gear 26 and the feed roller 22.

Referring now to Figs. 2-7 inclusive, the drum 12 is shown as provided with a gear 36. The gear 36 is secured to one end of the drum by suitable screws 37, 38 and 39. This end of the drum also carries a gear 40 that is adapted to be driven by a pinion 41 mounted on a drive shaft 42. The gear 36 is a mutilated gear, that is to say it has a portion of its teeth 43 removed to leave a section from a point 44 (see Fig. 2) to a point 45. A cam 46 (see Fig. 8) is secured to the gear 36 and extends over the section from which the teeth have been removed. The cam 46 has a recess at 47 and a recess at 48. Between the recesses 47 and 48, the cam has a circular surface 49 which is centered about the axis of the drum 12.

A second cam 50 is secured upon the gear 36 and directly overlies the cam 46. The cam 50 has a circular surface 51 also centered on the drum axis. The cam 50 has projecting shoulders 52 and 53 at its opposite ends. These shoulders are provided with curved auxiliary cam faces 54 and 55 adapted to have camming cooperation with a roller 56. The roller 56 is rotatably mounted upon a plate 57 which is riveted to a pinion 58. The pinion 58 is mounted on a stub shaft 59 carried by the side frame 11a of the machine. The pinion 58 is adapted to mesh with the gear 36 and be rotated thereby when the teeth of the gear are opposite the pinion.

The pinion 58 meshes with a pinion 60 which is mounted on the feed roll 18. It will be understood that rotation of the pinion 58 will result in driving the feed roll 18 in the direction indicated by the arrow in Fig. 2 to advance copy sheets 14 to the drum 12. The feed roll 17 is yieldingly pressed against the roll 18. The feed roll 17 has a shaft 61 which is rotatably supported by two lever arms 62 which are rotatably supported by the frame of the machine at 63. One of the lever arms 62 has an extension 64 provided with notches 65 to receive a spring 66. The spring 66 has its lower end secured to the side frame 11 of the machine.

The operation of the gear 36, the cams 46 and 50, the roller 56, the plate 57 and the pinion 58 to effect intermittent rotation of the feed rolls 17 and 18 will be best understood by reference to Figs. 4, 5 and 6. In Fig. 4, the plate 57 is shown with its cam surface 67 riding upon the surface 49 of the cam 46. The pinion 58 cannot rotate while the cam surface 49 is traversing the face 67 of the plate 57. When the parts reach the position shown in Fig. 5, the roller 56 starts to climb

up the face 55 on the cam 50. Normally, the roller 56 does not ride upon the surface 51 of the cam 50. It is so situated so as to just clear this surface when the surfaces 49 and 67 are in engagement. The engagement of the roller 56 with the face 55 starts the pinion 58 to turn in the direction indicated by the arrow in Fig. 5. This prevents the engagement of the pinion and gear teeth while the pinion is standing still and eliminates the shock and noise that would result from such engagement. Continued rotation of the gear 36 brings the parts to the position shown in Fig. 6, where the gear teeth and pinion teeth are actually meshing. One corner of the plate 57 extends into the recess 48 so that the plate 57 can turn in the manner illustrated in Fig. 6.

The pinion 58 will be rotated and the feed rolls 17 and 18 driven by it so long as the pinion meshes with the gear 36. During this interval the cam 35 does not actuate its lever 32 so as to drive the feed advancing roller 22. Now, however, when the gear 36 is about to run off the pinion 58, the cam 35 is in position to start the movement of the feed roller 22. The pinion 58 is brought to a stop by the roller 56 engaging the face 54 on the cam 50. One corner of the plate 57 will drop into the recess 47 of the cam 46 and the surface 67 will then engage the surface 49 of the cam 46. Owing to the deceleration of the pinion 58 by the roller 56, the feed rolls are brought to a positive stop and held there until the advance of the copy sheet 14 to the bite of these rollers is accomplished.

It is desirable to adjust the marginal point at which printing shall begin upon a copy sheet. It is evident from the foregoing description that there can be no adjustment between the gear 36 and the feed rolls 17 and 18. The marginal adjustment therefore is accomplished by the mounting of the gear 36 upon the drum 12 in such a fashion as to provide for angular movement between the gear and the drum. The gear 36 has a plurality of slots 68, 69 and 70 for the screws 37, 38 and 39. The drum 12 has a lug 71 to which there is secured a bracket 72. The bracket 72 fits into a bifurcated head 73 and is pivoted thereto by a pin 74. The bifurcated head 73 has a screw-threaded sleeve portion 75 that is adapted to receive a threaded shaft 76. The shaft 76 has right and left hand screw threads indicated at 77 and 78 (see Fig. 12). The threads 77 fit in the sleeve 75 while the threads 78 fit in a sleeve 79 which is pivotally mounted by a shank 80 upon the gear 36. The shaft 76 has a socket 81 to receive a wrench by which it may be turned. It will be understood that by rotation of the shaft 76 the sleeves 75 and 79 may be brought closer together or spread apart to adjust the relative angular position of the gear 36 with respect to the drum. Once the adjustment is made, the screws 37, 38 and 39 and the shaft 76 will retain the adjustment. A spring 82 is interposed between the sleeves 75 and 79 to aid in shifting the gear with respect to the drum and to take up all lost motion between the drum and the gear.

While the preferred embodiment of the invention has been shown and described, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims in which it is the intention to claim all novelty inherent in the invention as broadly as possible in view of the prior art.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a duplicating machine, the combination with a rotatable drum having means thereon for mounting a master copy, of feed rolls adjacent to said drum adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master copy, means to feed copy sheets into the bite of said feed rolls, a drive shaft, and means for actuating said feed means and said rolls from said shaft so that the feed rolls are stationary at the time a copy sheet is fed to them, said last named means including a drive gear having a mutilated section, a driven gear adapted to mesh with said drive gear, cams on said driven gear and the mutilated section having faces adapted to engage each other whereby to hold the driven gear stationary while they are in engagement, and means on the two gears cooperating to gradually retard the driven gear as the aforesaid cams are brought together.

2. In a duplicating machine, the combination with a rotatable drum having means thereon for mounting a master copy, of feed rolls adjacent to said drum adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master copy, means to feed copy sheets into the bite of said feed rolls, a drive shaft, and means for actuating said feed means and said rolls from said shaft so that the feed rolls are stationary at the time a copy sheet is fed to them, said last named means including a drive gear having a mutilated section, a driven gear adapted to mesh with said drive gear, cams on said driven gear and the mutilated section having faces adapted to engage each other whereby to hold the driven gear stationary while they are in engagement, and means on the two gears cooperating to gradually accelerate the driven gear as its teeth come into meshing relationship with the drive gear.

3. In a duplicating machine, the combination with a rotatable drum having means thereon for mounting a master copy, of feed rolls adjacent to said drum adapted, when rotated, to forward a copy sheet fed to the bite thereof into impression relationship with the master copy on the drum, a drive shaft, and means to intermittently actuate said rolls upon continuous rotation of said drive shaft so that the feed rolls are held stationary for a period of time sufficient to bring a copy sheet into the bite thereof before each copying operation, said last named means comprising a drive gear rotated by said shaft, said gear having a segment thereof devoid of gear teeth, and a cam surface extending the length of said segment, a driven gear operatively connected to the feed rolls and meshing with the drive gear, said driven gear having a cam thereon adapted to engage the aforesaid cam surface to hold the driven gear stationary for a period during each revolution of the drive gear, a roller on said driven gear, and an auxiliary cam on said drive gear cooperating with said roller to initiate movement of the driven gear at the termination of the stationary period.

4. In a duplicating machine, the combination with a rotatable drum having means thereon for mounting a master copy, of feed rolls adjacent to said drum adapted, when rotated, to forward a copy sheet fed to the bite thereof into impression relationship with the master copy on the drum, a drive shaft, and means to intermittently

actuate said rolls upon continuous rotation of said drive shaft so that the feed rolls are held stationary for a period of time sufficient to bring a copy sheet into the bite thereof before each copying operation, said last named means comprising a drive gear rotated by said shaft, said gear having a segment thereof devoid of gear teeth, and a cam surface extending the length of said segment, a driven gear operatively connected to the feed rolls and meshing with the drive gear, said driven gear having a cam thereon adapted to engage the aforesaid cam surface to hold the driven gear stationary for a period during each revolution of the drive gear, a roller on said driven gear, and an auxiliary cam on said drive gear cooperating with said roller to retard movement of the driven gear at the beginning of the stationary period.

5. In a duplicating machine, a rotatable drum having means to secure a master copy thereon, a drive shaft for said drum, copy sheet feed rolls adapted to advance copy sheets to said drum, a copy sheet tray, a feeding roller adapted to advance a copy sheet from said tray to said rolls each time the drum rotates, and means operable upon continuous rotation of said drum to intermittently actuate said feed rolls, said last named means comprising a mutilated gear on the drum and having a cam thereon, a driven gear connected to the feed rolls, a cam on the driven gear, adapted to engage with the cam on the mutilated gear to hold the driven gear stationary for a part of a revolution of the drum, a roller on the driven gear and two cam portions on the mutilated gear, one portion being mounted to engage the roller and increasingly retard its advance as the cam on the driven gear comes into engagement with the cam on the mutilated gear, the other cam portion being mounted to engage the roller and accelerate rotation of the driven gear as the cam on the driven gear passes out of engagement with the cam on the mutilated gear.

6. In a duplicating machine, a rotatable drum having means to secure a master copy thereon, a drive shaft for said drum, copy sheet feed rolls adapted to advance copy sheets to said drum, a copy sheet tray, a feeding roller adapted to advance a copy sheet from said tray to said rolls each time the drum rotates, and means operable upon continuous rotation of said drum to intermittently actuate said feed rolls, said last named means comprising a mutilated gear movably mounted on the drum and having a cam thereon, a driven gear connected to the feed rolls, a cam on the driven gear, adapted to engage with the cam on the mutilated gear to hold the driven gear stationary for a part of a revolution of the drum, a roller on the driven gear and two cam portions on the mutilated gear, one portion being mounted to engage the roller and increasingly retard its advance as the cam on the driven gear comes into engagement with the cam on the mutilated gear, the other cam portion being mounted to engage the roller and accelerate rotation of the driven gear as the cam on the driven gear passes out of engagement with the cam on the mutilated gear, and an adjustable link means connected with the drum and with the mutilated gear for shifting the mutilated gear circumferentially of the drum.

7. In a duplicating machine, a rotatable drum having means to secure a master copy thereon, a drive shaft for said drum, copy sheet feed rolls adapted to advance copy sheets to said drum, a copy sheet tray, a feeding roller adapted to advance a copy sheet from said tray to said rolls

- each time the drum rotates, and means operable upon continuous rotation of said drum to intermittently actuate said feed rolls, said last named means comprising a mutilated gear on the drum and having a cam thereon, a driven gear connected to the feed rolls, a cam on the driven gear, adapted to engage with the cam on the mutilated gear to hold the driven gear stationary for a part of a revolution of the drum, a roller on the driven gear and two cam portions on the mutilated gear, one portion being mounted to engage the roller and increasingly retard its advance as the cam on the driven gear comes into engagement with the cam on the mutilated gear, the other cam portion being mounted to engage the roller and accelerate rotation of the driven gear as the cam on the driven gear passes out of engagement with the cam on the mutilated gear, means for shifting the mutilated gear circumferentially of the drum, said last named means comprising a bracket on the drum, and a turnbuckle pivoted to said bracket and to the gear, and lugs on the drum supporting the gear for rotative movement about the axis of the drum.
8. In a duplicating machine, a rotatable drum having means to secure a master copy thereon, a drive shaft for said drum, copy sheet feed rolls adapted to advance copy sheets to said drum, a

copy sheet tray, a feeding roller adapted to advance a copy sheet from said tray to said rolls each time the drum rotates, and means operable upon continuous rotation of said drum to intermittently actuate said feed rolls, said last named means comprising a mutilated gear movably mounted on the drum and having a cam thereon, a driven gear connected to the feed rolls, a cam on the driven gear, adapted to engage with the cam on the mutilated gear to hold the driven gear stationary for a part of a revolution of the drum, a roller on the driven gear and two cam portions on the mutilated gear, one portion being mounted to engage the roller and increasingly retard its advance as the cam on the driven gear comes into engagement with the cam on the mutilated gear, the other cam portion being mounted to engage the roller and accelerate rotation of the driven gear as the cam on the driven gear passes out of engagement with the cam on the mutilated gear, an adjustable link means connected with the drum and with the mutilated gear for shifting the mutilated gear circumferentially of the drum, and yielding means acting upon said adjustable link means for taking up lost motion therein.

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