Oct. 28, 1941. W. A. KROPP 2,260,463

DUPLICATING MACHINE

Filed July 26, 1939 4 Sheets-Sheet 1

Fig. 1.

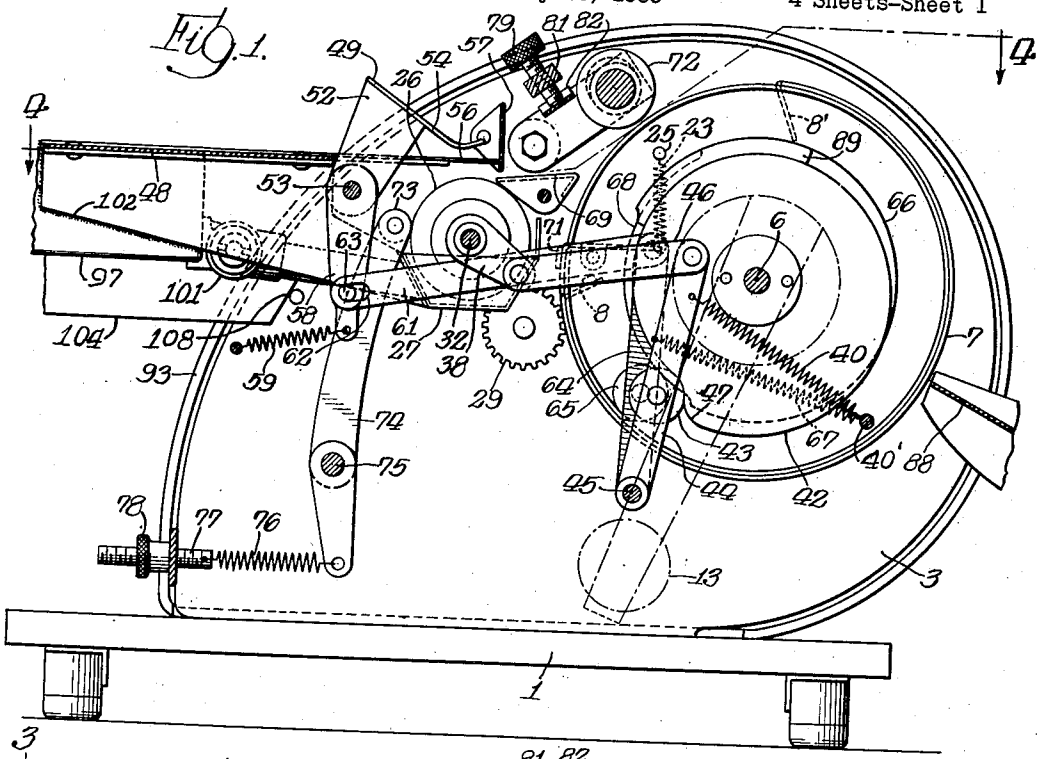
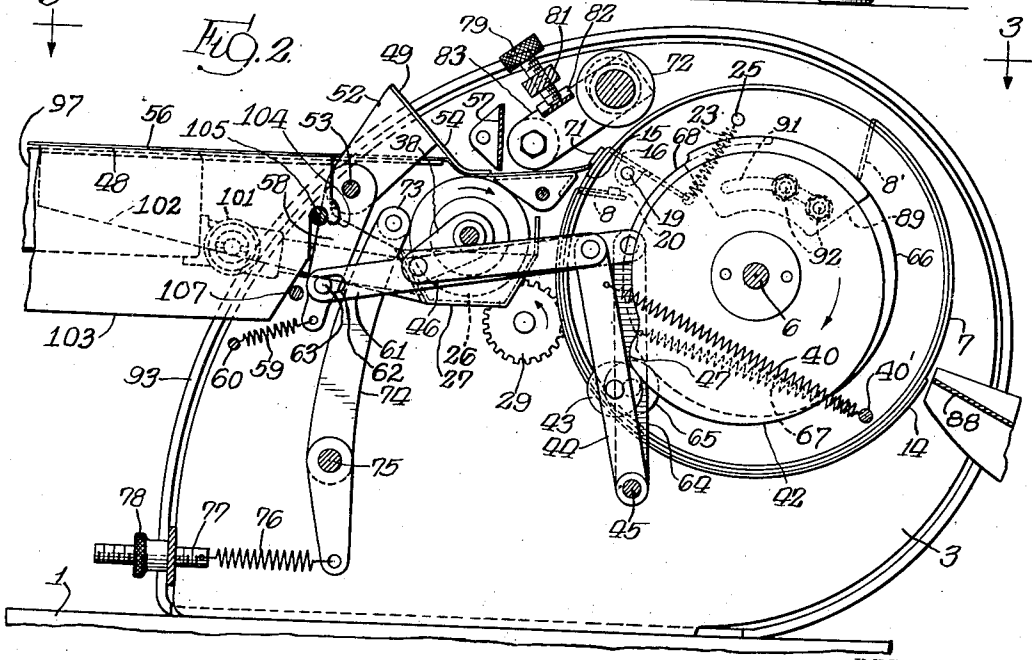


Fig. 2.



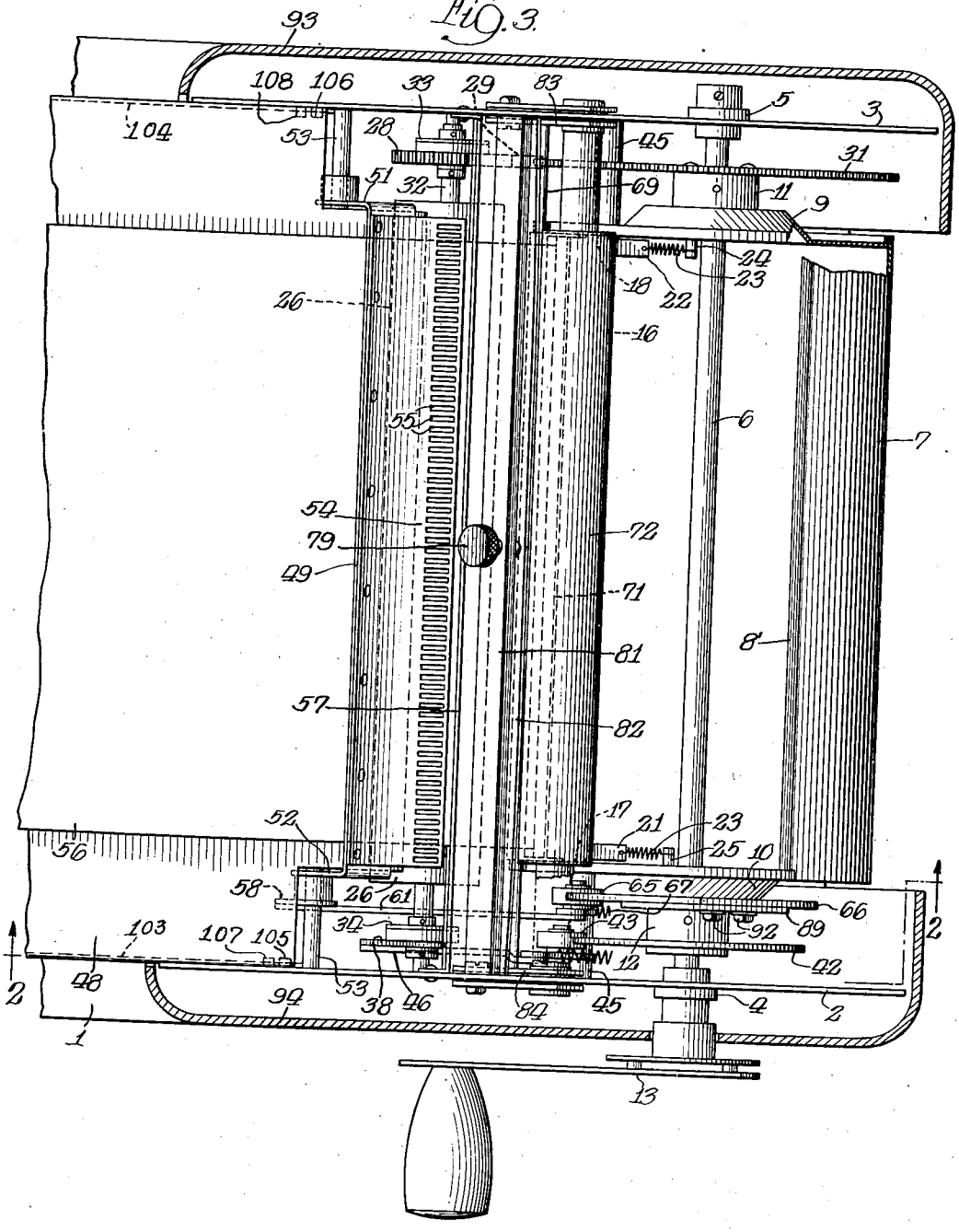
INVENTOR.
Willis A. Kropp.
BY Frank J. Foley
ATTORNEY.

Oct. 28, 1941. W. A. KROPP 2,260,463

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Fig. 3.



INVENTOR.
Willis A. Kropp.
BY Frank J. Foley
ATTORNEY.

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DUPLICATING MACHINE

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Fig. 4

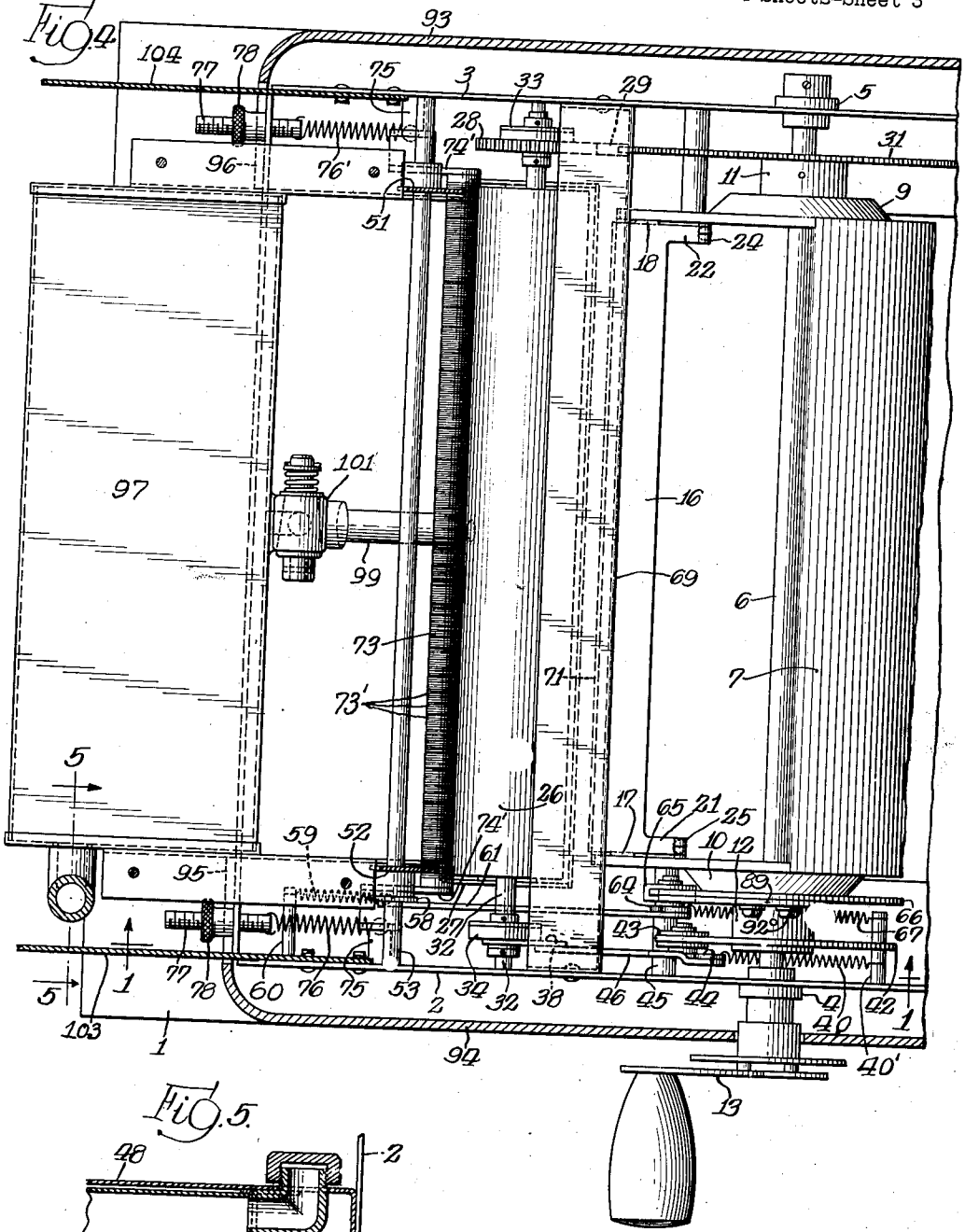
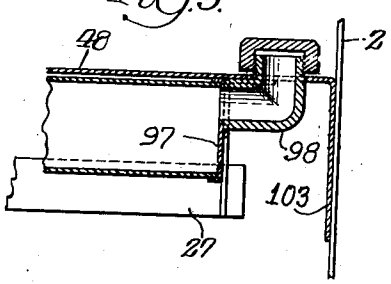


Fig. 5.



INVENTOR.
Willis A. Kropp.
BY Frank J. Staley
ATTORNEY.

Oct. 28, 1941. W. A. KROPP 2,260,463

DUPLICATING MACHINE

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Fig. 6.

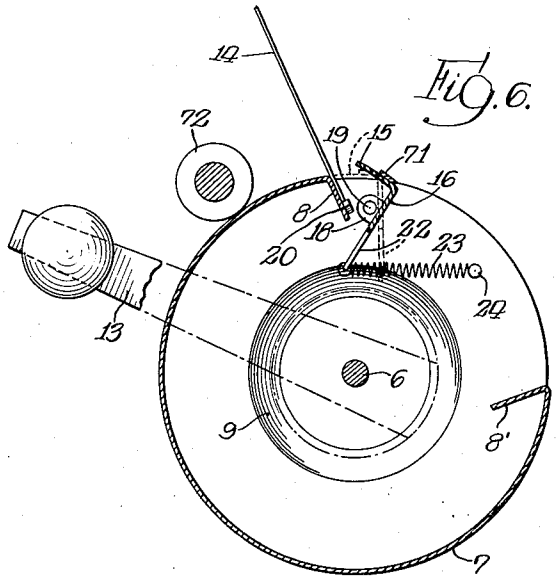


Fig. 7.

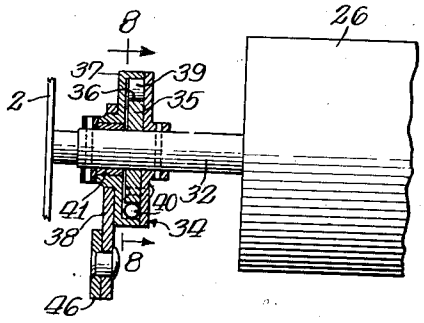


Fig. 8.

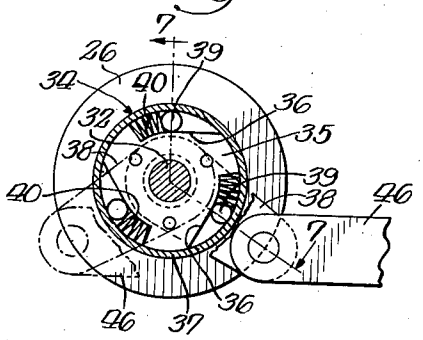
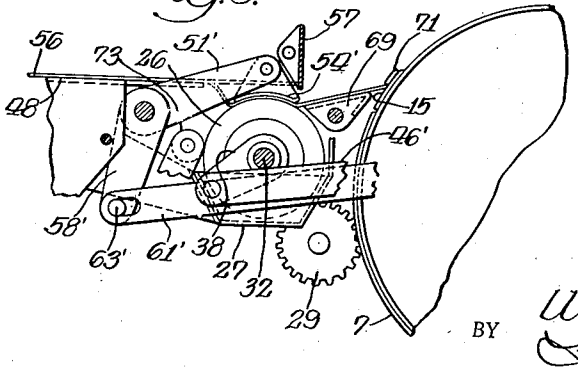


Fig. 9.



INVENTOR.
Willis A. Kropp,
BY Frank J. Foley
ATTORNEY.

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2,260,463

UNITED STATES PATENT OFFICE

2,260,463

DUPLICATING MACHINE

Willis A. Kropp, Oak Park, Ill., assignor to Victor Adding Machine Company, Chicago, Ill., a corporation of Illinois

Application July 26, 1939, Serial No. 286,503

7 Claims. (Cl. 101—132.5)

This invention relates generally to improvements in duplicating machines and particularly to that class of machines by means of which a large number of copies may be printed from a master sheet having type characters printed in reverse thereon.

In machines which employ reversely printed master sheets, it is customary to secure the master upon a rotary drum and successively press blank copy sheets against the master, whereby each copy sheet will receive a readable impression from the master sheet. It is also customary in the art to moisten the copy sheets with a volatile ink solvent prior to contacting them with the master sheet. Such a procedure obviously requires the application of the solvent in a uniform and controlled manner in order that a large number of clear copies of uniform appearance may be obtained.

The general object of this invention is to provide improvements in the mechanism for mounting master sheets on rotary drums and improvements in the apparatus for moistening and feeding copy sheets to the rotary drum.

Various particular objects and advantages of the invention will be specifically alluded to hereinafter or will become apparent from a perusal of the following specification.

In the drawings, Fig. 1 is a vertical sectional view of a duplicating machine made in accordance with my invention, and showing the machine in position ready to commence the feeding operation.

Fig. 2 is a vertical sectional view at the position of the line 2—2 of Fig. 3, illustrating the feeding of a copy sheet to the drum.

Fig. 3 is a top plan view of the machine with the apparatus in the feeding position, shown in Fig. 2.

Fig. 4 is a sectional view on line 4—4 of Fig. 1.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4.

Fig. 6 is a view showing the master sheet clamp opened to receive a master sheet.

Fig. 7 is a sectional view on line 7—7 of Fig. 8.

Fig. 8 is a sectional view on line 8—8 of Fig. 7.

Fig. 9 is a side elevation of a modified form of the moistening and feeding mechanism.

Referring further to the drawings, the machine comprises a base 1 to which are secured in any suitable manner vertical side frame plates 2 and 3. Supported in bearings 4 and 5 in the vertical side plates is a shaft 6 on which is secured a rotary drum in the form of a cylinder 7 having an opening extending longitudinally thereof defined by the inwardly turned flanges 8 and 8'. The end walls 9 and 10 of the drum are secured to hubs 11 and 12, respectively. Either or both of the hubs may be pinned to the shaft 6 to cause the drum to rotate therewith. The drum is rotated manually by means of a handle 13 secured to the shaft.

A master sheet 14 which may be made in any manner and having the printed characters in reverse thereon is secured to the rotary drum as follows: An L-shaped clamping member, preferably of metal, consisting of the plate 15 and the inwardly extending portion 16, is provided with ears 17 and 18 at opposite ends thereof by means of which the clamping member is pivotally mounted on the inner surfaces of the drum end walls. The axis of the pivotal support of the clamping member is shown as 19. The flange 16 is provided with two arms 21 and 22 to which are secured springs 23 anchored to the posts 24 and 25, the posts being secured to the inner surfaces of the drum end walls. Thus these springs normally hold the clamping member in a position where the longitudinal edge of the plate 15 rests snugly in contact with the shoulder of the flange 8. By manually pressing against the clamping member to rotate it away from the flange 8, one may thereby provide space into which the leading edge of a master sheet may be inserted, until its edge rests against stop posts 20 which are provided on flange 8 at close intervals. When the clamping plate 15 is allowed to rotate back to normal the master sheet will be held firmly clamped with its copy portion lying along the exterior of the drum surface and facing outwardly. In a machine of this character it is necessary to clamp only the leading edge of the master sheet, as the remainder of the sheet will follow the leading edge and lie against the drum when it is rotating.

For moistening the copy sheets prior to their contact with the master sheet I provide a wallowing roller 26 having a length slightly exceeding that of the drum or at least exceeding the width of the widest copy sheet intended to be moistened thereby. This roller is rotatably supported on the vertical side plates of the machine and dips into or wallows in a tank 27 which contains the volatile liquid employed for moistening the paper. The roller preferably is made of soft rubber of about 6 Shore hardness.

A pinion gear 28 is rotatably mounted on the roller shaft in mesh with another pinion gear 29, the latter being driven by a large gear 31 secured to the shaft 6 either through the hub 11

or by any other suitable means. The gear is not fixed to the roller shaft **32** because on the other end of the shaft there is provided a free-wheeling drive mechanism which makes it possible to momentarily accelerate the speed of the wallowing roller. Accordingly in order that the roller may be rotated faster than the gear **28** I connect this gear to the shaft through a free-wheeling clutch of suitable construction and indicated by the numeral **33**. Preferably this clutch is similar to the free-wheeling clutch at the other end of the shaft. Thus the wallowing roller is normally driven through gears **31**, **29**, **28** and the free-wheeling clutch **33**, whenever the drum is rotating, the peripheral speeds of the roller and drum being preferably equal.

The free-wheeling mechanism at the other end of the shaft consists of a member **35** pinned to the shaft **32** and to which is pinned a cam disc **35** having cams **36**. Surrounding the cam disc is a casing **37** pinned or otherwise non-rotatably secured to the arm **38**. Within the recesses adjoining the cams **36** there are disposed balls **39** which are normally held by the springs **40** in approximately the position shown in Fig. 8. The hub of the casing **37** is rotatably mounted on the sleeve **41**. Whenever the casing is stationary the shaft **32** and the cam disc may freely rotate within the casing, the balls slightly compressing the springs into the larger ends of the cam recesses. Whenever the casing is rotated more rapidly than the cam disc it will cause the balls **39** to ride up onto the higher portions of the cam surfaces and thereby grip the cam disc and cause it to rotate in unison with the casing. Thereafter when the casing slows down the balls will be automatically released and the shaft **32** will again be driven by the drum gear **31**.

To actuate the clutch to impart temporarily a higher speed to the wallowing roller I provide on the drum shaft and secured thereto through the hub **12** a positive cam **42**. A cam follower **43** rides along this cam and itself is pivotally carried on an arm **44** whose lower end is pivoted on a post **45** carried on the inside of frame plate **2**. A spring **40** anchored on post **40'** holds the follower **43** against the cam. To the upper end of the arm **44** is pivotally connected the pitman arm **46**. As the cam follower **43** rides up onto the high point **47** of the cam **42** the arm **38** will be swung from the position shown in Fig. 1 to that shown in Fig. 2, rotating the casing of the free-wheeling clutch **34** at a higher velocity than that maintained by shaft **32**, the free wheeling clutch thereupon acting to impart this higher velocity temporarily to the wallowing roll.

The clutch **33** is constructed in the same manner as the clutch **45** but in this instance the gear **28** will be pinned to the casing of the clutch to drive the shaft **32** whenever necessary but permitting the shaft and cam disc to rotate at a higher speed whenever such higher speed is imparted by the arm **38**.

The temporary speeding up of the wallowing roll is a feature of the paper feeding mechanism which will now be described. Extending above the feed table **48** is a bail **49** having ears **51** and **52** rotatably supported on a stationary rod **53** carried between the vertical frame plates **2** and **3**. Secured to the top surface of the bail is a plate or shoe **54**, the lower portion of which is provided with a large number of closely spaced narrow slots **55**. The normal inoperative position of this shoe is shown in Fig. 1.

A sheet of paper indicated as **56** is slid along the top of the table either manually or automatically until its leading edge strikes a stationary plate **57** which is secured to the frame plates **2** and **3**, as illustrated in Fig. 1. Connected to move integrally with the bail is a depending arm **58** by means of which the bail and shoe may be rotated about the shaft **53**. A spring **59** connected with the arm **58** and anchored on post **60**, normally urges the arm **58** to rotate in a clock-wise direction. A link **61** having a slot **62** therein engaged with a pin **63** in the lower end of the arm is pivotally connected with the upper end of a cam follower arm **64**, the arm being pivoted at **45**. A cam follower **65**, pivotally carried by arm **64**, is held in contact with a negative cam **66** by means of the spring **67**. Whenever the cam follower is riding on the minor diameter of the cam **66**, that is in the recess **68**, the shoe will be held in raised position by spring **67** as shown in Fig. 1, but when the cam is rotated to such a position as to bring the cam follower **65** onto the major diameter of the cam **66**, the shoe will be rotated downwardly by spring **59** into the position shown in Fig. 2, thus pressing the copy sheet into contact with the rotating wallowing roll. The slot **62** prevents the arm **61** from forcing the shoe against the roll.

The wallowing roll is preferably made of soft rubber and being wet, the paper adheres to it readily and is not only moistened but fed thereby across the top of the paper guide **69**.

Referring now to Fig. 2, it will be observed that at the time the cam follower **65** rides up onto the major diameter of the shoe cam **66**, the free-wheeling cam **42** imparts extra velocity to the rotating wallowing roll so that when the paper strikes the wet roll it is quickly advanced until its leading edge strikes against the margin bar **71** provided on the surface of the plate **15**. The free-wheeling mechanism may be so adjusted, if desired, to advance the paper far enough at this temporary higher velocity as to cause it to buckle slightly or at least press against the margin bar with a substantial pressure, after which the normal velocity of the wallowing roll will hold the copy sheet snugly against the margin bar until the latter passes underneath the soft resilient pressure roller **72**, whereupon the pressure roller will then press the copy sheet first against the plate **15** and thereafter against the master sheet. From the time the paper is gripped underneath the pressure roll, the feeding of the copy sheet is controlled by that instrument and is pressed against the master sheet with sufficient force to obtain the desired impression.

As the copy sheet passes over the wallowing roll it is moistened uniformly to the desired extent so that it may pick up from the master sheet the required amount of ink to produce a copy of desired clarity and brightness.

To prevent the wallowing roll from carrying an excessive amount of moisture on its surface from the solvent tank, I provide a doctor roll **73** which is preferably made of a special steel or any other suitable hard material not subject to corrosion and which squeezes off the excess amount of liquid and causes it to run back into the tank. This doctor roll is carried on the upper end of a pair of arms **74** and **74'** pivoted on a rod **75** carried between the frame plates **2** and **3**. Springs **76** and **76'** connected with the lower ends of the arms **74** and **74'** are anchored

on screws 77 and 77' and by means of nuts 78 and 78' the tension of the springs may be varied to thus vary the pressure of the doctor roll against the wallowing roll.

A large number of closely spaced narrow and shallow grooves 73' are cut or chased in the surface of the doctor roll to cooperate with the soft rubber surface of the wallowing roll whereby through the adjustment of springs 76 and 76' the amount of liquid left on the wallowing roll by the doctor roll is subject to accurate regulation and uniform distribution. Roll 26 is so soft that its surface may be forced into the fine grooves 73' to provide this opportunity for regulation. These grooves may be cut in the form of finely cut spirally arranged screw threads, or the chasing may be arranged in any other pattern capable of facilitating the desired regulation and distribution of the solvent allowed to remain on the wallowing roll.

While the solvent will ordinarily creep up the vertical end surface of the wallowing roll and over onto the cylindrical surface thereof I have found that in the present embodiment it will not advance from the ends more than about three eighths of an inch. Accordingly, I employ a wallowing roll at least about three eighths of an inch longer at each end than the maximum width of the copy sheets to be moistened thereby, hence such excess moisture cannot get onto that portion of the copy sheet which is intended to receive copy from the master sheet.

The pressure of the roller 72 is also capable of adjustment by means of a screw 79 threaded through a stationary bar 81 and pressing against a resilient bow 82 which lies upon the arms 83 and 84 pivoted at 85 and 86 which support the shaft 87 of the pressure roller.

In the operation of the device shown in Figs. 1 to 5 inclusive, a sheet of paper 56 is advanced on the feed table until its leading edge strikes the stop plate 57. This may be done at any time while the drum is rotating and before the cams reach the position shown in Fig. 1. Further rotation of the drum causes both cams to operate their cam followers bringing the shoe down upon the copy sheet to press it against the moist surface of the wallowing roll which at that instant or immediately thereafter is given an extra acceleration or "kick" by its free-wheeling clutch, causing the copy sheet to be advanced into contact with the margin bar 71.

As the drum continues to rotate the pressure roll 72 will grip and press the copy sheet against the master sheet, while at the same time the rest of the copy sheet is being moistened and advanced to the drum by the wallowing roll.

The shoe 54 remains in lowered position to press the paper against the wallowing roll until the entire length of the copy sheet has passed that position, at which time, or immediately prior thereto, the shoe will be raised by its associated cam to afford opportunity for the feeding of another copy sheet into the position shown in Fig. 1. The copy sheet after taking an impression from the master sheet is no longer positively held in contact therewith, hence it will be separated by centrifugal force and the effect of air currents and fall onto the delivery chute 88.

While it is contemplated that the gear drive of the wallowing roll will advance the copy sheet to the drum at the same speed as the peripheral speed of the drum, it is possible in the present arrangement for the pressure roller 72 to draw the copy sheet over the surface of the wallowing roll at the drum peripheral speed even if the wallowing roll should be rotating at a slightly lower speed due to some variation in manufacture or due to any other reason. This is possible because of the free-wheeling clutch 33.

Should the paper shoe 54 contact the wallowing roll in the absence of a copy sheet the slots 55 will prevent an excessive amount of solvent from accumulating on the underside of the shoe and will readily disperse the liquid and facilitate its normal rapid evaporation. Hence when a copy sheet is subsequently fed thereunder it will not be excessively dampened.

In Fig. 9, I have shown a modification of the shoe for causing the copy sheets to contact the wallowing roll. In this instance the shoe has a contour somewhat like a train wheel brake shoe and is fixed on a pair of arms corresponding to the ears 51 and 52, one of these arms being indicated as 51'. An arm 58' is connected with the arm 51' to effect the raising and lowering of the shoe 54'. To the arm 58' is connected a link 61' and the remainder of the cam mechanism for operating this shoe is identical with that shown in Figs. 1 and 2. However, in this modification the travel of the shoe 54' is so adjusted that it will not actually contact the wallowing roll should there be no copy sheet underneath it. It will be held just slightly separated from the wallowing roll by the link 61 but close enough that when it does force a copy sheet downwardly the curvature of the shoe is such that the copy sheet disposed underneath the forward and rear edges of the shoe must contact the wallowing roll. I have found that once the paper is brought into contact with the moist soft rubber roller it will adhere thereto without any actual pressure from the shoe.

By avoiding actual contact of this shoe with the wallowing roll I eliminate any difficulties which might arise from the collection of moisture on the underside of the shoe should the machine be operated without copy sheets.

The operation of the modified form of the device is substantially the same as the operation of the preferred form. The free-wheeling drive is employed to accelerate the wallowing roll temporarily and the shoe 54' will be raised and lowered in the same manner as is the shoe 54, the only difference being that actual contact of the shoe with the wallowing roll in the absence of paper is prevented.

In the event that one should wish to vary the length of the period in which the paper shoe is held depressed, this can be accomplished by utilizing an adjustable cam plate attached to the cam 66 for varying the peripheral length of the cam surface of major diameter on that cam. Such a plate is indicated as 89 in Figs. 2 and 3 and is provided with an arcuate groove 91 and a pair of machine screws 92 for securing this cam plate adjustably to shorten or lengthen the high section of the cam. This may be useful in connection with copy sheets of different length, the shoe being lifted promptly after or just before the passage of the end copy sheet between it and the wallowing roll.

The ends of the machine are enclosed by a pair of casing members 93 and 94 which are secured to the base 1 in any suitable manner. Inwardly turned flanges 95 and 96 serve as supports for the tensioning springs 76 and 76' which hold the doctor roll against the wallowing roll.

For supplying the volatile ink solvent to the tank 27 I provide a storage tank 97 which is con-

veniently mounted underneath the feed table. A filling spout 98 as shown in Fig. 5 extends through one margin of the feed table. A pipe 99 provided with a plug valve 101 of ordinary construction supplies the liquid to the tank 27 and inasmuch as the lower end of the pipe is submerged in the liquid the arrangement acts as a fountain feed. The wallowing tank is supported on a pair of brackets, of which one is shown and indicated as 102, secured to the underside of the feed table.

By mounting the feed table so that it may be readily removed from the frame of the machine the wallowing tank may be removed integrally therewith for emptying and cleaning. For this purpose I form on the opposite vertical depending flanges 103 and 104 of the feed table hooks such as 104 which may be engaged over posts 105 and 106, integral with the side frame of the machine. The flanges rest against posts 107 and 108 thus maintaining the desired horizontal position of the feed table.

It should be understood that the invention is not limited to the specific details of construction herein shown but rather its novel features are susceptible of considerable variation without departing from the spirit and scope of the claims which follow.

Having shown and described my invention, I claim:

1. In a duplicating machine, a rotary drum, a feeding roll, means for rotating the drum and roll at predetermined relative speeds and for rotating said roller continuously during the feeding of successive copy sheets, means on the drum for positioning the leading edge of a copy sheet, and means controlled in accordance with the rotative position of the drum and the travel thereof for temporarily accelerating the feed roll.

2. In a duplicating machine, a rotary drum, a feeding roll, means for rotating the drum and roll at predetermined relative speeds and for rotating said roller continuously during the feeding of successive copy sheets, means on the drum for positioning the leading edge of a copy sheet, and means controlled in accordance with the rotative position of the drum and the travel thereof for contacting a copy sheet against the feed roll and means similarly controlled for temporarily accelerating the feed roll to advance the copy sheet to said positioning means.

3. In a duplicating machine, a rotary drum, a combined feeding and moistening roll, means for supplying moisture to the roll, means for rotating the drum and roll in unison and for rotating said roller continuously during the feeding of successive copy sheets, shiftable means for contacting a copy sheet with the roll to moisten and feed the same, and means for accelerating the roll without varying the drum speed during said feeding operation.

4. In a duplicating machine, a rotary drum having means for securing thereon a master to be contacted by copy sheets, a margin stop carried by said drum in advance of the leading end of the master copy, a soft roller having a smooth surface, means for continuously driving the roller and drum during the feeding of successive copy sheets, and means having sliding contact with the copy sheets cooperating with said soft roller for advancing copy sheets into contact with said margin stop.

5. In a duplicating machine, a rotary drum and means for securing a master copy sheet thereon, a feed table adjoining said drum, an ink solvent tank and a continuously driven roller wallowing therein with the roller positioned below and beyond the edge of the feed table, a stop member positioned above the roller and beyond the table edge positioned for stopping copy sheets fed thereagainst and slightly overhanging the table edge, and a pressing member actuated in a timed relation to the drum for pressing the overhanging edges of copy sheets downwardly against the wallowing roller to effect the moistening and feeding of the copy sheets.

6. In a duplicating machine, a rotary drum and means for securing a master copy sheet thereon, a feed table adjoining said drum, an ink solvent tank and a continuously driven roller wallowing therein with the roller positioned below and beyond the edge of the feed table, a stop member positioned above the roller and beyond the table edge positioned for stopping copy sheets fed thereagainst and slightly overhanging the table edge, and a shoe having a non-rotating contact surface and means operated in a timed relation to the drum for pressing said shoe downwardly upon the copy sheets between the table edge and said stop member for contacting the copy sheets agains said roller to moisten and feed them to the drum.

7. In a duplicating machine, a rotary drum and means for securing a master sheet thereon, a feed table adjoining said drum, a solvent tank and a continuously driven roller wallowing in said tank positioned with the roller slightly beyond and below an edge of the feed table, a paper stop positioned to intercept a copy sheet fed beyond the table edge at a line slightly above the roller and beyond its highest peripheral point in the path of feed, and a rockable shoe arranged to be poised above the copy sheets fed against said stop member and actuated in a timed relation with the drum to press copy sheets against the periphery of the roller to cooperate with the roller to moisten and feed the sheets to the drum.

WILLIS A. KROPP