

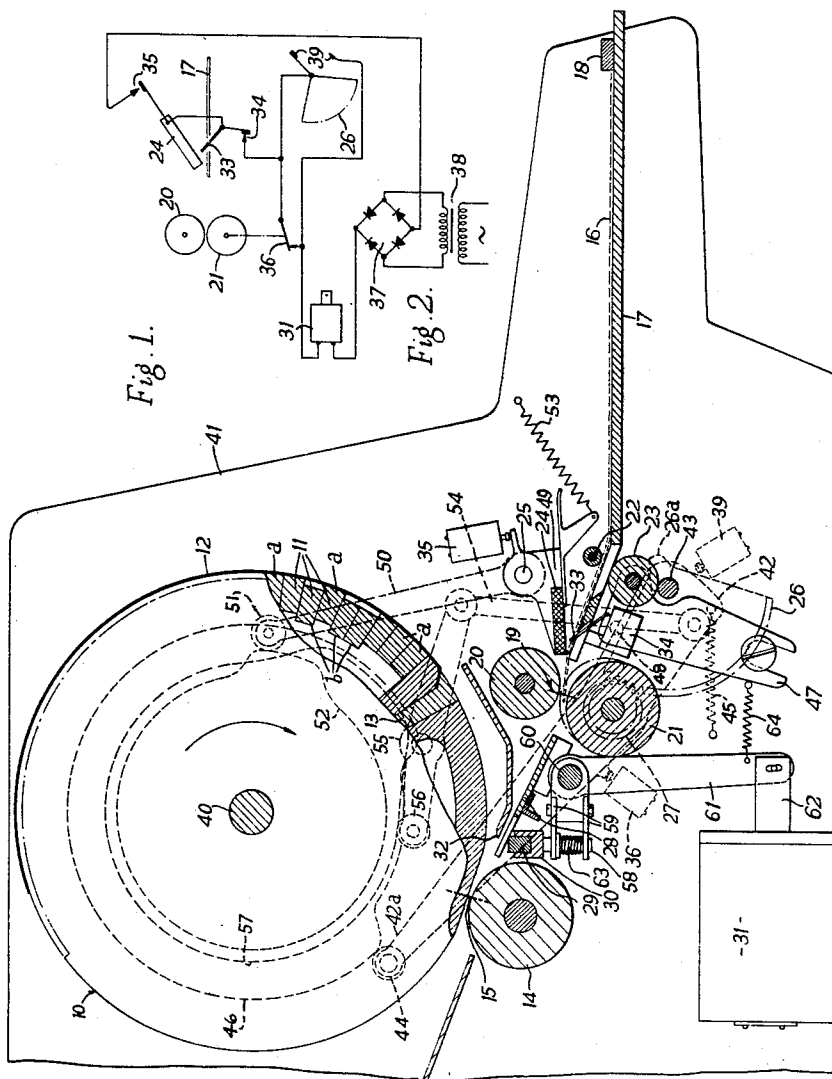
Nov. 24, 1964

S. MATTHEWS ETAL

3,158,091

ROTARY HECTOGRAPHIC DUPLICATING MACHINES

Filed April 25, 1961



INVENTORS
STEPHEN MATTHEWS
ROLAND BROWN
BY
Irwin G. Thompson
ATTORNEY

1

3,158,091

ROTARY HECTOGRAPHIC DUPLICATING MACHINES

Stephen Matthews, Hadley Wood, Barnet, and Roland Brown, Friern Barnet, London, England, assignors to Block & Anderson Limited, London, England, a British company

Filed Apr. 25, 1961, Ser. No. 105,495

Claims priority, application Great Britain, Apr. 29, 1960, 15,176/60

4 Claims. (Cl. 101—132.5)

The present invention relates to rotary hectographic duplicating machines of the type wherein copy sheets moistened with a solvent for hectographic ink are fed to a printing couple consisting of a printing drum and a counterpressure roller or like member, the printing drum carrying a flexible master sheet bearing a mirror-script image in hectographic ink of the matter to be copied.

The present invention is particularly concerned with machines for effecting so-called selective line printing and in which the lines of copy material on the master sheet extend parallel to the axis of the drum and in which it is possible to take, upon a single copy sheet, impressions of a random selection of different line items from the mirror-script original in such manner that the selected line items appear in consecutive order with a common spacing relationship to one another upon the copy sheet. Examples of such machines are described in the pending applications of Francis R. Bonsch, Ser. No. 703,973 filed December 19, 1957, now Patent No. 2,980,014, Ser. No. 755,763 filed August 18, 1958, now Patent No. 3,033,517, and Alfred E. Block, Ser. No. 780,355 filed December 15, 1958. In each of these examples, the peripheral working surface of the printing drum is subdivided into a plurality of equi-width printing segments disposed parallel to the drum axis and each arranged so as to be in either an outward (printing) or an inward (non-printing) position as they pass through the printing bight opposite the counterpressure roller according to whether the master image line item overlying such printing segment is to be copied or not copied on the copy sheet. Other forms of selective line printing machines are known, for example, types in which the counterpressure roller is segmented instead of the printing drum or other types in which the counterpressure roller or equivalent member is moved towards and away from the printing drum.

A difficulty which arises in practically all types of such selective line printing machines is that of maintaining the copy sheet from inadvertent displacement during those, non-printing, times when, by reason of the separation of the opposing regions of the printing drum and the counterpressure member within the printing bight, the copy sheet is not held in any way between the printing drum and such counterpressure roller. Should the trailing end of the copy sheet already have left the last of any preceding sheet-engaging means, such as the initial feeding rollers or a damping pad by which the sheet is necessarily held, it may easily become displaced either forwardly or sideways out of alignment with its normal travel path by purely fortuitous circumstances such as inertia or vibration or even a light frictional contact with the sheet delivery tray or with the overlying and still rotating master sheet carried by the printing drum.

To overcome this difficulty, it has already been proposed to provide supplementary sheet gripper means such as gripper fingers or friction-inducing balls located as close as possible to the actual printing line in the printing bight. These means, in turn, introduce further dif-

2

ficulty in that they must be opened or rendered inoperative in order to permit free passage of the forward edge of the copy sheet as it moves up to and just into the printing bight during the initial feeding movement of the sheet into the machine before the printing operation actually commences. Such supplementary sheet gripper means must then be closed to grip the sheet at some time instant which is always after such feeding-in movement has been completed. A further disadvantage of the known arrangements resides in the differences which occur in the frictional resistance to the forward movement of the copy sheet which is imparted thereto when it is frictionally gripped in the printing bight between the outwardly positioned or operative printing segments and the co-operating counterpressure member. Thus, during the initial stages of the printing operation cycle, it is probable that the damping pad or like means is still pressing upon or engaging the copy sheet at some point intermediate its leading and trailing edges and if such supplementary gripper means is also effective upon the sheet at the same time, the resistance to forward movement of the sheet is greater than during later stages of the printing operation cycle when the trailing edge of the sheet has passed from beneath such damping means since the frictional resistance to forward movement of the sheet is then that due only to the supplementary gripper means. This change of resistance tends to result in alteration of the spacing distance between successive line items printed during the different periods, items printed during the times of lesser resistance being more widely spaced from one another than those printed during times of greater resistance.

An object of the present invention is to provide an improved arrangement of such supplementary sheet gripper means wherein the grip thereof becomes effective at a time which is approximately coincident with the instant when the trailing edge of the copy sheet becomes freed from any other previous restraining influence thereon.

In accordance with the invention, in a rotary hectographic duplicating machine of the kind referred to above, supplementary sheet gripper means is arranged to be movable between an operative and an inoperative position under the control of means which sense the presence or absence of a copy sheet in the immediate vicinity of the last continually effective sheet restraining means, such as sheet damping means, in the direction of travel of the copy sheet into the printing bight whereby such supplementary sheet gripper means is held inoperative until the trailing edge of each copy sheet is about to pass from such sheet restraining means.

In order that the nature of the invention may be more readily understood, one particular constructional embodiment thereof will now be described by way of illustrative example with reference to the accompanying drawing, in which:

FIG. 1 is a fragmentary longitudinal vertical sectional view through a hectographic duplicating machine embodying the invention, only those parts necessary for an understanding of the invention being shown, while

FIG. 2 is an electric circuit diagram of the arrangements employed.

Referring first to FIG. 1, the machine chosen for illustration of the invention comprises a rotatable printing drum 10 which is provided, in a manner similar to that described in the above-mentioned co-pending applications, with a plurality of printing segments 11 which are of equal, unit text line, width and which can be moved independently of one another in a radial direction and under pre-selection key control between an outward (printing) position, as indicated by the segments marked "a," and an inward (non-printing) position as shown by the segments marked "b." A master sheet 12 held by

its forward edge in a clamp 13 is wrapped around the outer surface of the drum and accordingly overlies the various printing segments 11, the position of the master sheet being adjusted so that each of its individual text line items, which are disposed parallel with the drum axis, overlies a different one of the segments 11. The printing segments underlying those text line items which are required to be printed are moved radially outwards to the position as indicated by the segments marked "a," whereas those underlying the text line items which are not required to be printed are held radially inwards at the position of those segments marked "b."

The printing drum 10 is rotatable about a fixed axle 40 which is secured at each end in the opposing side frame plates of the machine and of which only one, namely the righthand side plate 41, is shown.

The printing drum 10 co-operates with a counter-pressure roller 14 which is journaled within the aforesaid side plates at a fixed position parallel to the axis of the drum 10 and is arranged in the customary manner to provide both printing pressure upon and forward transmission movement to the copy sheet at the printing line 15 only when opposed by those segments 11 which are in the outward position "a" and the remaining unsegmented parts of the printing drum surface which lie at the same radius from the drum axis as the outer segments "a."

Each copy sheet 16 to be printed is initially placed upon a substantially horizontal feed table 17 with its trailing or rear edge abutting a back stop 18. The position of the latter, relative to the length of the copy sheet, is such that the forward or leading edge of the copy sheet then lies just forwardly of the line of meeting engagement 19 of a pair of sheet feeding rollers 20, 21. The upper roller 20 is journaled in the side plates of the machine at a fixed position parallel to the printing drum axis but the lower roller 21 is rotatably mounted at each end in a pair of rocking lever arms 42 rigidly secured to opposite ends of a transverse rock shaft 43 journaled in the same side plates. One of the lever arms 42 has an upwardly inclined extension 42a carrying a follower roller 44 at its free end. Spring means 45 continuously urge the lever arms 42 to rotate in a clockwise direction whereby the roller 21 is spring biased towards the roller 20. The follower roller 44 co-operates with the contoured edge surface of a cam disc 46 rigidly connected to the drum 10 whereby the lower feed roller 21 is allowed to move upwardly so as to grip the copy sheet 16 between itself and the upper feed roller 20 immediately the printing drum 10 commences its operative rotation in a clockwise direction from the initial or rest position as shown. The contour of the cam disc 46 is such that the roller 21 is moved downwardly again after the leading edge of the copy sheet has been moved, in a manner as described later, to a position where it is in the printing bight and just past the printing nip or meeting line 15.

The second pair of feed rollers 22 and 23 are provided for performing a supplementary or "posting" sheet feed operation which will be referred to later. Of these two rollers, roller 22 is journaled in fixed horizontal position between the side plates of the machine just above the level of the forward end of the sheet feed table 17 while the lower roller 23 is journaled at each end in a pair of rocker plates 47 which are movable about pivot pins 48 carried by the respective side frame plates. By control means, not shown, the two rocker plates 47 can be moved in unison to lift the roller 23 through the aperture in the feed table 17 so as to grip the copy sheet between the two rollers and thereafter the rollers caused to be rotated so as to cause forward movement of the gripped copy sheet by an amount equal to the unit text line dimension of the master sheet 12.

Immediately before the sheet feed rollers 20, 21, as viewed from the direction of travel of a copy sheet, is disposed a sheet damping or moistening pad 24 associated with means, not shown, for maintaining such pad sup-

plied with the appropriate solvent liquid. The pad 24 is carried in a holder structure 49 mounted at each end upon pivots 25 carried by the machine side plates. Rigidly interconnected with such holder 49 is a control lever 50 having a cam follower roller 51 at its free end, said follower roller co-operating with a second cam disc 52 also rigidly connected to the drum 10. Spring means 53 continuously bias the pad for movement in anticlockwise direction about the pivots 25 whereby the pad 24 bears upon the upper surface of the copy sheet 16 except when the roller 51 lies upon the proud portion of the cam disc 52; when this occurs, the pad 24 is raised clear of the copy sheet to allow free insertion of the latter. Such raised position is that shown and occurs for only a short period of time just before the drum 10 reaches the end of its operative revolution cycle and whilst the drum is in its initial or rest position. Immediately the drum commences to rotate to perform another printing operation, the pad 24 is lowered on to the upper surface of the copy sheet to effect moistening thereof.

Secured to the lower feeding roller 21 is a gear wheel 27 which is in meshing engagement with the teeth of a gear quadrant 26, the latter being freely rotatable about the rock shaft 43. Such gear quadrant 26 is coupled by a link arm 54 to one end of a rock lever 55 which is pivotally mounted at a point intermediate its ends upon the frame side plate 41 and which carries a follower roller 56 at its opposite end. The follower roller 56 co-operates with a further cam disc 57 also rigidly connected to the printing drum 10. The contour of the cam disc 57 is such that the rock lever 55 commences to be moved in an anticlockwise direction as the drum 10 commences an operative cycle from the rest position shown. In consequence, through link arm 54, the gear quadrant 26 is rotated in a clockwise direction thereby rotating the lower feed roller 21 in an anticlockwise direction at a time which coincides with the lifting of such roller into gripping engagement with the copy sheet. The amount of rotary movement imparted to the roller 21 is such that the leading edge of the copy sheet 16 is moved from the meeting line 19 of the feeding rollers 20, 21 into and just through the printing line 15 between the drum 10 and counter-pressure roller 14. The arrival of the leading edge of the copy sheet at the printing line 15 is coincident approximately with the passage of the clamp 13 through the printing bight.

Between the feeding rollers 20, 21 and the printing line 15 there is disposed an extension support plate 28 for carrying the copy sheet up to the printing bight while above such support plate 28 is disposed a further plate forming an entry throat and terminating, near the printing line 15, in an overlying clamping plate portion 32. The extension plate 28 is interrupted or gapped to accommodate a supplementary sheet gripper member 29 in the form of one or a plurality of transversely disposed lengths of friction material, such as compressed felt, held in a rigid U-section support bar 30. The latter is provided with a number of downwardly projecting and spaced pins 58 which are slidable within apertures in spaced support plates 59 secured to a transverse rock spindle 60 which is journaled at each end in the machine side plates and which has secured thereto a downwardly directed lever arm 61 whose lower end is coupled to the armature 62 of a solenoid 31 rigidly secured to the adjacent machine side plate. Each pin 58 is surrounded by a compression spring 63 bearing against a collar on the pin whereby the gripper member 29 is resiliently mounted. By spring means 64, the spindle 60, arm 61 and gripper pad 29 are normally held in the position illustrated when the solenoid 31 is de-energised. When the solenoid is energised, however, the arm 61 is rocked clockwise and the pad 29 lifted towards the overlying clamp plate 32 thereby to apply resilient clamping pressure upon the intervening copy sheet and thus to hold the latter against undesirable displacement whenever it

is not gripped between the drum 10 and counterpressure roller 14.

Immediately in front of the point of application of the damping pad 24 to the copy sheet, as viewed from the direction of feeding movement of the copy sheet, is provided a feeler arm 33 connected to and controlling an electric switch device 34, such feeler arm 33 being resiliently urged by the very light spring means of the switch mechanism upwardly through an aperture in the feed table 17 into the path of the copy sheet 16. When the feeler arm 33 is raised, the switch contacts are closed but the latter become opened when the feeler arm is depressed. A further electric switch 35 is mounted upon the side plate 41 for control of its contacts by an extension of the holder structure 49 carrying the damping pad 24, the switch mechanism being such that its contacts are opened when the pad 24 is raised and closed when the pad is lowered. A third switch device 36 fixed to the side plate 41 is arranged to be controlled by a projection of the extension arm 42a associated with the movable lower sheet feeding roller 21. The contact arrangement of this switch 36 is such that its contacts are closed when the roller 21 is lowered as shown and become opened whenever the roller is raised to grip and transmit forward movement to the copy sheet.

A further electric switch device 39, also secured to the side plate 41, is controlled by the position of the gear quadrant 26, the construction of this switch 39 being such that its contacts are normally open but become closed by engagement of the extension 26a of the quadrant with the switch operating lever when such quadrant nears the end of its clockwise operative movement to transmit anticlockwise rotary motion to the roller 21. Such roller 21 may be arranged to rotate in the reverse direction as the gear quadrant 26 returns to the position shown later in each operation cycle or, alternatively, a freewheel clutch device may be provided between the gear wheel 27 and the roller 21.

The circuit arrangement of the various contacts of the switches 34, 35, 36 and 39 is shown in FIG. 2. The contacts 39 associated with the quadrant 26 are connected in parallel with the contacts 36 controlled by the lower feeding roller 21 and these contacts then arranged in series with the remaining contacts 34 (controlled by the feeler arm 33) and 35 (associated with damping pad 24) and the solenoid 31 across the D.C. output terminals of a rectifier 37 whose opposite input terminals are supplied with alternating current of suitable voltage from a transformer 38 connected to suitable current supply means, such as those which provide energy for the driving motor of the machine.

The manner of operation is as follows: During the initial positioning of the copy sheet 16 upon the feed table 17, the feeler arm 33 is depressed and its associated contacts 34 are opened. If now the machine is set into operation, the damping pad 24 is lowered on to the copy sheet 16 thereby closing the associated contacts 35, the lower feed roller 21 is simultaneously raised to grip the copy sheet between itself and roller 20, thereby opening contacts 36 and such lower feed roller 21 is then rotated by actuation of the gear quadrant 26 to move the copy sheet forwardly by the distance between the lines 19 and 15, whereby its forward edge is brought just into the printing nip. Towards the end of this roller driving movement of the quadrant 26, the contacts 39 close but, under normal conditions, such closure does not have any effect upon the supplementary gripper means for the copy sheet since contacts 34 are still opened by the presence of the copy sheet overlying the feeler arm 33. Thereafter, the lower feed roller 21 is lowered again, closing contacts 36, and the quadrant 26 then returned to its normal rest position as shown, the corresponding reverse motion of the roller 21 (if no freewheel clutch is fitted) having no effect upon the copy sheet since there

is now no bite or grip between the separated rollers 20, 21. Contacts 39 again open.

Under these conditions, the circuit of the solenoid 31 is still not completed, due to the sustained opening of the feeler contacts 34 by the copy sheet 16, the supplementary gripper member 29 is accordingly held in its lowered, inoperative, position. During subsequent stages of the printing cycle, the copy sheet will be intermittently gripped between each outwardly displaced printing segment 11 of the drum 10 and the opposing counterpressure roller 14 with resultant intermittent forward movement and the printing thereon of the related image text lines of the master 12; in between such periods of movement and printing, the copy sheet 16 must remain stationary awaiting the arrival of the next operative printing segment. Initially during this period of clamping pressure exerted by the damping pad 24 suffices to prevent the copy sheet being inadvertently displaced even though the latter is in no way held in the actual printing nip.

At a subsequent instant when the trailing edge of the copy sheet 16 passes from over the feeler arm 33, i.e. just before such trailing edge passes from beneath the damping pad 24, the switch contacts 34 close and since the other contacts 35, 36 are already closed, an energization circuit is set up for the solenoid 31. This now operates and raises the supplementary gripper member 29 to hold the sheet firmly against the underside of the clamping plate 32 and allows movement of the copy sheet only during those periods when an outward printing segment 11 opposes the counterpressure roller 14 in the printing nip 15. The frictional drag exerted upon the copy sheet 16 by the pressure of the supplementary gripper member 29 is adjusted to be substantially equivalent to that exerted by the damping pad 24 whereby the resistance to forward movement of the sheet during the various active printing periods is substantially the same under the alternative conditions of when the damping pad 24 alone is lowered and when the supplementary gripper member 29 alone is operative upon the sheet.

The purpose of the third set of contacts 36 controlled by the position of the lower feed roller 21 is to prevent possible energization of the solenoid 31 and resultant raising of the gripper member 29 prior to the termination of the forward sheet feeding movement of the rollers 20, 21. This might otherwise occur in the case where the copy sheet 16 is very short or under conditions when the second or posting set of rollers 22, 23 are employed to pre-position the copy sheet 16 for effecting posting of an image line of the master 12 into a position which is near to the trailing edge of the copy sheet. Under these conditions, the initial positioning of the copy sheet 16 may be such that either the trailing edge of the sheet is already forward of the feeler arm 33 or that such edge will pass the feeler arm 33 very shortly after the commencement of the initial forward feeding movement of the sheet by the rollers 20, 21 during the actual machine operation cycle. The automatic opening of contacts 36 before the roller 21 is raised into gripping engagement with the copy sheet prevents any possible closure of the supply circuit of the solenoid 31 until after the forward feeding movement by such rollers is completed.

The automatic closure of the switch contacts 39 at the extreme end of the initial forward sheet feeding movement by rollers 20, 21 operates to avoid the time delay in closing the solenoid supply circuit when feeding short copy sheets or effecting line posting near the bottom of a copy sheet which would otherwise occur if such circuit closure had to await the lowering of the lower feed roller 21 to close contacts 36, since under such conditions, the trailing edge of the copy sheet might be forward of the damping pad 24, the sheet would be left without any restraint against undesired displacement, particularly due to the inertia of such sheet, during the period when the lower feed roller 21 is being lowered.

Various modifications may obviously be made without departing from the invention. For example, the feeler arm 33 may be positioned to lie adjacent other sheet engaging members, such as sheet damping and feeding rollers, instead of the damping pad as shown, provided such other members are continuously operative to impose restraint upon the copy sheet during the whole of the actual printing period and are the last to do so, as viewed from the aspect of copy sheet movement from its initial lay position to the printing zone. Instead of using entirely electric control and operation of the supplementary sheet gripper member, a combination of electrical and mechanical control may be provided or an entirely mechanical system in which the feeler arm acts as a trip member for releasing a latched up supplementary gripper member which is later reset into an inoperative latched position by the printing drum in the final stage of its operative revolution.

We claim:

1. A rotary hectographic duplicating or like machine which comprises a rotatable printing drum having means for securing an image-carrying master sheet therearound with the text or copy lines thereof extending parallel to the axis of said printing drum, a counterpressure member for forming a printing couple in conjunction with said printing drum to impress the image of said master sheet against the copy sheet in the printing bight thereof, means for causing intermittent printing pressure between said printing drum and said counterpressure member in synchronism with the passage through said printing bight of said copy sheet and said master image to effect selective line printing, copy sheet conveyance means defining a travel path for said copy sheet up to said printing bight, first copy sheet restraining means at a first position along said copy sheet travel path, said first copy sheet restraining means bearing against both sides of the copy sheet moving therepast so as to exert a retarding drag thereon and being separated from said printing bight by a portion of said copy sheet travel path which is devoid of any further continuously effective copy sheet restraining means, movable supplementary copy sheet restraining means located at a second position along said copy sheet travel path between said first position and

said printing bight, said supplementary copy sheet restraining means being movable between an operative position in which it is effective to impose restraint upon movement of said copy sheet along said path and an inoperative position in which it does not impede the free travel of said copy sheet along said travel path, copy sheet sensing means located in the immediate vicinity of said first position for detecting the presence or absence of a copy sheet at said first position, and operating means for said movable supplementary sheet restraining means responsive to said sheet sensing means to move said supplementary copy sheet restraining means to an inoperative position whenever a copy sheet is present at said first position.

2. A duplicating machine as claimed in claim 1, wherein said operating means includes means responsive to said sheet sensing means to move said supplementary copy sheet restraining means to an operative position when the trailing edge of a copy sheet passes through said first copy sheet restraining means.

3. A duplicating machine as claimed in claim 1, wherein said sheet sensing means includes an electric switch having a movable feeler disposed in the path of copy sheets in said first position.

4. A duplicating machine as claimed in claim 1, further including a displaceable sheet feed roller, means mounting the sheet feed roller for movement toward said travel path to convey copy sheets along the travel path and for movement away from said travel path, and switch means operable by movement of said sheet feed roller, said operating means being responsive to said sheet sensing means and to said switch means to move said supplementary copy sheet restraining means to an inoperative position whenever a copy sheet is present at said first position and said feed roller is disposed in said travel path.

References Cited in the file of this patent

UNITED STATES PATENTS

1,212,242	Novick	Jan. 16, 1917
2,758,539	Ritzerfeld et al.	Aug. 14, 1956
2,860,574	Ritzerfeld et al.	Nov. 18, 1958
3,016,825	Ritzerfeld et al.	Jan. 16, 1962