

June 30, 1953

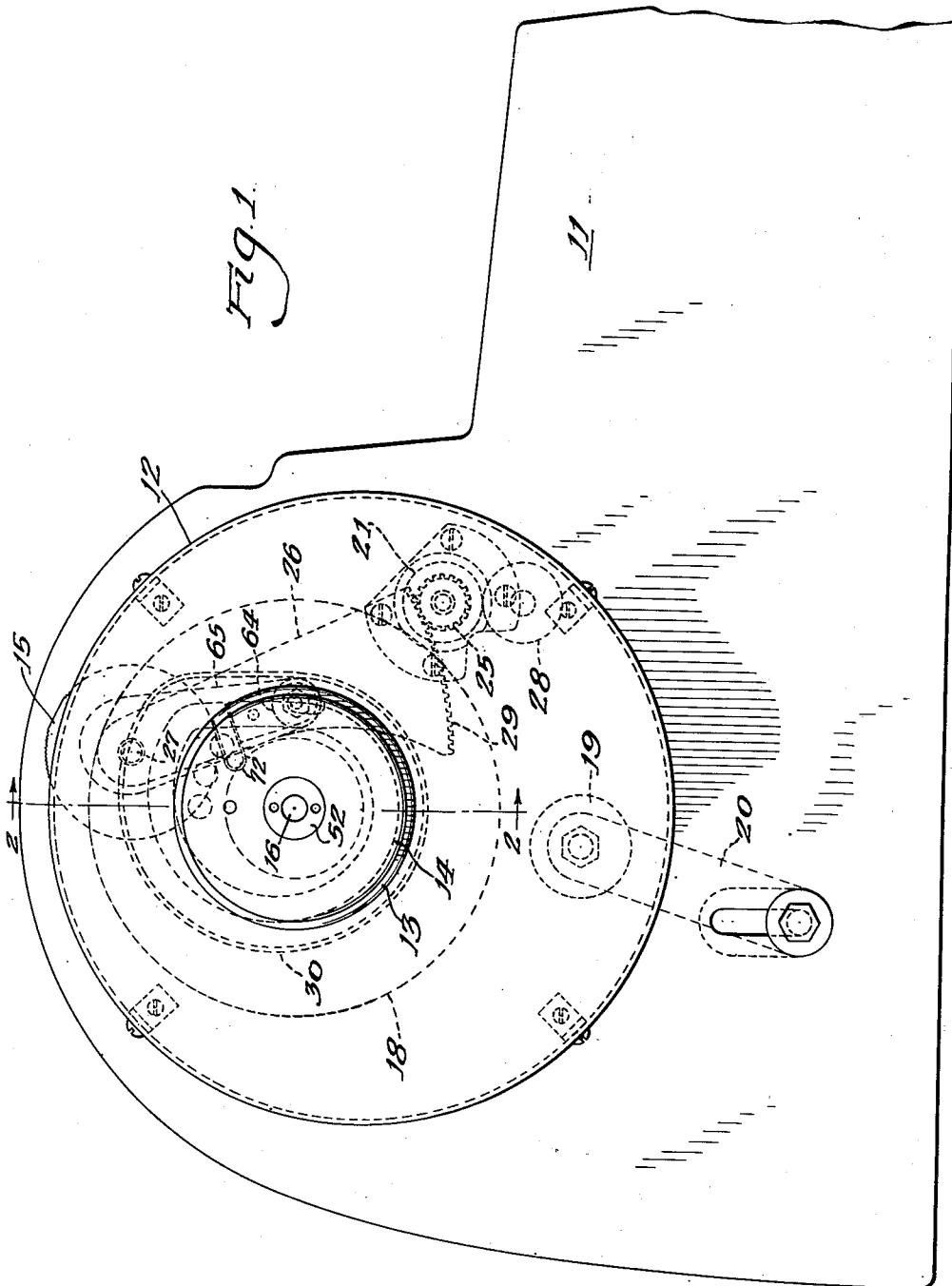
C. A. LEVIN ET AL

2,643,607

REGISTRATION MEANS FOR DUPLICATING MACHINES

Filed Feb. 3, 1950

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 2.

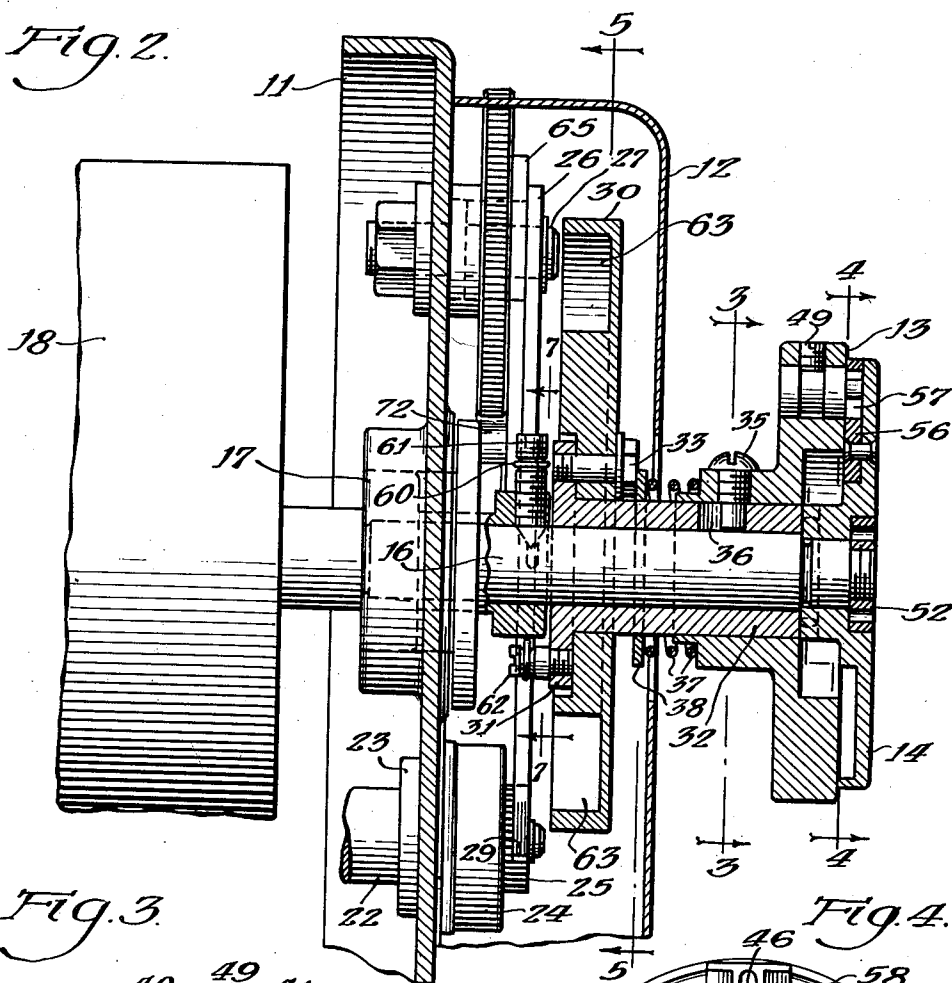


Fig. 3.

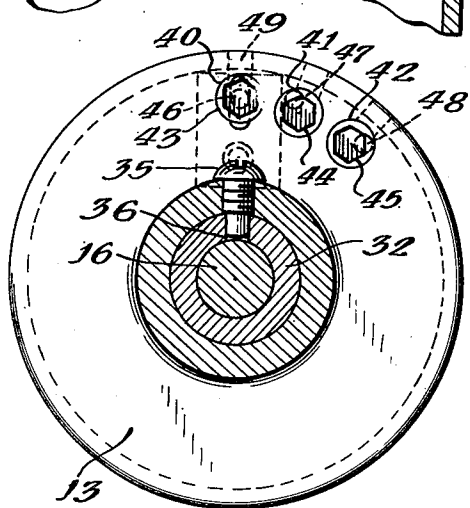
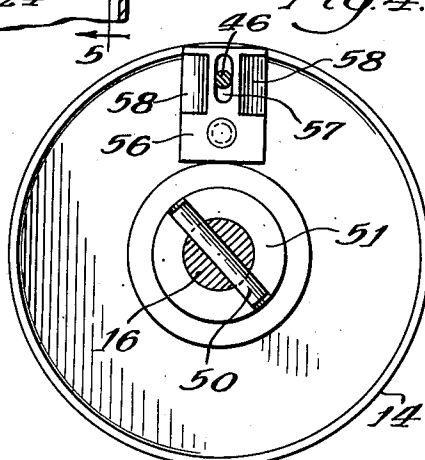


Fig. 4.



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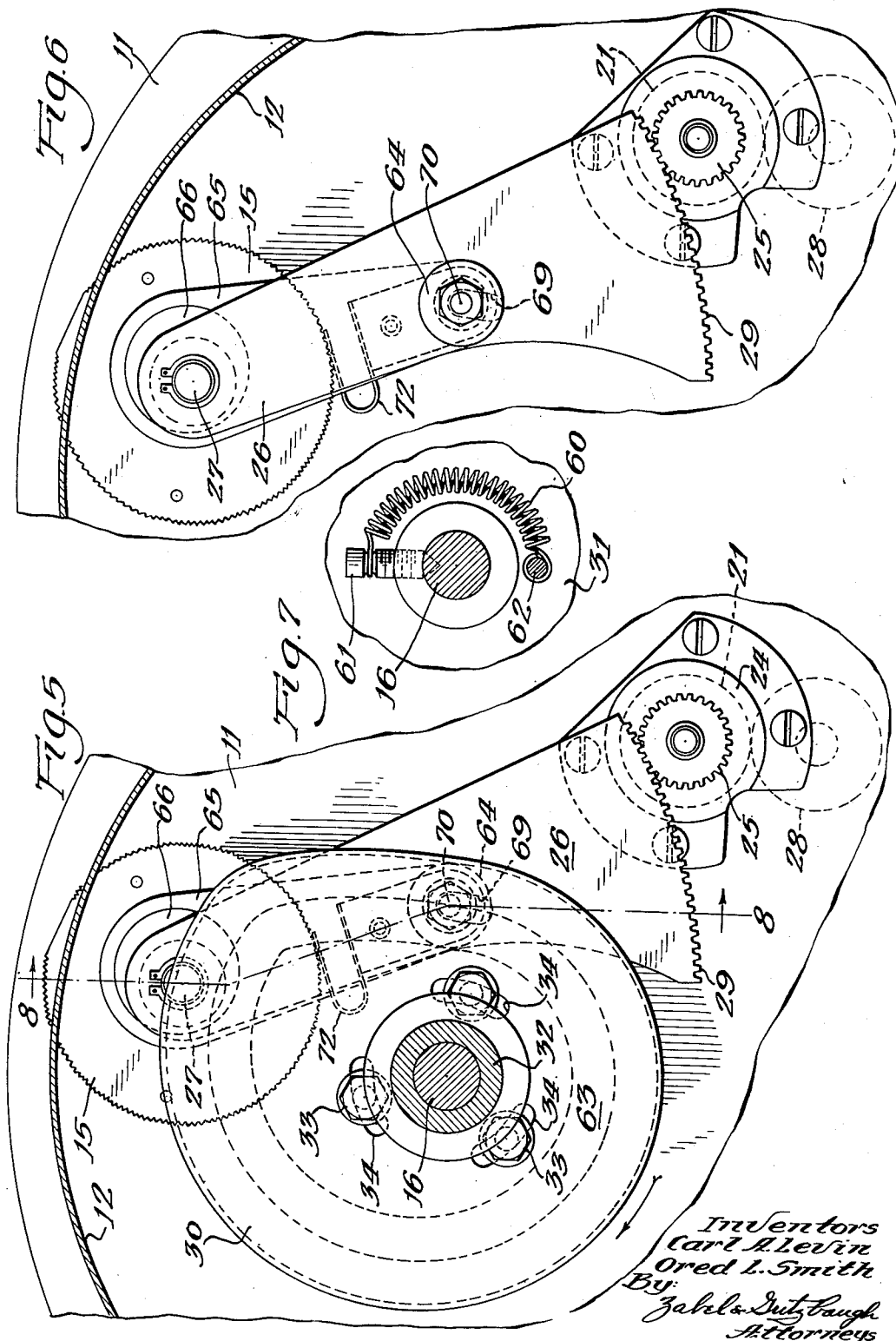
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4 Sheets-Sheet 4

Fig. 8

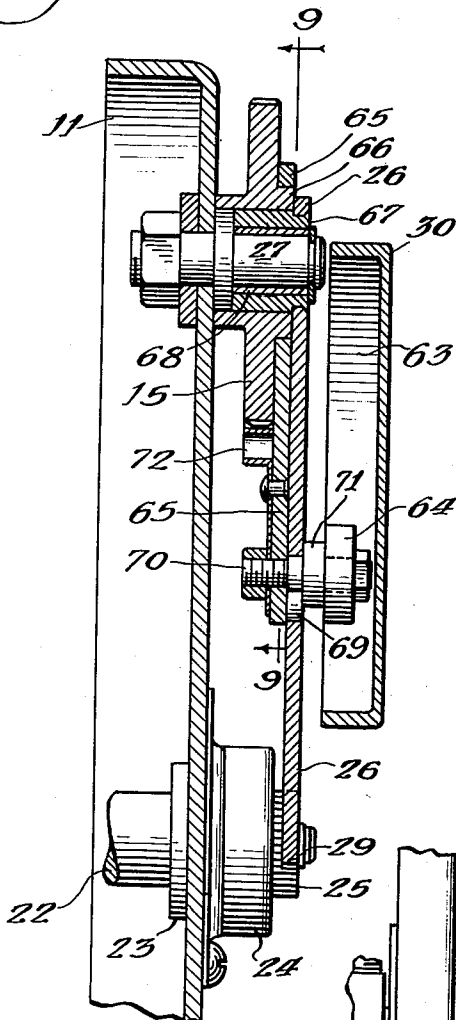
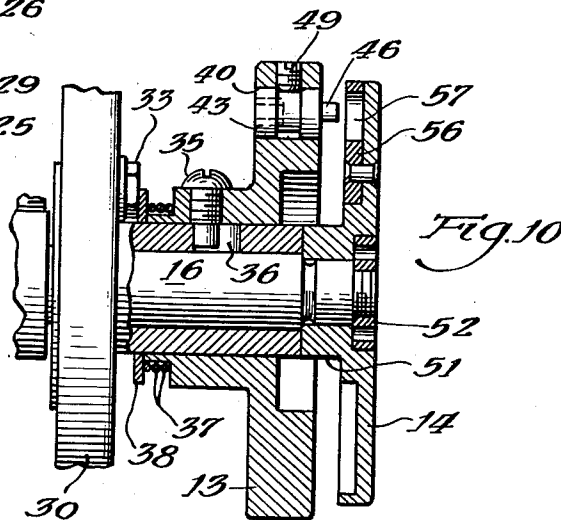
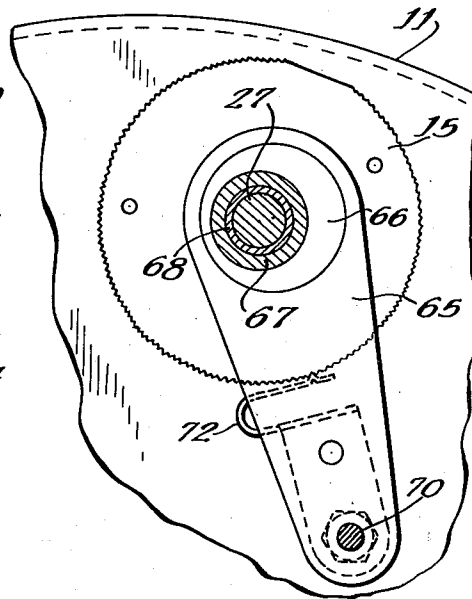


Fig. 9



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UNITED STATES PATENT OFFICE

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REGISTRATION MEANS FOR DUPLICATING MACHINES

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14 Claims. (Cl. 101—232)

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This invention relates to duplicating machines, and in particular to means for adjusting the registration of the copy sheet with the drum or printing couple, to the end that the top margin of the printed copy sheet may be regulated.

The invention is shown and described herein with respect to a duplicating machine of the wet process type in which the printing couple comprises a drum and a cooperating pressure roll. The matter to be duplicated is in the form of a master sheet which is secured to the drum in a predetermined position. This type of machine is also provided with sheet feeding means in the form of a pair of feed rolls which are intermittently rotated in order to properly position the copy sheet with respect to the master sheet. These feed rolls may also serve as a moistening means. However, it is obvious that the present invention is applicable to other types of duplicating machines in which the matter to be duplicated is in a form other than that of a wet process master sheet, and which includes a somewhat different form of printing couple and sheet feeding means.

In such devices, registration is accomplished by the intermittent rotation of the sheet feeding device which is driven in timed relationship with the drum so that the copy sheet will be put into motion at such time that its leading edge will be engaged by the drum at a point which is forwardly of the first line of the matter to be duplicated by a distance which corresponds to the desired margin. According to this arrangement, the sheet feeding device is driven from the drum or the drum driving means, and in order to regulate the margin, various expedients have been proposed for adjusting the timing. Such expedients generally involve the angular adjustment of one rotatable element with respect to another, such as the position of the drum with respect to a cam, a gear or other rotatable element.

Due, however, to the mass of rotating parts, and due to the fact that duplicating machines generally embody means to bring the drum to a stop in a so-called "home position," such expedients have in the past, necessitated the use of positive locking means which lock the relatively adjustable members only in one of a series of predetermined positions, or in the alternative, have necessitated the use of screw-threaded clamping means for urging the adjustable parts into very tight frictional engagement. The first alternative does not provide an infinite number of adjusted positions, and the adjustment provided by the second alternative cannot readily

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be made by the average operator due to the difficulty of providing a sufficiently tight clamping engagement without the use of special tools. Furthermore, since the adjustably mounted elements are rotating elements, they are generally not accessible, with the result that the adjustment of such clamped elements is a service operation.

It is an object of the present invention to provide an adjustment means of the type indicated which avoids the disadvantages pointed out above, and which provides an infinite number of adjusted positions and which is readily accessible to the operator.

A further object is to provide a margin adjusting means which utilizes two separate means, one of which shifts the cycle of operation of the feed roll with respect to the drum by predetermined increments, and the other of which shifts said cycle by infinitesimal increments. There is thus provided what may be termed "coarse adjustment" and a "fine" adjustment which cooperate with each other to produce a fine adjustment throughout a much greater range than has heretofore been provided by mechanisms of this sort.

Another object is to provide, in mechanisms of this sort which embody a cam and a follower for actuating the feed roll, means for shifting the position of the follower with respect to the cam so as to shift the cycle of operation of the feed roll.

Still another object is to provide a margin adjusting means of the coarse adjustment type which may be regulated to produce a very fine adjustment of the several predetermined positions provided thereby.

A still further object is to provide comparatively simple and inexpensive means for adjusting the position of a cam with respect to the drum of a duplicating machine and for adjusting the position of a cam follower with respect to the cam.

Other objects, advantages and features will become apparent as the description proceeds.

With reference now to the drawings in which like reference numerals represent like parts:

Fig. 1 is an elevation of a duplicating machine embodying a preferred embodiment of our invention;

Fig. 2 is a vertical section taken along line 2—2 of Fig. 1;

Fig. 3 is a section taken along line 3—3 of Fig. 2;

Fig. 4 is a section taken along line 4—4 of Fig. 2;

Fig. 5 is a section taken along line 5—5 of Fig. 2;

Fig. 6 is a section similar to Fig. 5 but showing the cam removed so as to show the underlying parts in elevation;

Fig. 7 is a section taken along line 7—7 of Fig. 2;

Fig. 8 is a section taken along line 8—8 of Fig. 5;

Fig. 9 is a section taken along line 9—9 of Fig. 8; and

Fig. 10 is a section similar to that of Fig. 2 but showing the parts in changed position.

The duplicating machine as shown in Fig. 1 includes a side frame 11 on which is mounted a circular housing 12 which serves to conceal certain of the parts. Projecting from the housing is an adjusting knob 13 which is provided with an end plate 14. A control disk 15 projects from the upper part of the housing 12.

As shown in Fig. 2, a shaft 16 is journaled in the side frame 11 by means of a bearing 17. A drum 18 is keyed to the shaft for rotation therewith. A pressure roll 19 is disposed beneath the drum and is adjustably mounted by means of arms 20 and the other elements not shown.

Disposed in front of the drum is a feed roll 21 which is carried on a shaft 22. The shaft is journaled at one end in a suitable bearing 23 which is mounted in side frame 11. The shaft and feed roll are driven by means of a gear 25 which operates through an over-running clutch 24 in the usual manner, so that the feed roll may be driven only in one direction. A sector 26, which includes a rack 29, meshes with and drives the gear 25, the sector being mounted for oscillation on a pivot pin 27 which is carried in side frame 11. Thus, oscillation of the sector will cause the feed roll 21 to be rotated intermittently only in one direction.

As shown in Fig. 1, a lower feed roll 28 is suitably mounted for engagement with the upper feed roll so that a sheet may be fed between the feed rolls 21 and 28 and into engagement with the drum and the pressure roll. The drum may be caused to rotate either continuously or intermittently, and the intermittent rotation of the feed rolls is so timed that they begin their rotation at such a point in the cycle of operation that the position of the leading edge of the copy sheet with respect to the drum may be regulated. When the feed rolls are stationary, they serve as a stop against which the leading edge of the copy sheet may be positioned. The length of the sector 26 is sufficient to positively drive the feed rolls until such time as the leading edge is engaged by the drum and pressure roll, after which time, the drum and pressure roll pull the sheet through the feed rolls, which action is possible by virtue of the over-running clutch.

The sector 26 is oscillated by means of a cam 30 which rotates with the shaft 16 and the drum 18. The cam is secured to the flange 31 of a sleeve 32 by suitable means, such as screws 33 which pass through slots 34 formed in the cam. This arrangement permits the angular position of the cam with respect to the drum to be adjusted, although this adjustment is in the nature of a factory adjustment due to the inaccessibility of the screws 33 and the necessity to provide a very tight clamping action.

Other means are provided to permit the operator to adjust the position of the cam with respect

to the drum so that registration can be regulated. This means includes the adjusting knob 13 which is slidably mounted on sleeve 32 and keyed thereto by means of a screw 35 which extends into a slot 36 formed in the sleeve. Thus, the knob can be displaced axially, but rotation of the knob 13 with respect to the shaft causes angular adjustment of the cam 30 with respect to the shaft.

A spring 37 surrounds the sleeve 32 and urges the knob 13 outwardly. A washer 38, which rests against the screws 33, serves for an abutment for the inner end of the spring 37.

The knob 13 is provided with a plurality of circumferentially arranged bores, three bores 40, 41 and 42 being shown in the present embodiment. Plugs 43, 44 and 45 are held in the bores by set screws 49. Plugs 44 and 45 are provided with eccentric pins 47 and 48 respectively and plug 44 is provided with a concentric pin. These pins are alternatively adapted to be received in a slot 57 formed in slotted plate 56 which is carried by end plate 14. End plate 14 is non-rotatably secured to the shaft 16. Thus, the cooperation between the eccentric pins and the slotted plate 56 provides three different angular adjustments of the cam with respect to the drum.

The end plate 14 is fitted over the reduced end of shaft 16 and is keyed thereto by a pin 50, as shown in Fig. 4. The central portion of the end plate comprises a slotted hub 51 which accommodates the pin 50. A nut 52 is threaded onto the end of shaft 16 and holds the end plate in position. The slotted plate 56 is provided with tapered surfaces 53 which facilitate the adjusting operation.

A spring 59 is tensioned between a screw 61 which bites into shaft 16, and a pin 62 which projects from the flange 31, as shown in Figs. 2 and 7. This spring provides a load on the knob 13 so as to prevent any rattling which might occur due to clearances between the pins 46—48 and the slotted plate 56.

The coarse adjustment provided by the knob 13 and its associated parts is an adjustment of predetermined increments.

For instance, the spacing between any two adjacent plugs may represent a distance of $1\frac{1}{2}$ inches on the master sheet. Thus, in certain types of system work where the identical information is to be duplicated in different positions on different printed forms, the adjustment provided by knob 13 permits the change over from one form to another to be made instantaneously.

By varying the angular positions of the plugs 44 and 45 to shift the position of the eccentric pins 47 and 48, the position of the drum can be regulated half an inch one way or the other. Thus, when the concentric pin 46 engages the slotted plate, the copy can be duplicated in what may be called its normal position on one form. A second set of forms may require the copy to be duplicated at a position from one to two inches further down on the form, and a third set of forms may require still another position which is from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches from the normal duplicating position. By providing additional plugs, additional sets of forms can be accommodated in like manner. Thus, the coarse adjustment is in itself of utility in certain types of systems work since the margin can be shifted practically instantaneously to accommodate the margin requirements of several different sets of forms.

Means are also provided to regulate the registration by infinitesimal increments, as contrasted with the predetermined increments provided by

the knob 13, so as to provide a fine margin adjustment throughout a range of several inches. Such means comprise a follower 64 in the form of a roller which is adjustably mounted on the sector 26 by means of an arm 65. The arm is pivotally mounted on an eccentric hub 66 which is integral with the control disk 15. The hub is rotatably mounted on a sleeve 67 which surrounds the pivot pin 27 and to which sleeve is staked the sector 26. An anti-friction bushing 68 is interposed between the pivot pin and the sleeve 67. As shown in Figs. 6 and 8, a slot 69 is provided in sector 26 in which slot the follower 64 is mounted. The follower includes a stud 70 which passes through the slot and takes into arm 65. A flanged portion 71 of the stud serves as a spacer to maintain the follower roller in the groove 63 of the cam.

It will be observed that by rotating the control disk 15, the arm 65 and the follower 64 will be slidably moved in a radial direction with respect to the pivotal mounting of the sector 26. This adjustment is made when the cam 30 and the drum are stationary in their home position as shown in Fig. 5. Thus, the cycle of operation of the feed roll may be shifted with respect to the drum cycle, and since an infinite gradation of the follower position is provided, the margin may be regulated in the same manner.

A click 72 is mounted on the follower stud 70 and on the arm 65 and engages the edge of the control disk, which may be knurled, in order to maintain the control disk and the follower in their adjusted positions.

By mounting the eccentric hub 66 concentrically with the sector, there will be no relative motion between the two during normal operation of the machine, which considerably simplifies the problems of lubrication and wear.

By mounting the cam 30 on an axial sleeve which extends outwardly beyond the housing 12, it is possible to provide a simple means of obtaining a coarse adjustment which is readily accessible to the operator.

Although the cam 30 is shown as a groove cam, it is obvious that the usual type of cam may be substituted therefor. However, by the use of a grooved cam in which the width of the groove closely corresponds with the diameter of the follower roller, the usual spring is eliminated and hence the load on the mechanism is reduced.

The operation has been described in detail in connection with the description of the several parts. In summary, the margin is regulated by regulating the time at which the feed rolls begin their rotation with respect to the angular position of the drum. This timing is regulated first by adjusting the angular position of the drum with respect to the cam 30 to provide a coarse adjustment, and secondly by regulating the position of the follower 64 with respect to the cam 30 to provide a fine adjustment.

Where the margin regulation is comparatively small in extent, that is, less than an inch, regulation is effected by rotation of the control disk 15. But where the regulation is of greater extent, the knob 13 is first operated to provide the desired coarse adjustment, and the fine adjustment is obtained by rotating the control disk 15.

In those instances where the machine is to be used constantly on two or three sets of forms, the plugs 44 and 45 may be adjusted so that the desired margin may be obtained merely by manipulation of the knob 13, thereby permitting

immediate change over of the machine from one margin to another.

If desired, the knob 13 may be provided with additional plugs to accommodate a greater range of margin regulation. Also, the plug 43 may be provided with an eccentric pin, rather than a concentric pin, if desired. Or, if desired, where three plugs are provided as shown herein, the middle plug may have a concentric pin, and the two outer plugs may have eccentric pins, thereby providing a somewhat greater range of adjustment than the arrangement herein shown.

Although only a preferred embodiment of our invention has been shown and described herein, it will be understood that various modifications and changes may be made in the construction shown without departing from the spirit of our invention as defined in the appended claims.

We claim:

1. In a duplicating machine having a feed roll, a drum and a shaft therefor, means for regulating the registration of a copy sheet as it is fed by said feed roll into operative engagement with said drum, comprising a cam rotating with said drum, a follower for said cam, a gear for driving said feed roll, overrunning clutch means disposed between said gear and said feed roll so as to permit unidirectional rotation of said feed roll, a sector for driving said gear, said follower being adjustably mounted on said sector whereby displacement of said follower by said cam will cause oscillation of said sector, means for adjusting the angular position of said cam with respect to said drum in predetermined increments, said means including a sleeve disposed on the end portion of said shaft, said cam being mounted on the inner end of said sleeve, a manually controlled knob mounted on the other end of said sleeve, and means for locking said knob to the end of said shaft in any one of several predetermined angular positions and means including a manually operated control member for regulating the position of said follower with respect to said sector whereby the cycle of operation of said sector will be shifted with respect to the cycle of operation of said drum in order that the registration of a copy sheet may be regulated without respect to said increments.

2. In a duplicating machine, a driving shaft, a cam secured thereto, a feed roll having a gear rotating therewith, a sector assembly including a pivotally mounted sector meshing with said gear and pivot means therefor, a cam follower adjustably mounted on said sector, manually operated eccentric means mounted on said sector assembly and a link extending in a direction generally tangent to said cam and having a portion surrounding said eccentric means and having another portion engaging said cam follower so that rotation of said eccentric means will cause the position of said link and said cam follower to be shifted circumferentially with respect to said cam in order that the cycle of operation of said sector and feed roll may be regulated.

3. A duplicating machine according to claim 2 having a frame, a pivot pin mounted on said frame, and in which said pivot means includes a sleeve rotatably mounted on said pivot pin, said sector being carried by said sleeve, and said eccentric means being rotatably mounted on said sleeve whereby no relative rotation between said eccentric means and said sleeve will occur due to the rotation of said cam.

4. In a duplicating machine having a drum shaft, means for rotating the same, and means

for stopping said drum shaft in a home position, the combination of a cam secured to said drum shaft, a feed roll having a gear rotating therewith, a pivotally mounted sector meshing with said gear, a pivot therefor, a cam follower adjustably mounted on said sector, a rotatable control member mounted coaxially with said pivot, an eccentric hub on said control member and rotatable therewith, and a link disposed adjacent said sector and extending in a direction generally tangent to said cam, said link having a portion engaging said eccentric hub and having another portion engaging said cam follower so that rotation of said control member when said drum shaft is stationary in home position will cause the position of said link and said cam follower to be shifted circumferentially with respect to said cam in order that the cycle of operation of said sector and feed roll may be regulated with respect to the rotation of said drum shaft.

5 A duplicating machine according to claim 4 in which said control member is in the form of a disk having a knurled edge, and a resiliently mounted member engaging said knurled edge to maintain said disk in adjusted position.

10 6. A duplicating machine according to claim 4 in which said sector is provided with a slot, and in which said cam follower includes a mounting stud which passes through said slot, said stud being secured to said link.

15 7. A duplicating machine according to claim 4 having overrunning clutch means interposed between said feed roll and said gear so that said feed roll will be driven in only one direction.

20 8. A duplicating machine according to claim 4 in which said cam is secured to said drum shaft by means of two cooperating members, one of which comprises an axially displaceable knob rotatably mounted on said drum shaft and the other of which comprises an end plate keyed to said shaft, said cam and said knob being non-rotatably secured to each other, and means for locking said cooperating members together in any one of a plurality of angular positions.

25 9. A duplicating machine according to claim 8 in which said locking means comprises a plurality of axially projecting pins on one of said cooperating members, and a slotted plate mounted on the other of said cooperating members.

30 10. In a duplicating machine having a feed roll and a drum, means for regulating the registration of a copy sheet fed by said feed roll into operative engagement with said drum, comprising a cam rotating with said drum, a follower for said cam, a gear for driving said feed roll, overrunning clutch means disposed between said gear and said feed roll so as to permit unidirectional rotation of said feed roll, a displaceable rack for driving said gear, means including a manually operated control member providing an adjustable connection between said follower and said rack whereby displacement of said follower by said cam will cause displacement of said rack, a manually controlled knob for adjusting the angular position of said cam with respect to said drum in predetermined increments, whereby the cycle of operation of said displaceable rack will be shifted with respect to the cycle of operation of said drum, two cooperating members for establishing an adjustable driving connection between said shaft and said cam, said members being radially disposed with respect to said shaft at one end thereof, a sleeve connecting one of said members to said cam and being mounted on said shaft for relative movement with respect thereto, the other

of said members being keyed to said shaft, and means for locking said cooperative members together in any one of a plurality of angular positions, said first mentioned cooperating member constituting said manually controlled knob.

11. A duplicating machine according to claim 10 in which one of said cooperating members is axially displaceable, and in which said locking means comprises a plurality of axially projecting pins on one of said cooperating members, and a slotted plate mounted on the other of said cooperating members for receiving one of said pins.

12. In a duplicating machine having a drum shaft and a feed roll, the combination of a cam driven by said drum shaft for actuating said feed roll, a sleeve rotatably mounted on said drum shaft at an end portion thereof, said cam being non-rotatably secured to said sleeve at the inner end thereof, a knob slidably keyed to said sleeve at the outer end thereof, a radially projecting member secured to said drum shaft at a point adjacent said knob, and means providing a plurality of locking positions for said knob with respect to said radially projecting member whereby the angular position of said cam with respect to said drum shaft may be adjusted by means located at the end of said drum shaft.

13. In a duplicating machine having a feed roll, a drum and a shaft therefor, means for regulating the registration of a copy sheet fed by said feed roll into operative engagement with said drum, comprising a cam rotating with said drum, a follower for said cam, a gear for driving said feed roll, overrunning clutch means disposed between said gear and said feed roll so as to permit unidirectional rotation of said feed roll, a displaceable rack for driving said gear, means including a manually operated control member providing an adjustable connection between said follower and said rack whereby displacement of said follower by said cam will cause displacement of said rack, a manually controlled knob for adjusting the angular position of said cam with respect to said drum in predetermined increments, whereby the cycle of operation of said displaceable rack will be shifted with respect to the cycle of operation of said drum, two cooperating members for establishing an adjustable driving connection between said shaft and said cam, said members being radially disposed with respect to said shaft, said cam being secured to one of said members for relative rotation with respect to said shaft, and the other of said members being keyed to said shaft, and means for locking said cooperating members together in any one of a plurality of angular positions, said first-mentioned cooperating member constituting said manually controlled knob, one of said cooperating members being axially displaceable, said locking means comprising a plurality of axially projecting pins on one of said cooperating members, and a slotted plate mounted on the other of said cooperating members for receiving one of said pins, one of said pins being mounted eccentrically on a rotatable member, and said rotatable member being rotatably mounted in one of said cooperating members.

14. In a duplicating machine having a feed roll, a drum and a shaft therefor, means for regulating the registration of a copy sheet fed by said feed roll into operative engagement with said drum, comprising a cam rotating with said drum, a follower for said cam, a gear for driving said feed roll, overrunning clutch means disposed between said gear and said feed roll so as to permit

unidirectional rotation of said feed roll, a displaceable rack for driving said gear, means including a manually operated control member providing an adjustable connection between said follower and said rack whereby displacement of said follower by said cam will cause displacement of said rack, a manually controlled knob for adjusting the angular position of said cam with respect to said drum in predetermined increments, whereby the cycle of operation of said displaceable rack will be shifted with respect to the cycle of operation of said drum, two cooperating members for establishing an adjustable driving connection between said shaft and said cam, said members being radially disposed with respect to said shaft, said cam being secured to one of said members for relative rotation with respect to said shaft, and the other of said members being keyed to said shaft, and means for locking said cooperating members together in any one of a plurality of angular positions, said first-mentioned

cooperating member constituting said manually controlled knob, said locking means comprising three peripherally spaced plugs mounted on one of said cooperating members, pins projecting axially from said plugs, and a slotted plate mounted on the other of said cooperating members, the pins of the two outer plugs being eccentrically mounted with respect to said plugs, and the said two outer plugs being rotatably mounted with respect to said first-mentioned cooperating member.

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ORED L. SMITH.

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