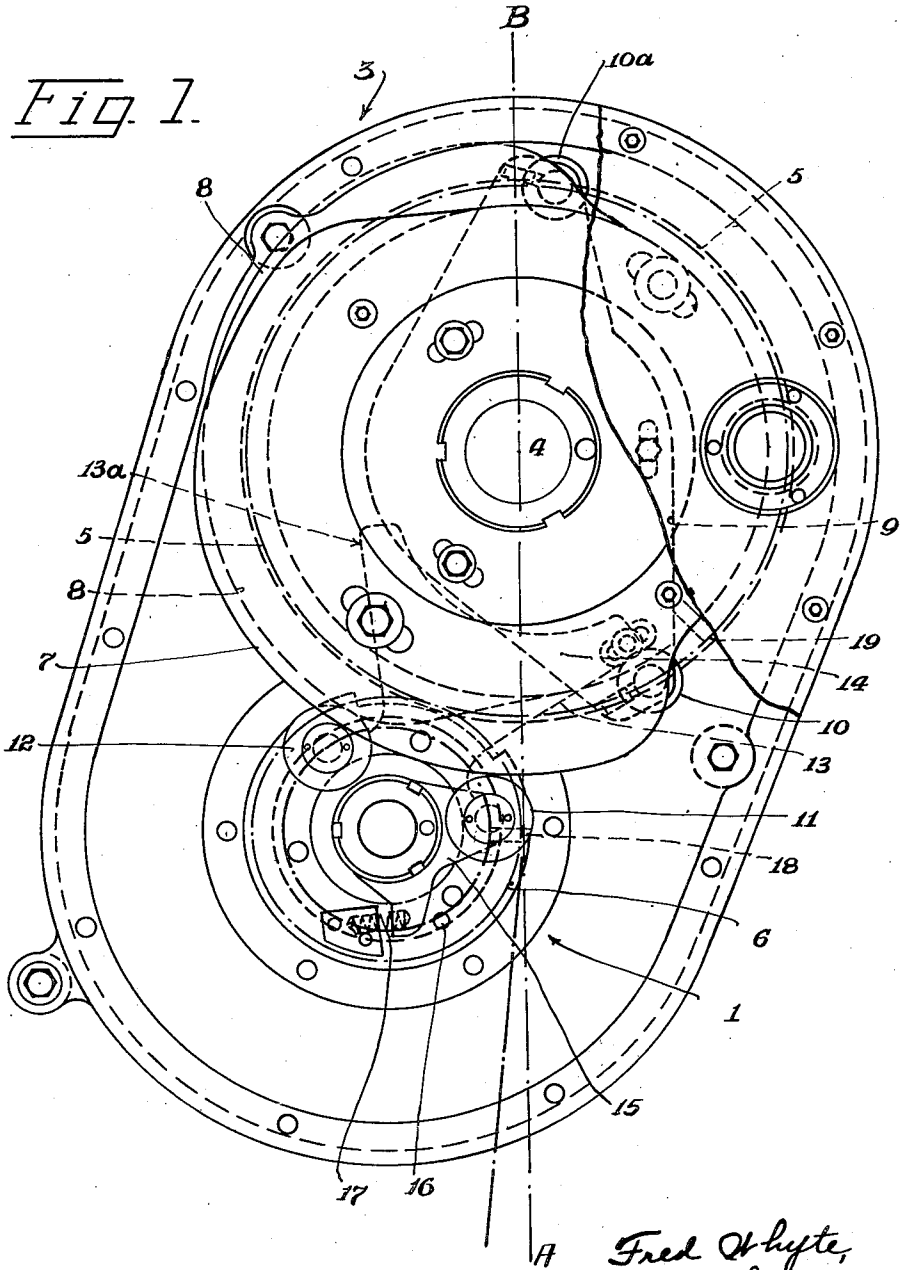
March 17, 1953 F. WHYTE 2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Filed Dec. 26, 1946 5 Sheets-Sheet 1

Fig. 1.



Fred Whyte,
Inventor

By Cushman, Darby & Cushman,
Attorneys

March 17, 1953 F. WHYTE 2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Filed Dec. 26, 1946 5 Sheets-Sheet 2

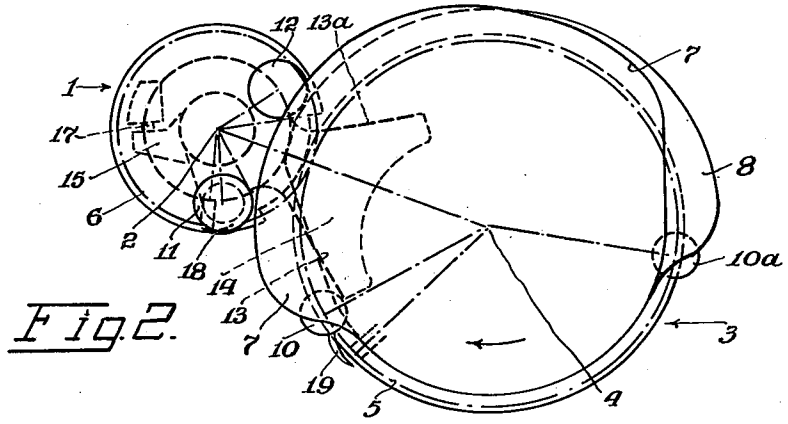


Fig. 2.

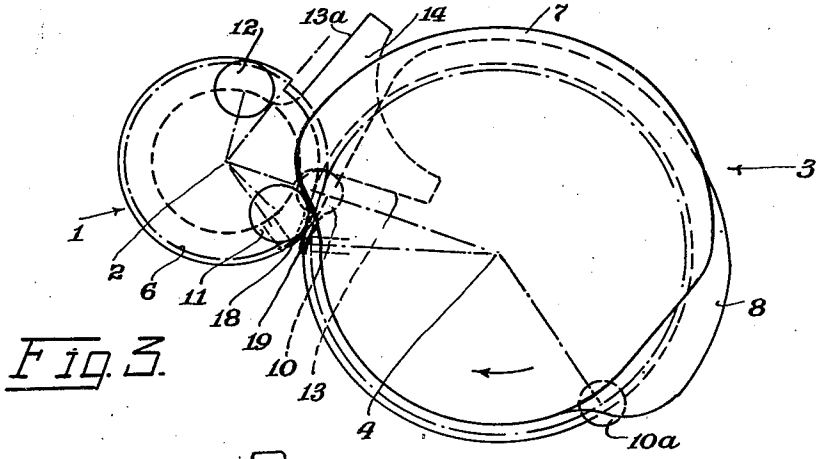


Fig. 3.

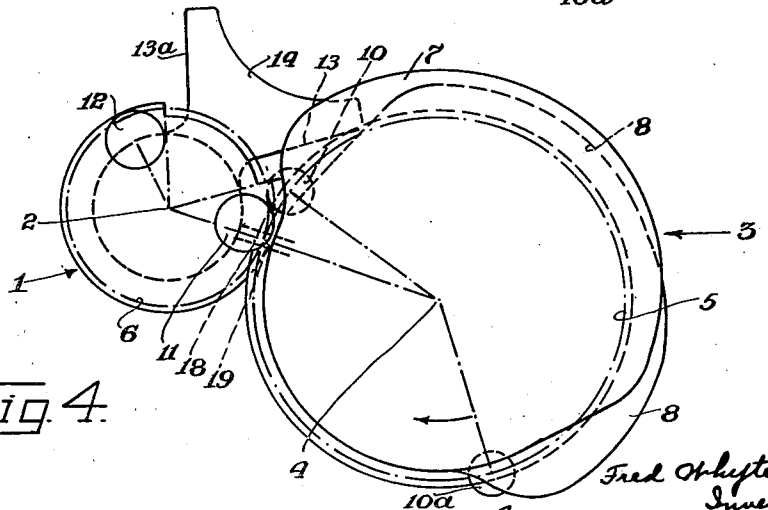


Fig. 4.

Fred Whyte,
Inventor
By Cushman, Darby & Cushman
Attorneys

March 17, 1953 F. WHYTE 2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Filed Dec. 26, 1946 5 Sheets-Sheet 3

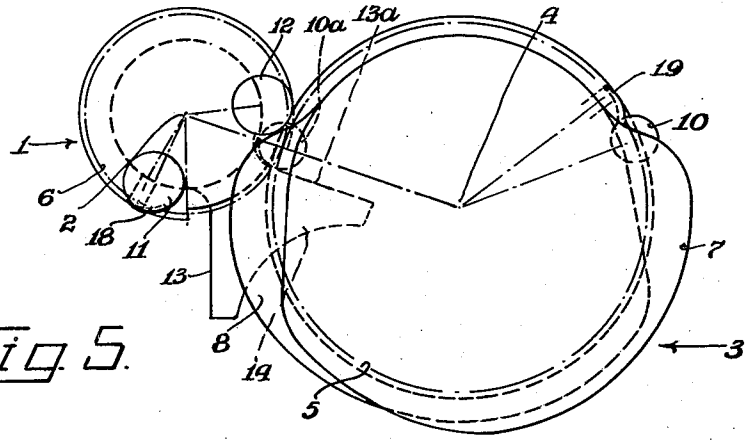


Fig. 5.

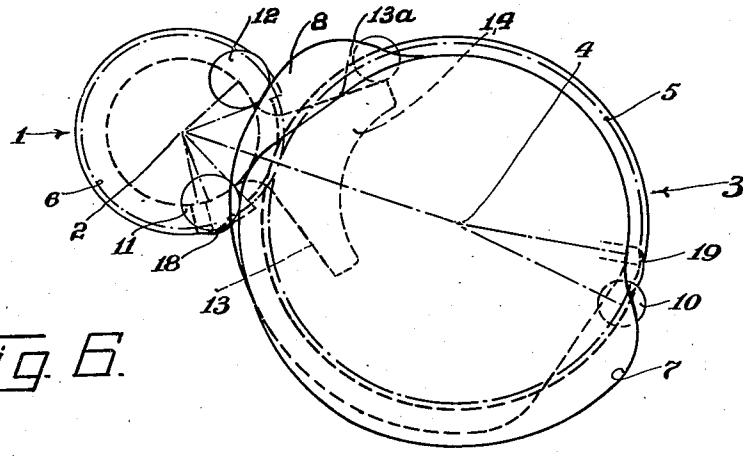


Fig. 6.

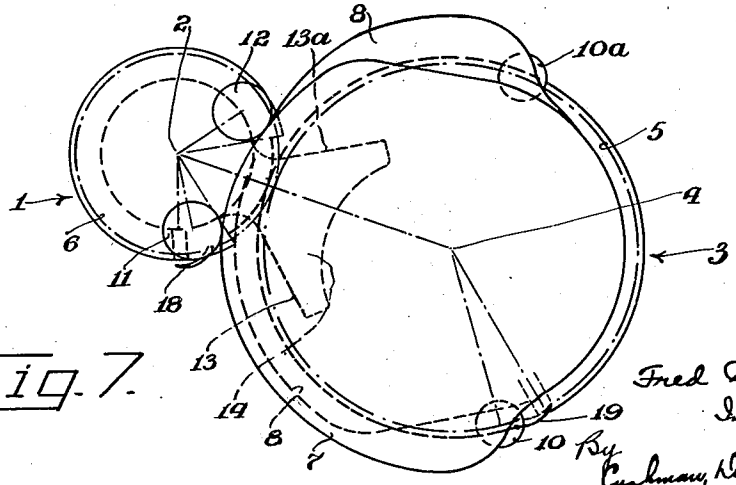


Fig. 7.

Fred Whyte,
Inventor

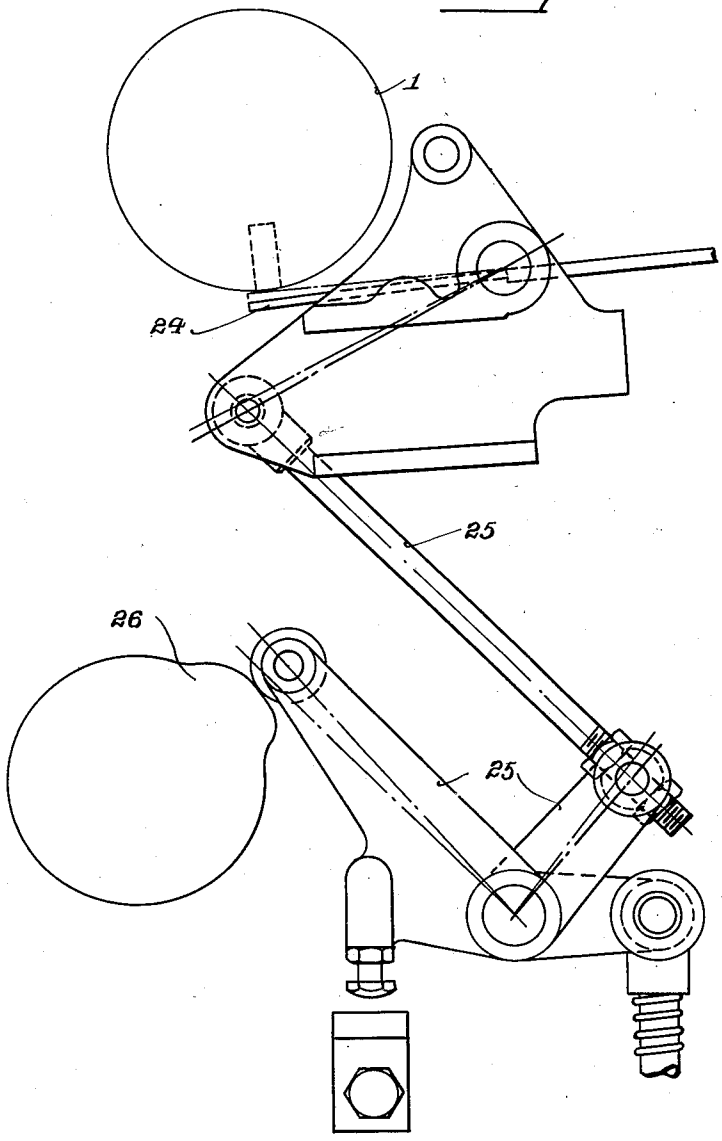
By Cushman, Darby & Cushman,
Attys

March 17, 1953 F. WHYTE 2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Filed Dec. 26, 1946 5 Sheets-Sheet 4

Fig. 8.



Fred Whyte, Inventor

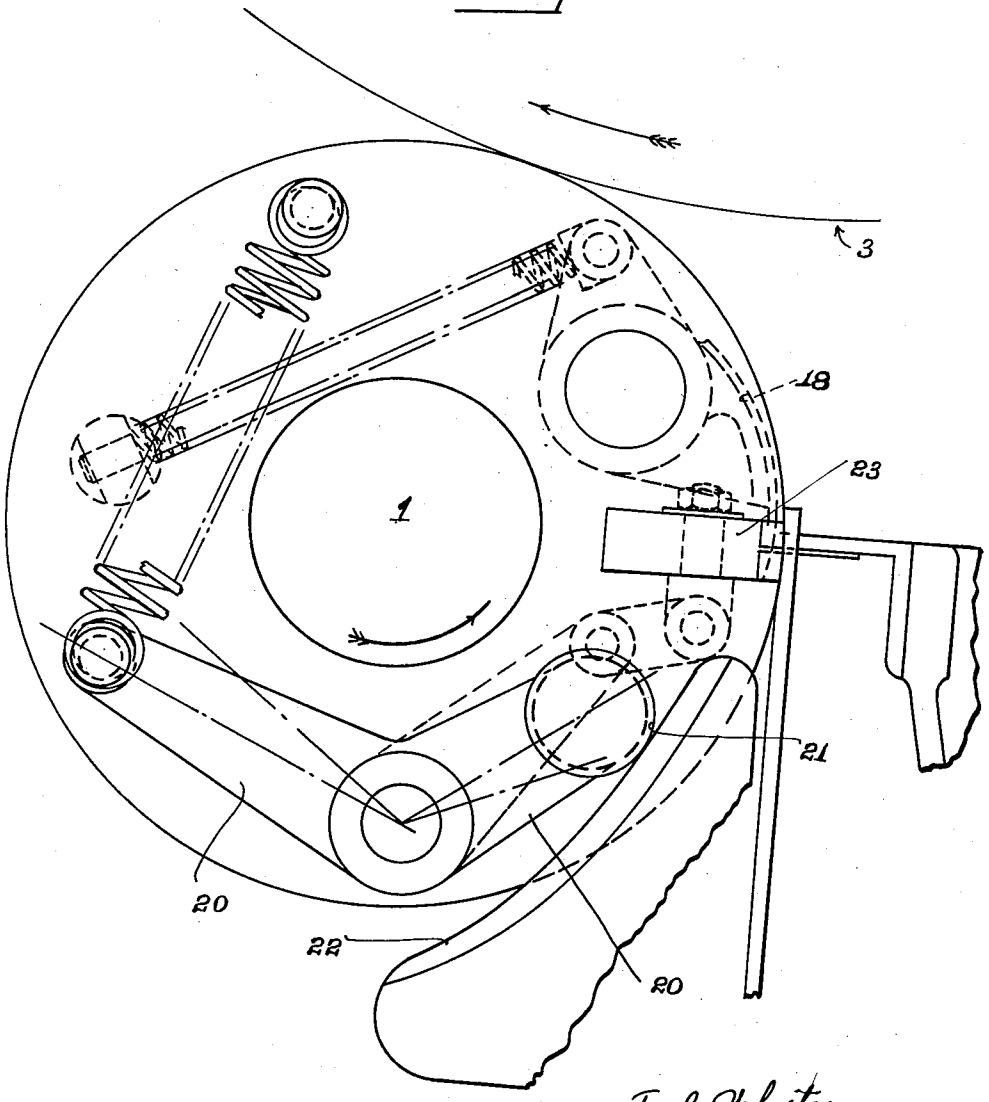
By Cushman, Darby & Cushman, attorneys

March 17, 1953 F. WHYTE 2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Filed Dec. 26, 1946 5 Sheets-Sheet 5

Fig. 9.



Fred Whyte
Inventor
By
Cushman, Darby & Cushman,
attorneys

Patented Mar. 17, 1953 2,631,849

UNITED STATES PATENT OFFICE

2,631,849

FEEDING AND REGISTRATION OF SHEETS TO PRINTING MACHINES

Fred Whyte, Otley, England, assignor of one-half to Waite & Saville Limited, Otley, England, a British company

Application December 26, 1946, Serial No. 718,298
In Great Britain October 13, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires October 13, 1965

5 Claims. (Cl. 271—51)

1

This invention relates to the feeding and registration of sheets to printing or like machines and more particularly to feed gripper and sheet transfer mechanism of the intermittent rotary type.

One object of the invention is to enable relatively long sheets to be accurately fed and registered to an impression or like printing cylinder of a given diameter. A further object is to permit the rotary feed grippers to clear the front edge portion of a sheet resting up against the front lays. Another object is to ensure a sheet being accurately gripped whilst at rest and gradually and positively accelerated up to the same circumferential speed of the cooperating impression or like cylinder.

A still further object is to enable the feed gripper to be driven at the same normally constant speed of the cylinder during a substantial portion of one cycle and during which the sheet may be transferred in accurate register to said cooperating cylinder, and also to permit of the feed gripper being disengaged so that it may be gradually and positively decelerated to a position of rest prior to gripping a succeeding sheet.

Other objects are to ensure the rotary feed gripper to be accurately registered and locked in position for gripping the sheet in a position of rest; to positively control the rotary feed gripper throughout the complete cycle of operations, irrespective of any variation in speed or reversal of direction of rotation of the printing or like machine; to eliminate and provide for the adjustment of backlash as well as the taking up of wear likely to be detrimental to the accurate registration of the sheets; to reduce the amount of wear to a minimum.

According to the invention means are provided whereby during the deceleration of the feed gripper the latter is first brought to rest in advance of the sheet taking position, whilst the extreme tips of the grippers will move beyond the sheet resting against the front lays.

More specifically the intermittent rotary feed gripper operating mechanism comprises acceleration and deceleration driving rollers mounted on the impression cylinder, normally rotating at uniform speed, and cooperating with two cams on the feed gripper shaft, a quadrant gear mounted on the feed gripper shaft, meshing intermittently with a driving gear on the impression cylinder, two separate follower cams mounted on the impression cylinder cooperating with two follower rollers mounted on the feed gripper shaft, arranged in such a manner that in each complete

2

rotation of the impression cylinder the feed gripper has a stationary period, an acceleration period, a uniform travel period and a deceleration period.

The intermittent rotary feed gripper mechanism comprises a shaft mounted, preferably on antifriction bearings, in the main frame of a printing or like machine. On the intermittent shaft are mounted arms or a member of cylindrical construction carrying the gripper bar or seats and a further shaft carries a number of cooperating grippers together with associated apparatus for opening and closing the grippers in such a manner that a sheet which has been laid on a feed board or plate and registered against the front lays also of the usual kind may be gripped whilst the feed gripper mechanism is at rest and later transferred to a further set of grippers similarly mounted and operated on the impression or like cylinder of the printing machine. Keyed on the intermittent shaft is a control member having two cam arms cooperating with a uniformly revolving member of the printing machine, for example, the impression cylinder. Also mounted on the impression or like cylinder is a driving gear intermittently engaging and disengaging with a quadrant gear mounted integrally with a control cam member of the intermittent shaft, the proportions of the roller radii and cam faces being such that on a centre line between the driving member and the intermittent shaft centres the linear speeds of the cooperating gripper bars or seats are equal as also when the two gears are driving in mesh with each other. The angles of the cam faces on the control cam are such that with the intermittent shaft at rest in the sheet taking position, also while at rest on the decelerated position, they are substantially tangential to the centre of the driving member and the respective roller point of contact in each case.

The number of teeth in the quadrant gear on the intermittent shaft is such that when the first cam face of the control cam under the influence of the accelerating driving roller has reached a point substantially parallel to a line running between the centres of the intermittent shaft and the driving member at which point the two members are travelling with the same circumferential speed, the driving gear becomes engaged with the quadrant gear. This engagement is maintained until the decelerating roller, which is suitably angularly disposed in relation to the accelerating roller, engages the second cam face, again parallel to a line across the centres and with the two

members travelling at substantially the same circumferential speed. At this point the gears disengage and the momentum of the intermittent shaft is gradually retarded by the deceleration roller until at the tangential point the shaft is stationary and the roller runs clear of or disengages the control cam face.

During the periods of deceleration and acceleration the changes in velocity of the intermittent shaft are smooth, gradual and without shock. Similarly with the engagement and disengagement of the constant speed drive. Since both of these take place whilst the corresponding members are rotating with the same linear speed, no shock or abrupt change of movement will occur.

As applied to a printing machine, the forces of inertia and momentum in the intermittent rotary feed gripper are such that the acceleration and deceleration control cam faces are maintained in natural contact with the respective driving rollers. During periods of change in velocity of the printing machine, such as might occur when starting, stopping and alterations in running speed or in the event of the printing machine being moved or rotated in the reverse direction the forces referred to may become changed to such an extent as to interfere with the satisfactory operation of the mechanism. For this reason it is proposed to mount two separate follower cams on the constant speed member, preferably integral with the driving gear and roller driving member referred to. Cooperating with these cams are two rollers or runners suitably mounted and spaced on the intermittent rotary feed gripper shaft in such a manner that during the period of acceleration one of the cams substantially follows the normal path of its corresponding roller and similarly during the period of deceleration the other cam substantially follows the path of the other roller. Since both these cams operate in opposition to the control cam faces the movement is substantially positive irrespective of any changes in forces or velocities which might occur.

In order that the invention may be clearly understood and readily carried into effect the same will now be more fully described with reference to and by aid of the accompanying drawings, in which,

Figure 1 is an elevation of a rotary feed mechanism for a printing or like machine constructed according to the invention;

Figures 2 to 7 are diagrammatic elevations of the relevant parts of the mechanism in the various stages in the complete cycle of operations;

Figure 8 shows an arrangement for lowering the front portion of the feed plate and

Figure 9 shows an arrangement for moving the gripper bar inside the normal radius of the rotary feed gripper.

Referring to the drawings, 1 represents an intermittent rotary feed gripper cylinder mounted on a shaft 2, said feed gripper taking the sheets from the feed board (not shown) and transferring them to a cooperating impression or like printing cylinder 3 mounted on a shaft 4 and adapted to be driven at a constant speed. On the constant speed shaft 4 is mounted a circular gear 5 and the shaft 2 carries a segment or quadrant gear 6 which meshes at times with the gear 5 thereby imparting to the rotary feed gripper cylinder 1 a constant speed motion during a substantial portion of each cycle. Two separate follower cams 7, 8, are mounted on the constant speed shaft preferably integral with each other and the driving gear 5. Also mounted on the constant speed shaft 4 is an arm 9 carrying an acceleration roller 10 and a spaced deceleration roller 10*a*. Cooperating with the cams 7, 8, are two follower rollers or runners 11, 12, suitably mounted and spaced in the intermittent rotary feed gripper shaft 2 in such a manner that during the period of acceleration one (7) of the cams substantially follows the normal path of the corresponding roller 11 and similarly during the period of deceleration the other cam 8 substantially follows the normal path of the other roller 12. The two cams 7, 8, operate in opposition to cam faces 13, 13*a* on a control cam or arm 14 on the intermittent shaft 2, so that the movement is substantially positive irrespective of any changes in forces or velocities which might occur.

One (12) of the rollers is mounted integrally with the quadrant gear 6 on the intermittent shaft 2, whilst the other roller 11 is carried on a separate lever 15 on the intermittent shaft 2 but is maintained in angular relationship against a suitable stop 16 on the quadrant gear 6 and on to its associated cam by means of a spring pressure device 17. If desired either roller 11 or 12 may be integrally mounted.

For the purpose of gripping the sheet during the stationary period it is desirable that the intermittent shaft 2 should be accurately registered and held in position whilst the sheet is being gripped. For the purpose it is proposed that the locking of the intermittent shaft 2 be effected by means of the follower rollers 11, 12, and cams 7, 8, referred to, the outer portions of both these cams 7, 8, being utilised for this purpose. In order to ensure accuracy and provide for self adjustment of backlash, the diameter of the cams 7, 8, hence the pressure on the rollers 11, 12, is such that the spring against the loosely mounted roller 11 becomes compressed, and this in turn tends to force the fixed roller 12 against the top surface of its corresponding cam surface without backlash and since at this period the top diameter of the cam 7 is inoperative the accurate positioning of the intermittent feed gripper is maintained for the purpose of gripping the sheet.

With rotary feed mechanism of this kind difficulty may be experienced owing to the grippers 18 on the intermittent shaft being required to clear the front edge portion of a sheet which may already be registered in position or resting against the front lays on the feed board of the printing machine. This is liable to occur more particularly in cases where it is desired to print a relatively long sheet on a cylinder of comparatively small diameter. In such cases the length of the gap and period of time or distance between the back edge of one sheet and the front edge of the next is relatively short, and it is, therefore, desirable that the second sheet should be in process of being registered against the front lays either before or immediately after the whole length of the first sheet has moved past the front lay position.

Various methods have been proposed to overcome this difficulty. These are generally complicated, however, and often introduce additional points of wear, likely to cause inaccurate registration and restriction in operating speed. In order to overcome the difficulty and objections referred to, it is, therefore, proposed that during

the deceleration period the intermittent rotary feed gripper instead of being brought to rest at the initial starting position and sheet gripping position it is first brought to rest at a point in advance of the extreme front edge on the sheet, and in such a manner that the extreme tips of the feed grippers 18, in closed position, will have moved beyond a sheet resting against the front lays, whereupon said grippers may be opened clear of the sheet and shaft 2 moved in a reverse direction.

In the preferred arrangement such reversal action is obtained by utilising the deceleration and acceleration follower and locking cams and rollers. Here again the cams 7, 8, are arranged in opposition and the spring mounted roller 11 utilised to maintain the fixed roller 12 in contact with its corresponding cam surface without play or backlash. After this reversal action has taken place the feed gripper i may be locked during the gripping of the sheet in the manner referred to.

Suitable means are arranged in conjunction with the feed grippers 18 for opening and closing same at the appropriate time in the cycle for the purpose of closing and gripping the sheet at the front lays, also at the point of transfer of the sheet to the cooperating impression or like cylinder. Means may also be provided whereby the feed grippers 18 are arranged so as not to close on or feed a sheet which has not been fed or registered correctly against the front lays, and moved clear of the path of the sheet after it has been gripped by the feed grippers.

Means are also provided whereby any normal wear may be taken up and in the preferred arrangement the whole accelerating, constant speed drive, decelerating, reversal and registration mechanism may be totally enclosed in an oil bath as shown in Figure 1 so as to reduce wear and noise of operation to a minimum.

The clearance of a sheet at the front lays by the feed grippers 18 is dependent upon the thinness of the tips of the grippers and/or the setting of the feed plate in relation to the bar or pads upon which the feed grippers seat. In order to ensure perfect gripping and registration of a sheet it is sometimes desirable that the sheet should be disposed closely to the feed gripper bar or seats, therefore additional means may be provided whereby the feed gripper bar or seats are mounted in such a manner that the bar or seats together with the grippers closed thereon may by cam or other means be withdrawn inside the radius normally occupied during the period when the grippers are passing the front edge portion of a sheet at the front lays. This would also enable the grippers to clear any portion of a preceding sheet which has not been drawn fully clear of the path of the feed gripper.

Such an arrangement is shown in Figure 9 wherein a spring controlled bell crank lever 20 is mounted on the rotary feed gripper 1 and having a roller 21 engaging a cam surface 22 so that as the feed gripper rotates the lever 20 is moved inwardly to withdraw the gripper bar 23 and grippers 18 inwardly as aforementioned.

Alternatively the feed plate may be arranged so that the whole or a certain front portion of same may be lowered to a position sufficient to enable the grippers 18 to clear a sheet at the front lays, after which it may be returned to its normal position when the grippers have passed and prior to their gripping the sheet.

Such an arrangement is shown in Figure 8, where 24 denotes the feed plate which is lowered to the position shown in full lines by a system of levers or linkage 25 controlled by a cam 26 to rock the levers 25 and thus lower the feed plate 24 as will be apparent from the drawing.

Operation

The various stages in the complete cycle of operations in one embodiment are shown in Figures 2 to 7 inclusive of the accompanying drawings.

In the position shown in Figure 2 the feed gripper mechanism is at rest and the feed grippers 18 have closed on a sheet. The accelerating roller 10 has just engaged with the control cam surface 13. The spring loaded follower roller 11 is just commencing to leave the top portion of the follower cam 7. The front lays which are not shown have been moved clear off the path of the sheet.

In the position shown in Figure 3 the feed grippers 18 carrying the sheet are accelerated to the same circumferential speed as the cooperating impression or like cylinder 3, the quadrant gear 6 engaging the constant speed driving gear 5. The spring loaded roller 11 is just running clear of the cam 7 at the lower end of the fall on the cam.

In Figure 4 the feed gripper 18 is at the sheet transfer point and the gripper is carrying the sheet travelling at the same circumferential speed as the cooperating impression or like cylinder 3, under the influence of the constant speed driving gear 5. The cylinder grippers 19 have closed on the sheet just prior to the feed grippers 18 opening to effect transfer at a point substantially on the centre line of the feed gripper and cylinder shafts 2 and 4. By reason of the meshing of the gears 5 and 6 the feed gripper continues rotation at the same rate and direction until the deceleration control cam surface 13*a* engages the decelerator roller 10*a*.

Figure 5 shows the feed grippers 18 at the beginning of the constant speed travel and just commencing to decelerate. At this point the quadrant gear on the feed gripper shaft 2 commences to disengage with the constant speed driving gear 5. At the same time the deceleration follower roller 12 approaches within a close distance of the deceleration follower cam 8 at the commencement of the rise. The cam is so shaped that this small clearance is maintained, due to the momentum normally possessed by the feed gripper shaft 2, acting to maintain the driving roller 10*a* in contact with the control cam face 13*a* throughout the deceleration period.

In Figure 6 the feed gripper mechanism is at rest with the gripper 18 closed at the end of the deceleration period. The decelerating roller 10*a* has travelled along the corresponding control cam face 13*a* to a point substantially tangential with the feed gripper shaft 2. At this stage the decelerating roller 10*a* would with further movement disengage with the control cam face 13*a*. At this point both the deceleration and acceleration follower rollers 11, 12, are in contact with high portions of the cooperating cams 7, 8. In this position the feed gripper 18 has been moved to a point in advance of the front edge of a sheet resting against the front lays and thus may be opened without fouling or disturbing the sheet as already described.

In the position shown in Figure 7 the feed gripper mechanism has been rotated in a reverse direction to the initial sheet taking posi-

tion and registered in this position with the gripper 18 open, this taking place under the influence of the acceleration and deceleration rollers 11, 12, and a suitable rise and fall on each of the peripheries of the corresponding cams 7, 8, which also maintain the feed gripper mechanism in this position during which the grippers 18 close on the sheet at the front lays ready for another cycle.

I claim:

1. Intermittent rotary feed gripper operating mechanism for printing machines, and the like, including a rotary feed shaft, an intermittent rotary feed gripper mounted on said shaft, a quadrant gear keyed to said shaft, a constant speed driving shaft, an impression cylinder operatively connected to said driving shaft, a circular gear mounted on said driving shaft and meshing intermittently with said quadrant gear to rotate the feed gripper at the same circumferential speed as the impression cylinder, two separate follower cams on said driving shaft, a member mounted on said driving shaft and having an acceleration driving roller and a spaced deceleration driving roller, said feed shaft having spaced control cams, one of said control cams being engageable with the acceleration roller and the other control cam engageable with the deceleration roller, two separately mounted follower rollers on the feed shaft and two corresponding follower cams on the driving shaft, one of the follower rollers being resiliently urged and relatively movable toward the other, one of said follower rollers being engageable with one of said follower cams and the other of said follower rollers being engageable with the other follower cam during the operation of the machine so that during the period of acceleration one of the follower cams follows the path of its complementary follower roller and during the period of deceleration the other follower cam follows the path of the other follower roller, the parts being constructed and arranged so that upon each complete rotation of the impression cylinder the feed gripper has a stationary period, an acceleration period, a uniform travel period, and a deceleration period.

2. Intermittent rotary feed gripper operating mechanism as called for in claim 1 wherein one of the follower rollers is mounted integrally with the quadrant gear and the other follower roller is carried by a separate lever on the feed shaft, and means are provided for maintaining the follower rollers in spaced angular relationship relative to each other.

3. Intermittent rotary feed gripper operating mechanism as called for in claim 1 wherein one of the follower rollers is mounted integrally with the quadrant gear and the other follower roller is carried by a separate lever on the feed shaft and is maintained in angular relationship against a stop by means of spring pressure.

4. Intermittent rotary feed gripper operating mechanism as called for in claim 1 wherein the feed gripper shaft is accurately registered and locked in the sheet taking position.

5. Intermittent rotary feed gripper operating mechanism as called for in claim 1 wherein means are provided whereby the feed gripper shaft is accurately registered and locked in the sheet taking position, the locking of the feed gripper shaft being effected by means of the two follower rollers on the feed gripper cooperating with the two follower cams on the impression cylinder.

FRED WHYTE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,192,908	Harrold et al.	Mar. 12, 1940
2,192,916	Kaddeland et al.	Mar. 12, 1940
2,309,979	Pritchard	Feb. 2, 1943
2,334,775	Karp	Nov. 23, 1943

FOREIGN PATENTS

Number	Country	Date
602,285	Great Britain	May 24, 1948