March 22, 1960 O. J. SUNDSTRAND 2,929,476

PRINTING CALCULATING MACHINE

Original Filed Jan. 14, 1954 2 Sheets-Sheet 1

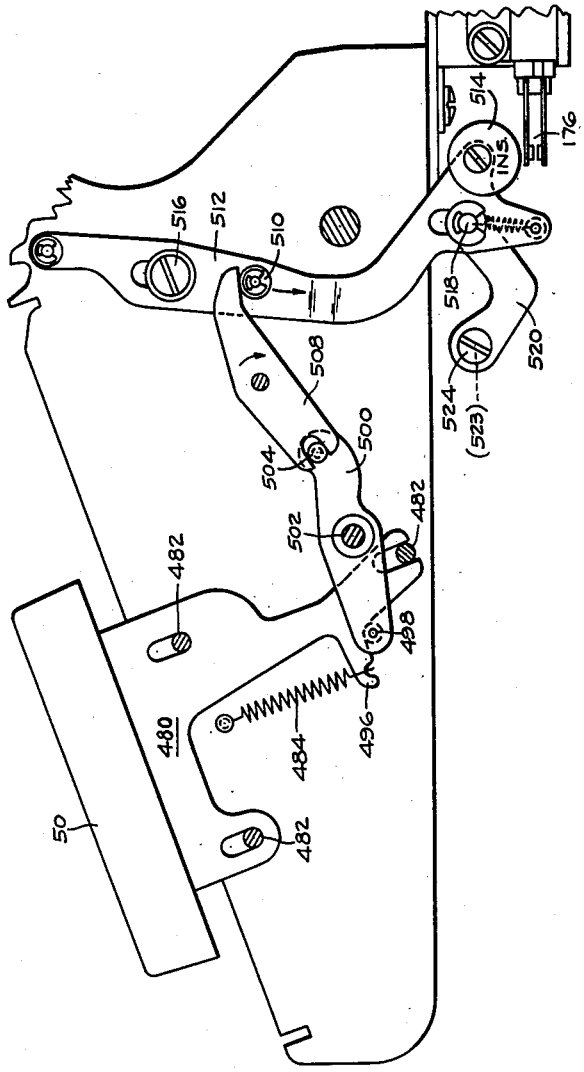

Fig. 1

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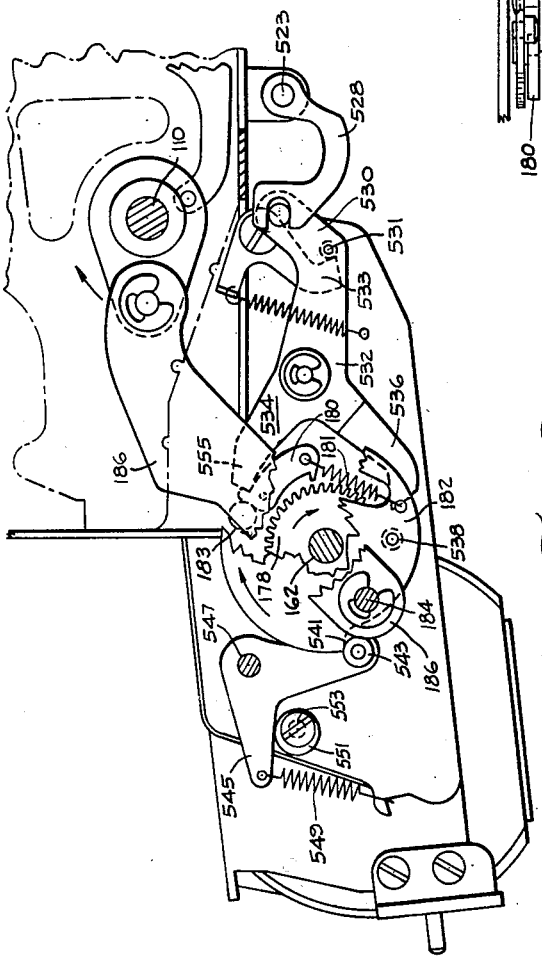

Fig. 2

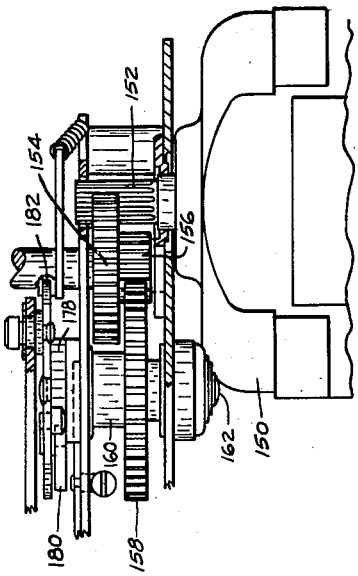

Fig. 3

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United States Patent Office 2,929,476
Patented Mar. 22, 1960

2,929,476

PRINTING CALCULATING MACHINE

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Original application January 14, 1954, Serial No. 404,088. Divided and this application July 18, 1957, Serial No. 672,804

3 Claims. (Cl. 192—28)

The invention relates generally to one revolution clutch mechanisms, particularly for operation of adding, calculating, check writing, and similar machines. More particularly, it relates to an improved means for reducing the frictional force opposing release of the clutch pawl for engagement with its associated ratchet wheel.

This application is a division of my copending application Serial No. 404,088, filed January 14, 1954, entitled "Printing Calculating Machine."

It is thus an object of the invention to provide an improved mechanism for reducing the friction opposing release of the clutch mechanism for engagement upon operation of the motor starting and clutching means.

It will be understood that in the design of adding, calculating, and check writing machines, it is desirable to reduce, as much as possible, the energy (or force) required to be applied to the control mechanism for starting operation of the machine, and the present invention is directed to means for accomplishing this result.

Other objects will become apparent from the following description, reference being had to the accompanying drawings, in which—

Fig. 1 is a vertical sectional view, taken from the right, of an illustrative machine embodying the invention, showing particularly the manually operated control elements for initiating a cycle of operation;

Fig. 2 is a vertical sectional view, from the left side of the machine, broken in parts, showing the particular one revolution clutch mechanism and adjusting means therefor; and

Fig. 3 is a fragmentary horizontal sectional view showing the drive gearing for the one revolution clutch mechanism.

It is a common expedient to utilize as a means for controlling the operation of an adding, calculating, or check writing machine, to provide a motor and one revolution clutch mechanism control operated by the operator upon depression of a motor control bar or key, and it is desirable that the force required for the depression of such key be very light. This desiderata is emphasized if the machine is to be automatically controlled, because under these conditions the entire mechanism for operating the motor starting and one revolution control clutch is operated by a train of mechanism, the parts of which must necessarily be strengthened, if the force required to disengage the clutch mechanism and start the operation of the motor is more than absolutely required.

In the present application, the means for initiating operation of the one revolution clutch mechanism and causing the energization of the driving motor, is shown in Fig. 1, the mechanism being more or less conventional to machines of the type to which reference has been made.

Referring to Fig. 1, a motor bar 50 (which, upon depression, controls the initiation of an operating cycle)

is provided with a key stem 480 suitably guided by studs 482 for substantially vertical movement. This key stem operates against the tension of the spring 484, one end of which is suitably anchored to the frame of the machine and the other end of which is connected to an ear 496 forming part of the key stem 480. The ear 496 overlies a stud 498 on a lever 500 pivoted upon stud 502 secured to the frame of the machine, and the rearward end of this lever 500 carries a stud 504 engageable in an open slot 506 formed in the end of a lever 508. The rearwardly projecting arm of lever 508 overlies a roller stud 510 carried by a vertically reciprocable link 512 guided by a stud 516 extending through a suitable slot in the link 512. The lower end of the link 512 carries an insulating washer 514 for cooperation with the blade of a motor energizing switch 176. This disc 514 is preferably mounted eccentrically so that it may be readily adjusted for suitably timed operation in conjunction with the one revolution clutch mechanism.

The link 512 is urged upwardly by a suitable tension spring connected between this link and a stud 518, or, stated conversely, an arm 520 secured to a shaft 523 by a screw 524 is urged to swing clockwise by the tension spring whenever the lever 512 is depressed.

From the foregoing, it will appear that when the motor bar (or comparable means) is operated to cause initiation of a cycle of operation of the machine, the kinematic train comprising the arm 496 of its key stem 482, levers 500 and 508, will result in depression of the link 512 and through its associated spring attached to stud 518 will tend to swing clockwise (Fig. 1) the arm 520, its associated shaft 523, and its screw 524, in addition to closing the switch 176 to energize the driving motor.

Referring to Fig. 2, the shaft 523 has an arm 528 secured thereto so that when the motor bar 50 is depressed and the shaft 523 turned clockwise (Fig. 1) the arm 528 will swing counterclockwise from the position in which it is shown in Fig. 2. The end of the arm 528 has a pin and open end slot connection to the forwardly extending arm 530 of the three-arm tripping lever 532. This arm 530 carries a stud 531 engageable with a spring pressed detent lever 533 which is provided with suitable surface for engagement with the stud 531 so as to hold the latter in either its operative or inoperative position.

As shown in Fig. 3, the machine is driven by a motor 150, the rotor shaft of which is formed as a pinion 152 meshing with gear 154. This latter gear is preferably connected by suitable friction means to a pinion 156 which in turn meshes with the gear 158, having a hub 160 which is rotatable on a suitably mounted shaft 162. The frictional driving connection between the gear 154 and pinion 156 is more or less conventional, being provided to form a part of the driving connection between the motor and the machine parts operated thereby under all normal conditions of operation, permitting the frictional connection to yield if there is any abnormal lock-up of the machine.

A ratchet wheel 178 is fixed to the hub 160. A plate cam disc 182 is supported for rotation on the shaft 162. A pawl 180 is pivoted to the disc 182 and has the tooth thereof urged to move into engagement with the ratchet wheel 178 by a spring 181, and when thus engaged provides a driving connection between the ratchet wheel 178 and disc 182, rotating the latter clockwise (Fig. 2). The pawl 180 is normally held from engagement with its ratchet wheel by having the upper portion thereof abut against the toothed end 555 of an arm 534 of the three-arm tripping lever 532. A stud 183 on the disc 182 coacts with the upper rear portion of the pawl 180,

as shown in Fig. 2, to positively preclude turning of the disc 182 beyond its starting position when the arm end 555 is in abutting engagement with the pawl.

The disc 182 has a sidewardly projecting stud 184 to which an actuating arm 186 is pivotally connected, the latter being connected by a suitable arm to the main shaft 110, to rock the latter back and forth upon each revolution of the disc 182.

The disc 182 also carries a stud 538 which is adapted, shortly before the completion of the operating cycle, to engage a suitable camming surface on arm 536 of the three-arm lever 532 so as to return the three-arm lever 532 to its normal pawl engaging position.

The disc 182 has a sharply rising cam surface 541 at its peripheral edge, which is adapted to be engaged by a roller 543 carried at the end of one arm of a bell-crank lever 545 pivoted on a stud 547. The roller 543 is resiliently urged into engagement with the edge of the disc 182 by a suitably anchored tension spring 549. The extent to which the spring 549 may swing the lever 545 counterclockwise is limited by an eccentric collar 551 secured in adjusted position by a screw 553.

In operation, upon depression of the motor bar 50, as previously described, the arm 528 (Fig. 2) will be swung counterclockwise and end 555 of the arm 534 of the three-arm tripping lever 532 will be raised to disengage it from the pawl 180, whereupon the latter will be swung by its spring 181 into engagement with the teeth of ratchet wheel 178, and thus form a driving connection between the ratchet wheel and the disc 182. The disc 182 will therefore be driven clockwise until the stud 538 thereof engages the cam surface of the arm 536 of the three-arm lever 532, shortly before the end of one revolution of the disc, whereupon the part 555 of arm 534 will be moved into position to engage the pawl 180 and swing it counterclockwise to disengage it from the ratchet wheel 178. Upon completion of one revolution of the disc 182, the roller 543 will be in engagement with the cam rise portion 541 and prevent retrograde or counterclockwise rotation thereof, and due to the force applied by the spring 549 to the lever 545, will tend to move the disc 182 clockwise, but the extent of such rotary movement of the disc 182 is limited by the engagement of the lever 545 with the eccentric collar 551. As shown in Fig. 2, the eccentric stop 551 is adjusted to terminate movement of the follower roller 543 toward the coacting cam simultaneously with movement of the disc 182 into its starting position. Thus, there is no tendency to rotate the disc 182 beyond the position in which it is shown in Fig. 2, and the tension of the spring 181 is the only force tending to hold the pawl 180 in engagement with the tooth 555 of the arm 534.

If the counterclockwise swinging movement of the lever 545 were not limited by the eccentric collar 551, the force applied by the resiliently pressed roller 543 would increase the friction between the tooth 555 of the arm 534 and the pawl so as to increase the force required to swing the three-arm tripping lever 532 clockwise upon initiating the following cycle of operation. The stop position of the disc 182 is thus precisely adjustable by adjustment of the eccentric collar 551, but nevertheless no force is applied tending to rotate the disc clockwise. Thus the only force applied between the pawl 180 and the tooth 555 is that due to the spring 181, which may be of such strength as to apply but a very small force tending to swing the pawl 180 into engagement with the ratchet wheel 178.

While I have shown and described a preferred embodiment of my invention, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or equivalent means.

I claim:

1. In a business machine, the combination of operating means, a motor, a ratchet wheel connected for rotation by said motor in a predetermined direction, a rotary driven member connected to said operating means and carrying a clutching pawl biased for engagement with said ratchet wheel, a movable trip element normally engaged abuttingly with a portion of said pawl to disengage the pawl from said ratchet wheel, rigid means on said driven member coacting with said pawl and said trip element positively to preclude rotation of the driven member in said direction beyond a predetermined starting position when the trip element is in engagement with said pawl, said driven member defining an arcuate cam thereon, a cam follower opposing said cam, a strong spring biasing said follower firmly against said cam, the portion of said cam which opposes said follower as said driven member approaches said starting position forming an incline oriented in relation to said follower to produce from the yieldable force of the follower on said incline a reaction on said cam which strongly urges said driven member rotatably in said direction toward said starting position, adjustable stop means separate from said cam positioned to positively terminate movement of said follower in the direction of said cam before the follower has reached the lowermost portion of said incline and simultaneously with movement of said driven member into said starting position, means for fixing said adjustable stop means in adjusted position, a manual control member, and linkage means connecting said control member to said trip element to slidably disengage the latter from said pawl.

2. In a business machine, the combination of operating means, a motor, a driving clutch comprising a rotary driving member connected for rotation by said motor in a predetermined direction and a rotary driven member connected to said operating means, a movable trip element, means on said driven member normally coacting with said trip element positively to restrain rotation of the driven member in said direction beyond a predetermined starting position, said driven member defining an arcuate cam thereon, a cam follower opposing said cam, a spring biasing said follower firmly against said cam, the portion of said cam which opposes said follower as said driven member approaches said starting position forming an incline oriented in relation to said follower to produce from the yieldable force of the follower on said incline a reaction on said cam which strongly urges said driven member rotatably in said direction toward said starting position, stop means separate from said cam positioned to positively terminate movement of said follower toward said cam before the follower has reached the lowermost portion of said incline and simultaneously with movement of said driven member into said starting position, a manual control member, and linkage means connecting said control member to said trip element to shift the latter for releasing said driven member for rotation.

3. In a business machine, the combination of operating means, driving means including a single revolution clutch comprising a rotary driving member therefor and a rotary driven member connected to said operating means and having a normal direction of rotation, said single revolution clutch including releasable stop means coacting with said driven member positively to terminate normal rotation of the latter in an exact starting position by the abutting action of slidably disengageable parts forming components of said stop means, a spring biased cam follower, means forming on said driven member an arcuate cam surface opposing said cam follower and having a steeply inclined portion positioned for engagement by said follower as said driven member approaches said starting position thereof and having an orientation relative to said follower that produces from the yieldable force of said follower on said inclined cam portion a reaction on said inclined cam portion which

urges said driven member rotatably in said direction toward said starting position, a positive stop positioned adjustably in the path of said follower as the latter moves down said inclined cam portion to terminate movement of the follower toward the cam surface before the follower has reached the lower end of said inclined cam portion, and means for fixing said stop in adjusted position.

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