Dec. 8, 1942. H. T. AVERY ET AL 2,304,231

CALCULATING MACHINE

Filed April 24, 1939

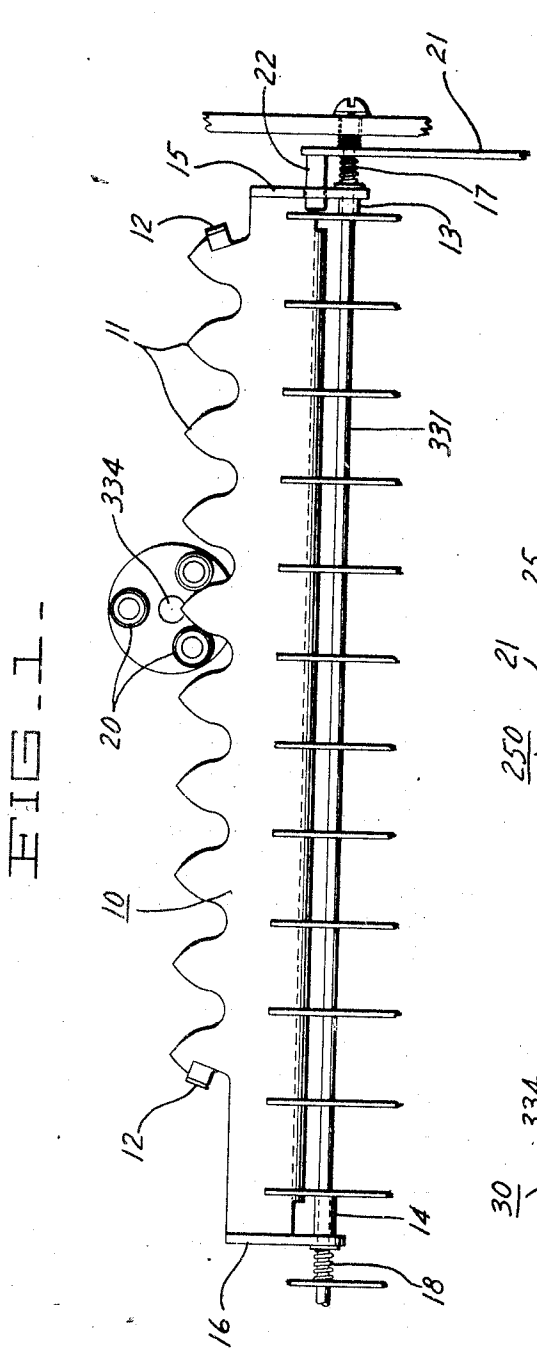

FIG. 1.

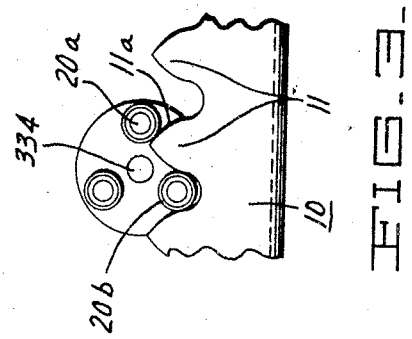

FIG. 3.

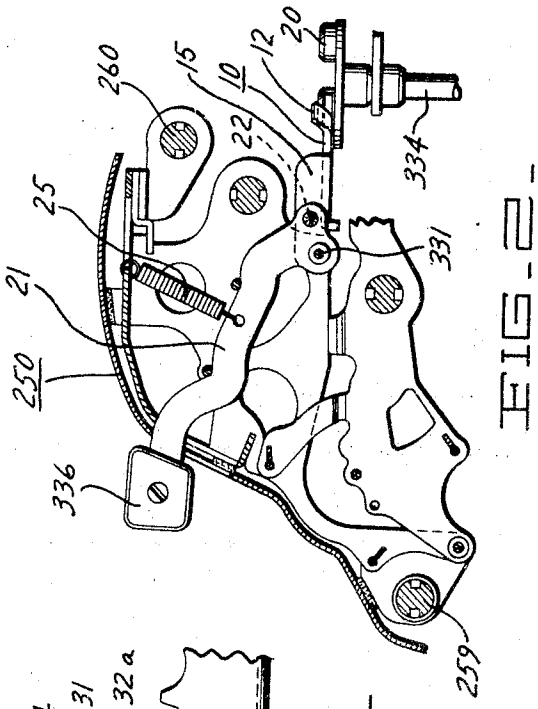

FIG. 2.

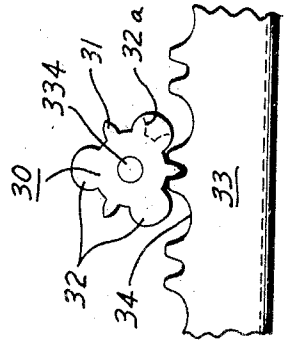

FIG. 4.

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CALCULATING MACHINE

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Application April 24, 1939, Serial No. 269,574

1 Claim. (Cl. 235—63)

The present invention relates to calculating machines, and particularly concerns improved means for shifting the carriage in which the accumulator register of such machines is mounted. The invention is disclosed as applied to the commercially known Marchant calculating machine disclosed in the patent application of Harold T. Avery, Serial Number 84,927 filed June 12, 1936, to which reference may be had for a description of mechanisms not specifically disclosed herein.

In calculating machines employing conventional rack and roller, or pin type mechanism for driving the register carriage laterally, the carriage moves with a jerky, or uneven movement. This type of operation has been intentionally provided for, because the operator may wish to stop the carriage in any one of its different operating positions and in order to make such a stop less abrupt, the driving mechanisms have been designed to decelerate the register carriage as it approaches an operating position, and accelerate it as it leaves the same.

It is a primary object of this invention to eliminate uneven carriage movement by providing means for driving the register carriage, or any similarly shiftable element of a machine of the class described, at a constant transitional velocity, while at the same time providing for positive location thereof in proper operating position when the driven element is reconnected to the driving means, after having been disconnected therefrom and manually moved to a different operating position.

It is a further object of the invention to provide means, in combination with such mechanism, for disconnecting the transmission mechanism from the register when said register reaches either of its extreme end positions, so that the register carriage will not stall the driving means when it arrives at either of said end positions.

In the embodiment disclosed herein, unevenness is eliminated by employment of a novel form of drive, and when the register carriage is shifted, it moves with a constant velocity from one operating position to another. Also, a spring cushion is provided between the carriage and the register proper to absorb the shock incident to quick starting and stopping of the driving and driven elements.

Although the invention is disclosed as adapted to an arrangement for shifting or traversing the register of a specific machine, it is adaptable in its broader aspects to machines in which the register is stationary and the actuators are shifted, or to machines in which both registers and actuators are stationary and transmission mechanism connecting them is shifted.

Other objects will appear during the following detailed description of preferred forms of the invention, reference being made to the accompanying drawing forming a part of this specification, in which:

Figure 1 is a plan view of parts of the accumulator register, showing the carriage rack and its yieldable connection to the register and the means for driving said rack;

Figure 2 is a vertical section through the register, as viewed from the right, showing a portion of the driving means and the means for disconnecting the rack from the driving means;

Figure 3 is a fragmentary view of part of Figure 1 showing the rack and roller driving mechanism in an intermediate position between carriage operating positions; and

Figure 4 is a fragmentary view of a modified embodiment of the invention.

Mechanism for shifting the register carriage of calculating machines laterally as smoothly as possible has long been desired, and while this can be accomplished by the use of a conventional rack and driving pinion, it is also necessary to provide means to disconnect the register from the driving mechanism so that the operator may shift the register carriage by hand without using the power driven means. If a conventional rack and pinion drive were disconnected in this manner, it would be possible for the operator to reconnect the register carriage to the driving pinion with said register out of a proper operating position with relation to the actuating mechanism. If the distance between the teeth of such a conventional rack and pinion were made equal to the distance between the operating orders of the machine, in order to avoid this probability of misconnection, it would be necessary to make the drive connection so large as to make such an arrangement impracticable when adapted to a compact calculating machine.

In the present disclosure, the teeth **11** of rack **10** (Figure 1) are spaced a distance apart equal to the distance between operating orders of the machine. The shape of the teeth is such that for constant rotation of the drive shaft **334**, the rollers drive the rack **10** at a constant linear speed. Figure 3 shows roller **20***a* after it has first contacted a tooth **11** during a leftward carriage shift. As said roller moves in a clockwise direction, its leftward displacement with respect

to shaft 334 is very little at first, and gradually increases until it reaches its lowest point, and then decreases as it rises. To compensate for this varying lateral displacement, the curved edge 11*a* of the tooth acts as a camming surface, so that downward motion of roller 20*a* imparts a lateral motion to the rack and during continued rotation of said roller, as the downward motion decreases and the leftward displacement increases, the camming effect of edge 11*a* becomes less and less until the roller reaches its lowest point. At this time the leftward motion of the roller is at its maximum and the rack 10 travels at the same lateral speed as the roller. Thus, the lateral camming effect of surface 11*a* plus the actual lateral displacement of roller 20 is constant during any increment of circular motion of roller 20, the rack moves a proportional increment laterally, and the register moves at a constant velocity. It is found that the edge 11*a*, when shaped to cause the rack 10 to move at such a constant velocity, follows a curved line parallel to a center line generated by the successive projections of the center of a roller 20 on the plane of the rack 10, the curved line being spaced from the center line an amount equal to the radius of a roller 20 and thus drawn tangent to the successive projections of said element.

The shaft 334 (Figure 2) is the carriage drive shaft of the commercial machine above referred to, and is driven at uniform speed by reversible drive mechanism, specifically not part of the present invention. In the present application, however, three rollers 20 are shown, instead of two used in previous machines. With this construction it is necessary that the shaft 334 be driven one-third of a rotation for each cycle of operation instead of one-half. This type of drive for shaft 334 is disclosed in an application for patent by Avery and Dustin, Serial Number 233,254, filed October 4, 1938, and since matured into Patent Number 2,162,238, issued on June 13, 1939.

As the shaft 334 turns in either direction, and the rollers 20 successively engage between the teeth of rack 10, the register 250 (Figure 2) is shifted laterally on the shafts 259 and 260 which are suitably mounted in the framing of the machine.

Means is provided to automatically disconnect the rack 10 from the rollers 20 when the register reaches either of its extreme left or right positions, so that if the driving pinion continues to operate, there will be no tendency to shift said register beyond said end position. For this purpose ears 12 are provided on the outer side of the end teeth 11 and are formed at such an angle that after the end position of the register is reached, one of the rollers 20 contacts the under surface of an ear 12, and cams the rack 10 upwardly about the shaft 334 (Figure 2), thus lifting it out of mesh and making any further rotation of shaft 334 in the same direction, ineffective. When the driving mechanism is stopped, the end tooth drops between two of the rollers and when a shift is initiated in the opposite direction, the roller 20 contacts the inner surface of the last tooth 11 and positively drives the register in the reverse direction.

Means is provided to absorb the shock of rollers 20 and rack 10 when suddenly starting and stopping at the beginning and end of shifting operations, comprising flanged bushings 13 and 14 loosely engaged in openings formed in flanges 15 and 16 on the ends of rack 10. These bushings are slidably mounted on shaft 331 which is supported by the framing of the register. Springs 17 and 18 are mounted on said shaft and press against the flanges of bushings 13 and 14 to maintain the rack in the position shown. When a shift is initiated, and the rack 10 is suddenly moved, for instance to the left, the flange 16 and bushing 14 compress spring 18, and the flange 15 slides to the left over bushing 13. As the spring 18 overcomes the inertia of the register, the parts return to the position shown and move together until the rollers 20 and rack 10 are suddenly stopped. At this time the inertia of the register carries it a limited distance beyond the stopping point against the pressure of spring 17, until the register stops and returns to the position shown under the pressure of said spring.

Means is provided to manually disconnect the rack 10 from rollers 20 so that the operator may shift the register by hand, comprising a lever 21 pivoted on shaft 331, and projecting beyond the cover 250 of the register where it is provided with a handle 336. A stud 22 is riveted to arm 21 and slips into a hole in flange 15 so that the rack 10 may slide, either to the right or left, over said stud, and still be engaged thereby. When the operator depresses the handle 336, the lever 21 and rack 10 are rocked counter-clockwise about shaft 331 until the teeth of said rack rise above the rollers 20, thus rendering the register free to be shifted by hand. If the operator stops the register out of an operating order and releases handle 336, the rack 10 will rock clockwise under the tension of a coil spring 25 connected to lever 21 and to a suitable anchorage on the carriage, until it rests on top of one of the rollers, where it will remain until shaft 334 carrying said rollers is revolved in an attempt to shift the register, at which time a roller 20 will pass from beneath the rack and allow a tooth 11 thereof to drop between two of the rollers. If the operator notices that the carriage is out of a centralized position, he may merely press against the side of the register carriage until a tooth of the rack drops between two of the rollers as the register moves into centralized position.

If the operator performs a calculation and does not notice that the register carriage is out of centralized position, the carriage is nevertheless automatically centralized to the nearest operating order by mechanism described in said Avery application.

With the modified embodiment of Figure 4, it is possible to use the conventional gear tooth and rack principle for such an arrangement and still keep the size of the teeth and the driving pinion down to a practical size. Figure 4 shows a pinion 30, rotatable with shaft 334, which comprises three conventional teeth 31 and three lobes 32, alternately arranged. The lobes are developed from, or are substitutes for, two gear teeth, as shown by the dotted lines on lobe 32*a*, the sides thereof being formed as of a tooth curve, and drive the teeth of rack 33 in the same manner as a gear tooth. Rack 33 is provided with a series of teeth of the same pitch as used to develop the pinion 30, with every third tooth removed, however, and a deep lobe space 34 provided to receive a lobe 32.

This embodiment assures centralization of the register in an operating order when connected to the driving mechanism, and permits use of a rack and driving pinion of small size.

Since other modifications of the invention dis-

closed herein will occur to those skilled in the art, the invention is not to be considered as restricted to the embodiments shown and described, except as required by the scope of the appended claim.

I claim:

A carriage shifting mechanism for motor driven calculating machines having a frame upon which a register carriage is transversely shiftable to a series of operating positions; comprising, in combination, a cyclically operable rotatable driving member mounted in said frame and having a plurality of equiangularly spaced driving elements thereon, a rack mounted on said carriage and having teeth engaged by said driving elements; the shape of said teeth being defined by a line parallel to a center line generated by the successive projections of the center of one of said driving elements on the plane of the rack when both the driving elements and the rack are moved at substantially uniform rates of speed, said first mentioned line being drawn tangent to the successive projections of said element, and the said teeth being spaced apart a distance equal to the distance between operating positions of said carriage.

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