July 19, 1932. L. TALAMINI 1,867,603

CALCULATING MACHINE

Filed Oct. 13, 1930

FIG. 2.

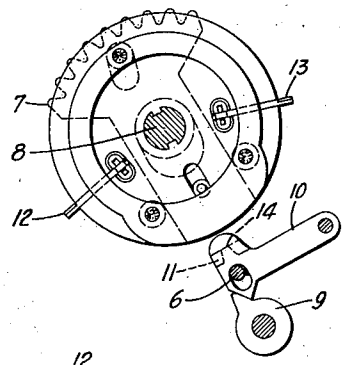
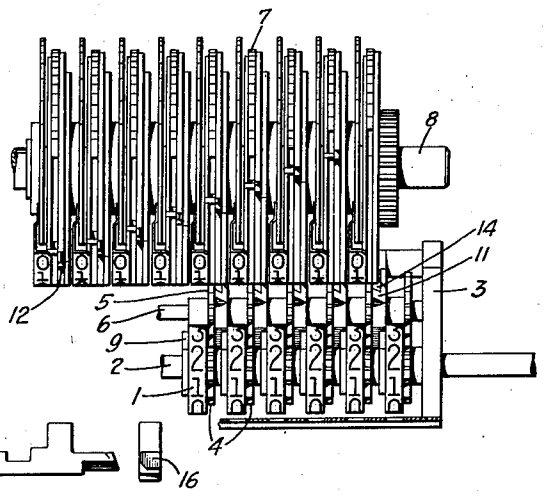


FIG. 1.



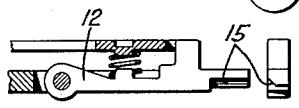


FIG. 3.

FIG. 4.

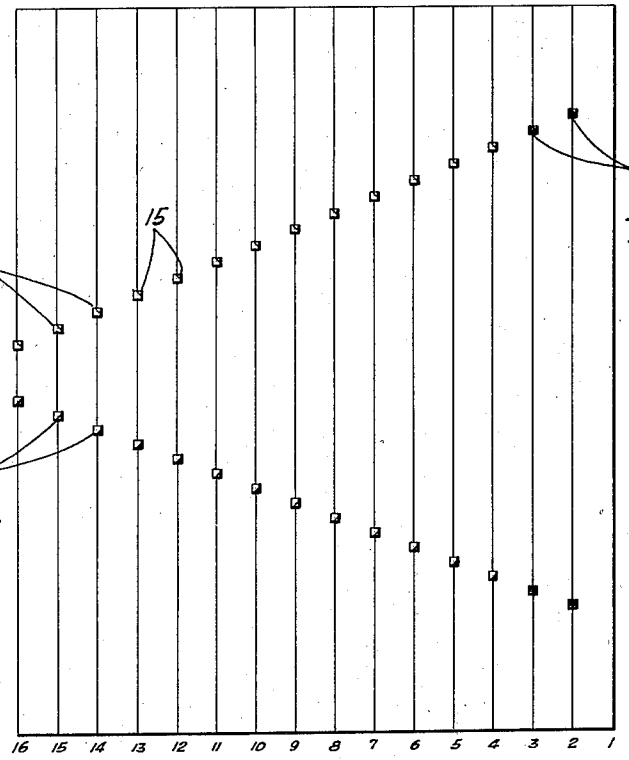


FIG. 5.

FIG. 7.

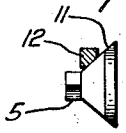
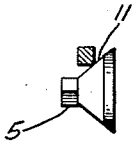


FIG. 6.



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Patented July 19, 1932 1,867,603

UNITED STATES PATENT OFFICE

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CALCULATING MACHINE

Application filed October 13, 1930. Serial No. 488,362.

The present invention relates to calculating machines and particularly to machines having rotary tens-carrying actuators, an example of which is disclosed in the patent to Odhner, No. 514,725, dated February 13th, 1894.

Machines of the Odhner type are provided with a laterally shiftable numeral wheel carriage, the numeral wheels being adapted to be differentially advanced by a reversible rotary actuator commonly called the drum, and which consists of a plurality of actuating sections, each provided with differential actuating means for advancing the numeral wheel from one to nine steps, and a pair of tens-carrying teeth disposed adjacent each end of the differential actuating means. Only one of these tens-carrying teeth, however, may be active in a given cycle of the machine operation; one being operable for an additive tens-carry and the other for a subtractive tens-carry, depending upon the direction of rotation of the drum. These tens-carrying teeth are normally inactive and are rendered active by the transit of the next lower numeral wheel between nine and zero in either direction which interposes a cam in the path of the carry tooth, moving it at the proper time to active position.

In view of the fact that the action of the carry tooth in a given order may move the numeral wheel between nine and zero, causing interposition of a cam in the path of the carry tooth of the next higher order, the carry teeth of all orders cannot be operated simultaneously, but must be staggered so that the carry tooth of each superior order comes to active position enough later in the cycle to permit the interposition of the cam by the action of the tooth of the next lower order to be completed. The result of this requirement is that the carry teeth of the drum as a whole form a spiral around the periphery of the drum, as shown in Figure 4 of the Odhner patent above referred to, and the additive and subtractive spirals of carry teeth approach a point of convergence toward the left end of the drum.

This approach to the point of convergence of the tens-carrying spiral limits the capacity of the machine. Sufficient space must be left between the left end teeth of the two spirals to permit passage of the transfer levers laterally in shifting the carriage, and, therefore the spirals can not completely converge. The capacity of the machine, that is, the number of actuating sections contained in the drum, is, therefore, determined by the number of carry teeth which can be placed in proper displacement between the end of the actuating section of the periphery of the drum and the carry levers of the carriage.

Two ways appear by which it is possible to increase the number of carry teeth which can be placed in this space. The first is to increase the diameter of the drum section. This, however, is impractical because the increased peripheral speed of the drum, caused by an increase in diameter, imparts a greater momentum to the numeral wheels and causes overthrow thereof at lower speed of rotation than for a drum of smaller diameter. The only other way involves decreasing the peripheral displacement of the carrying pins of successive orders, and it is toward this means that the present invention is directed.

An object of the invention is the provision of a high capacity tens carrying mechanism for a calculating machine.

Another object of the invention is the provision of an actuating drum for a machine of the class described, in which accurate centralization of the drum is not necessary in order to permit lateral shift of the carriage with respect thereto.

Other objects will appear as the specification progresses.

The invention is disclosed as applied to a machine having a selector of the type disclosed in the patent to Friden, Number 1,524,924, dated February 3d 1925, to which, together with the Odhner patent above referred to, reference is made for a full disclosure of details herein omitted, it being noted that the invention is particularly advantageous when applied to machines of this type adapted for automatic operations involving alternate operations of the actuator and automatic shifting of the carriage, such as disclosed in the application of Friden, Serial

Number 252,175 filed February 6th 1928, and the application of Friden, Serial Number 303,387 filed September 1st 1928.

Reference is had hereafter to the accompanying drawing forming a part of this specification in which:

Figure 1 is a partial plan view of the improved actuator in juxtaposition with the shiftable numeral wheel carriage.

Figure 2 is a sectional view of the improved actuator in juxtaposition with the carry lever and numeral wheel cam.

Figures 3 and 4 are details of the improved tens carrying pins.

Figure 5 is a diagrammatic development of the improved actuator.

Figures 6 and 7 are details comparing the old and new structures, respectively.

Numeral wheels 1 (Figure 1) are loosely mounted on a shaft 2 carried in the laterally shiftable carriage 3, and each is provided with a gear 4, adapted to mesh with an intermediate gear 5 loosely mounted on shaft 6, also carried in the carriage 3. Gears 5 are adapted to mesh with differential actuator segments 7, and to be advanced thereby from one to nine steps, depending upon the setting of the selection controlling device. During each rotation of the shaft 8 carrying the segments numeral wheels 1 are thus selectively advanced from one to nine steps during each cycle of operation of the machine. Fixed to the opposite side of the numeral wheel from the gear 4 is a cam 9 so placed that when the reading at the sight opening of each numeral wheel passes from nine to zero, or vice versa, the said cam will rock a lever 10 to the rear where it will be latched by well-known means, placing a cam surface 11 thereon in the path of tooth 12 carried by the actuating section associated with the numeral wheel of the next higher order.

As shown in Figures 6 and 7, the tooth 12 normally traverses a path to one side of the teeth of intermediate gear 5, but when the lever 10 is rocked to the rear its cam face 11 is placed in the path of tooth 12. As the tooth progresses it is first cammed into position to drive gear 5, and, after such positioning, is moved to drive gear 5 through one step.

Since a second carry lever 10 may be moved to the rear by the action of a carry tooth 12 upon any numeral wheel standing at nine or zero, the pin 12 of the next higher order must be sufficiently displaced around the periphery of the drum from the active pin to permit the lever 10 to be moved sufficiently to the rear before the higher pin is in position to impinge it. The amount of the peripheral displacement between successively acting pins, therefore, cannot be less than the distance that the periphery of the drum moves while a pin 12 is cammed from its normal position into position to drive gear 5, plus the distance that the periphery of the drum moves while the lever 10 is cammed, by numeral wheel cam 9, sufficiently to the rear to avoid striking the end of the next approaching pin 12.

In prior art structures, such as that shown in Figure 6, the pin 12 is moved substantially into its leftmost position before beginning to drive the gear 5, thus dividing its movement into two distinct phases. The amount of drum movement necessary to complete the first phase (camming the pin into position to drive the gear) is dependent on the amount of displacement of the pin necessary, width of the pin, and the camming angle chosen. The amount of drum movement necessary to complete the second phase (driving the gear) is dependent on the pitch of the gear. Changing any of these factors may result in less drum movement being required to complete the operation and hence permit the pins to be spaced closer together, but each is rather closely limited by requirements of strength, ease of operation, etc.

The present invention contemplates reducing the peripheral spacing of pins 12 without disturbing the balance of the above-mentioned factors by overlapping the above-mentioned phases of operation of the said pins. In the present embodiment of the invention this is effected by beveling the portion of pin 12 which impinges cam face 11 to conform substantially to the cam face 11 as shown at 15 in Figure 3, and in Figure 7. Thus, as shown in Figure 7, the gear operating phase begins somewhat before the completion of the positioning phase and the amount of drum movement required for the completion of both phases is substantially reduced permitting closer peripheral spacing of the pins.

A round pin 12, while apparently possessing the advantages of the invention here disclosed, presents objections which render it useless for the present purpose. In addition to the undesirable point contact with gear 5 and sliding line contact with cam face 11 which it gives as compared with the line contact with gear 5 and sliding surface contact with cam face 11 of the present structure, it is apparent that for a given overlap of the phases, the round pin will have a greater tendency, upon slight overthrow, to cam itself off the far side of the tooth of gear 5 dropping the carried increment. Furthermore, with a round pin, the amount of overlap of the phases cannot be regulated, whereas in the present structure, by varying the amount of chamfer of the beveled surface of the pin, the tendency to overthrow past the gear 5 can be readily avoided. In the practical manufacture of calculating machines, these considerations are of great importance, and the present invention has been found by actual experiment to permit the safe peripheral displacement of the pins 12 to be de-

creased about twenty-two per cent without any increased care in the manufacture and assembly of parts.

It will be noted in Figure 1 that the pins 12 of the second and third sections from the right, are placed relatively close to the end of actuator segment 7. When one of the said actuator segments has advanced its associated gear 5 through nine steps, and the said segment passes beyond the gear, there is a slight overthrow of the intermediate gear 5 which is taken up in a well-known manner by the centralizing pawls; however, since a very slight displacement of gear 5 is likely to cause a pin 12 coming into engagement with it, to jam on the end of a gear tooth, it has been found desirable to chamfer the end of the pin as shown at 16 in Figure 4, the said chamfer conforming with the outline of the associated gear tooth and permitting accurate engagement of the pin between gear teeth, even when the gear is slightly out of normal position.

As heretofore noted, it is necessary to leave sufficient space between the leftmost pins 12 and 13 of both the addition and subtraction spirals, to permit lateral passage of transfer levers 10 in the operation of shifting the carriage. While it is clear from the foregoing that about twenty per cent more actuating segments may be included in the same machine while maintaining the same spacing between these leftmost pins, the advantages of the invention are even more marked in machines of present standard capacity. In such machines, the close spacing of the leftmost pins has made very accurate centralization of the actuator before a carriage shifting operation necessary. Since accurate centralization of such a balanced and freely rotating actuator, especially in motor driven machines, requires the absorption of considerable momentum, very complex, accurately adjusted mechanism has been required to attain the desired results, and the attainable speed of the machine has been considerably limited by the necessity for so accurately centralizing the actuator. Since it is obvious, however, that when the invention is utilized in machines of less than the maximum capacity available therewith, a considerably wider space will be left between the leftmost pins of the two spirals, extremely accurate centralization of the actuator will not be necessary in order to permit shifting of the carriage. Therefore, extremely accurate centralizing mechanisms may be dispensed with and the speed of operation substantially increased.

While the invention has been disclosed as embodied in a particular type of machine, it will be obvious to those skilled in the art that it is capable of beneficial use in many other types, for instance, those which carry the members 12 on a shaft separate from that carrying the differential actuators 7, or which have only a single spiral. Other applications within the scope of the appended claims will occur to those skilled in the art to which the invention appertains.

I claim:

1. In a calculating machine, accumulator wheels, a plurality of successively acting carry actuating members therefor, carry controlling elements associated with said members, and means for concurrently conditioning said members and operating said wheels thereby comprising complementary cam faces on said members and said elements.

2. In a calculating machine, the combination of a plurality of carry controlling elements having cam faces thereon, and successively acting carry actuating members having portions adapted to impinge said cam faces, the impinging portions of said members being beveled to conform substantially to said cam faces.

3. In a calculating machine, the combination of a plurality of successively acting carry actuating members, and carry controlling elements adapted to be impinged by said members, said members being chamfered to conform to the impinged portion of said members.

4. In a calculating machine, registering elements, a plurality of successively acting carry actuating members adapted to actuate said registering elements, a plurality of carry controlling elements adapted to be displaced by a registering element to condition the carry actuating members of next higher order to actuate its associated registering element, and means comprising a registering element and controlled during the conditioning movement of a carry actuating member for effecting displacement of the carry controlling element of next higher order.

5. In a calculating machine, register driving gears, a plurality of successively acting carry actuating members therefor, and carry controlling elements adapted to be impinged by said members, said members being chamfered to conform to the impinged portions of said gears and said members.

In witness whereof, I have hereunto set my hand.

LOUIS TALAMINI.