March 22, 1960 G. DE CHANGY 2,929,257

SHIFTING DEVICE OF ROTATABLY DRIVEN OUTPUT MEMBERS, IN A CALCULATING MACHINE

Original Filed Dec. 28, 1955 4 Sheets-Sheet 1

Fig.1.

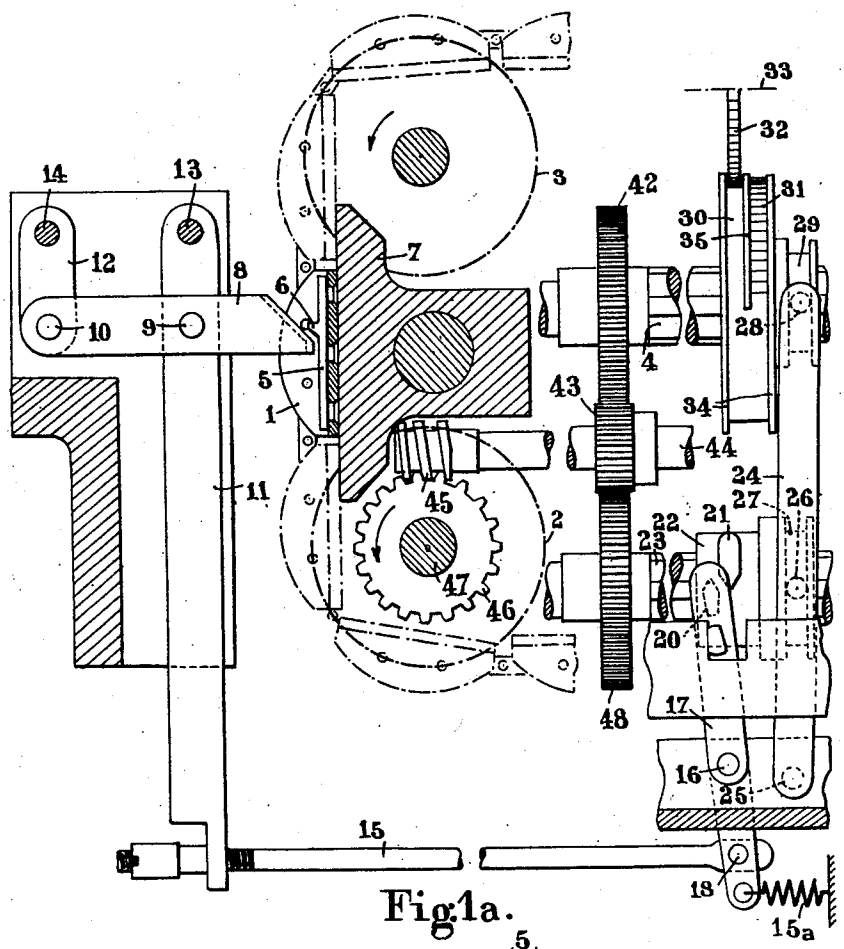
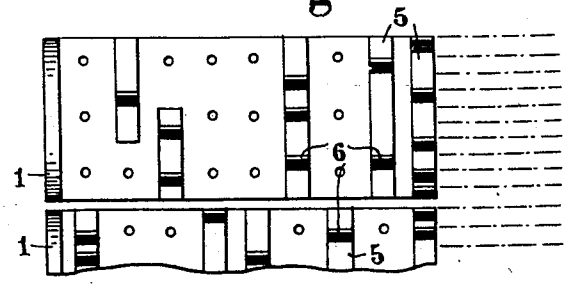


Fig.1a.

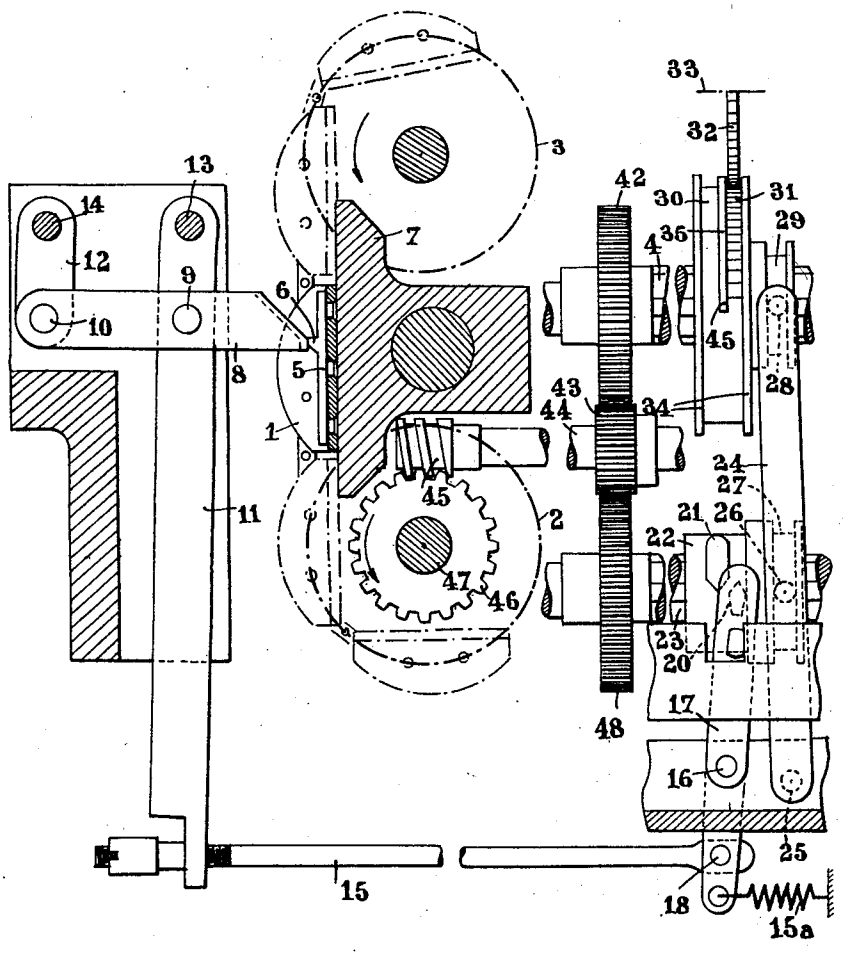


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Fig. 2.

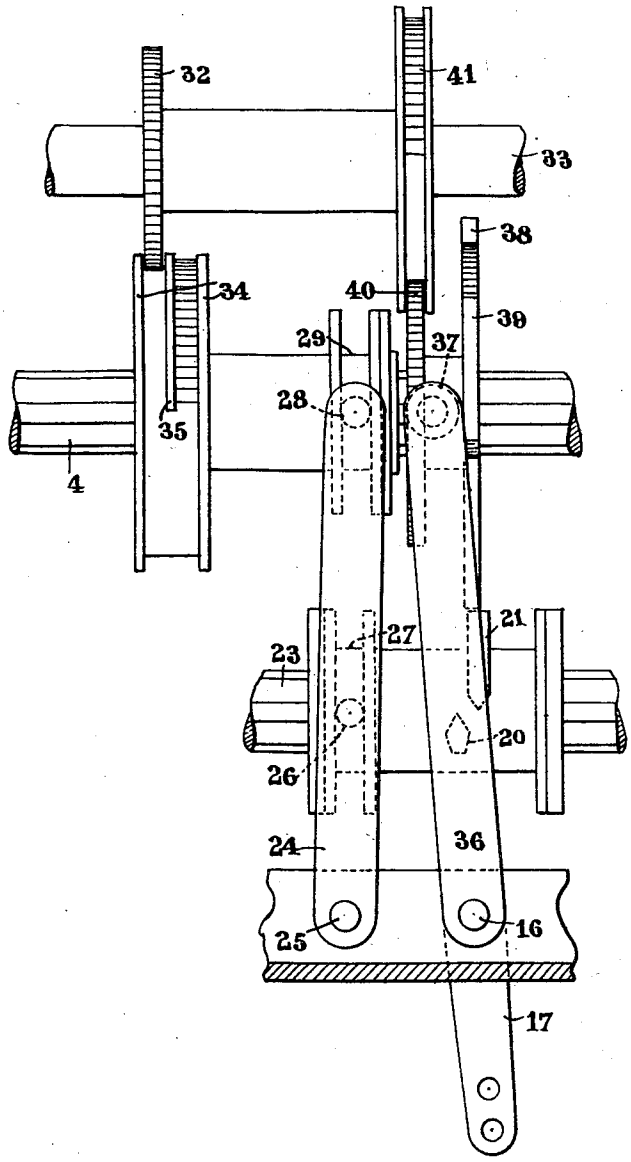


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Fig. 3.



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Fig.4.

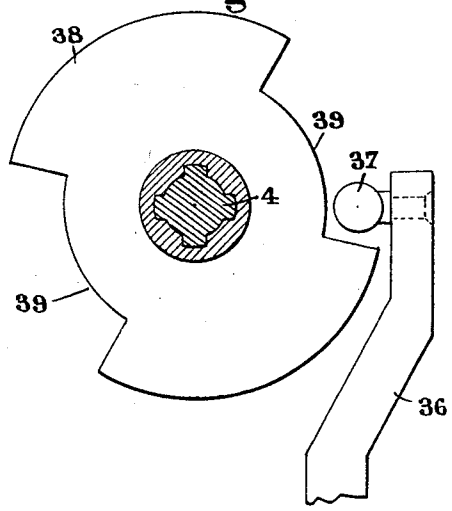


Fig.5.

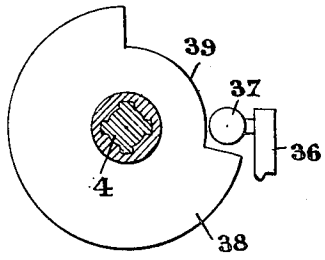


Fig.6.

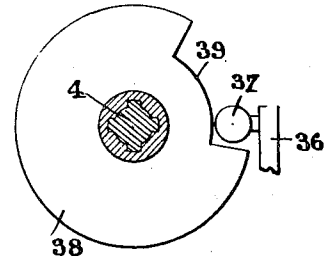


Fig.7.

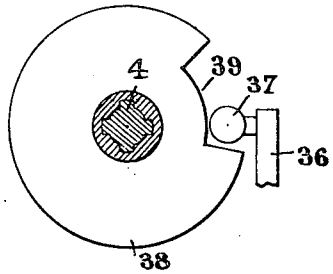
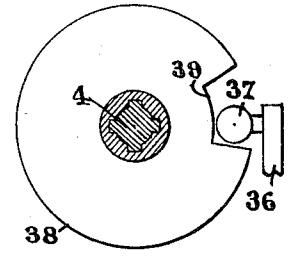


Fig.8.



United States Patent Office 2,929,257 Patented Mar. 22, 1960

2,929,257

SHIFTING DEVICE OF ROTATABLY DRIVEN OUTPUT MEMBERS IN A CALCULATING MACHINE

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Original application December 28, 1955, Serial No. 555,974, now Patent No. 2,866,341, dated December 30, 1958. Divided and this application April 15, 1957, Serial No. 653,000

Claims priority, application France December 31, 1954

4 Claims. (Cl. 74—337.5)

This application is a division of my application Ser. No. 555,974, filed December 28, 1955, now Patent No. 2,866,341.

The present invention relates to a shifting device from the operative position to the inoperative position and vice-versa, of a complete series of output members such as smooth or toothed disks, rotatably driven with a continuous motion from one or more power shafts. This device may be utilized in connection with a calculating machine.

According to a first form of embodiment of the invention, the output member previously brought to its operative position returning automatically to its inoperative position before the power shaft on which it is mounted has completed a full revolution.

According to another form of embodiment of the invention, the element concerned will remain in its operative position during a predetermined number of revolutions of the power shaft, whereafter it resumes automatically its inoperative position before the last revolution has been completed.

The shifting device according to the invention may be controlled by the control device claimed in the copending application of the same applicant, Serial No. 555,974 filed December 28, 1955 for "Automatic, Selective and Cyclical Control Device."

The attached drawings forming part of this specification illustrate diagrammatically by way of example a few forms of embodiment of this invention. In the drawings:

Figures 1 and 2 are part-sectional, part-elevational views showing the essential component elements of the control device in their inoperative and operative positions, respectively.

Figure 1*a* is a detail elevational view of an element of the control device.

Figure 3 is an alternate embodiment, and

Figures 4 to 8 illustrate details of the device.

The device illustrated in the drawings which may be utilized as a part of a calculating machine, comprises an endless chain consisting of a pair of chains made of two series of identical links 1 passing over toothed wheels 2, 3, adapted to drive the endless chain synchronously with a splined power or output shaft 4 whose output is representative of a quantity or magnitude.

This drive is effected by means of a pinion 42 rigid with an output shaft 4 and meshing with pinion 43 rigid with a lay shaft 44. On this lay shaft 44 a worm 45 is formed for transmitting rotational motion to a pinion 46 secured on a schaft 47 driving the toothed wheels 2.

These link chains 1 are adapted to carry along a number of plates 5 hingedly interconnected and each formed with tappets or lugs 6 selectively distributed along regularly spaced lines and columns. The transmission ratio between the shafts 4 and 47 is so selected that for each complete revolution of the driving shaft 4 there corresponds a displacement of the endless chain which represents one interval between two successive lines.

As these plates 5 move past the bearing members 7 they are adapted to engage arms 8 pivotally connected at 9 and 10 on a lever 11 and a link 12 pivoted in turn on pins 13, 14, respectively. The pivot pins 9, 10, 13, 14 are located at the vertices of a parallelogram.

The free end of the lever 11 controls, through a rod 15, the pivotal motion about a connecting pin 16 of another pivoted lever 17 rockable between two angularly spaced or oppositely disposed terminal positions as later herein disclosed and has one end pivotally connected through a pivot pin 18 to the relevant end of rod 15 biased by a counterspring 15*a*. The other end of the lever 17 carries a laterally extending cam-like projection 20 adapted to co-act with a radial camming projection 21 provided on a disk 22 slidably mounted on, and rotatably driven from, a splined shaft 23 rotating continuously at the same speed as the power shaft 4 through the medium of pinions 42, 43 and 48. The last-mentioned pinion 48 is rigid with the shaft 23 and has the same characteristics as the pinion 42 carried by the shaft 4.

A lever 24 adapted to pivot about a pivot pin 25 carried by a stationary part of the machine on which the device is mounted is provided with a first stud 26 engaging a grooved pulley 27 rotatably and axially fast with the disc 22, and another stud 28 engaging another grooved pulley 29 also rotatably and axially fast with disks 30, 31 slidably mounted on the splines of power shaft 4.

When the lever 17 is in a normal inoperative position corresponding to one of its terminal positions the cam 20 is positioned on the left-hand side of the projection 21 and the disk 22 may rotate without any engagement between the projection 21 thereof and the cam 20; as a result, the lever 24 remains in its inoperative position, as well as the other disks 30, 31; on the other hand, as will be apparent from Fig. 2, when the tappet 6 has caused the lever 11 to be swung through the arm 8, this lever 11 will actuate the rod 15 and cause in turn the lever 17 to move from its inoperative position in which it is shown in Fig. 1 to its operative position in which it is shown in Fig. 2, the cam face 20 of this lever 17 passing on the right hand side of the projection 21 of disk 22 and engaging same to cause this disk 22 to move axially to the left together with the grooved pulley 27 fast therewith; as a result, this grooved pulley will carry along the stud 26 and cause the lever 24 to rock counterclockwise; thus, the stud 28, carried by this lever 24, will move the disks 30 and 31 to their operative positions.

If it is contemplated to utilize this automatic control device for operating a counter of which the input pinions 32 mounted for loose rotation on a shaft 33 have one tooth out of every *n* teeth truncated down to the pitch circle, these pinions 32 may co-act either with the smooth disk 30 or with the pinion 31 formed with a toothed segment having a number of teeth adapted to engage those of the pinion 32 associated therewith and such that one complete revolution of the shaft 4 and pinion 31 will drive pinion 32 through one complete revolution (see Fig. 2). After this revolution the pinion 32 is locked through the engagement of one truncated tooth with the complementary smooth disk 30. This pinion 31 is also provided with a smooth segment or peripheral portion of a diameter slightly smaller than that of the pitch circle and identical with that of the smooth disk 30. Thin flanges 34, 35, 34 are provided around these disks 30 and pinions 31, the flange 35 having formed in its peripheral portion adjacent to the smooth segment of pinions 31 a notch constituting a clearance to enable the associated pinion 32 to move axially from the disk 30 to

the pinion 31, and vice-versa. The lugs 6 are effective to carry out a rocking motion of shaft 16 at pre-selected intervals corresponding to given numbers of revolutions of the output driving shaft 4.

If desired, this device may be completed so that each group of disks 30 and pinions 31 may remain in their operative positions, i.e. with the pinion 31 in meshing engagement with the associated pinions 32 during a predetermined number of revolutions of the power shaft 4.

For this purpose, as illustrated in Fig. 3 each lever 17 is formed with an extension 36 carrying a stud 37 engaging a disk 38, this stud 37 remaining locked on the right hand side of the disk 38 against the action of spring 15*a* during the aforesaid predetermined number of revolutions; this disk 38 has a notch 39 formed therein (see Figs. 4 to 8) through which the stud 37 is adapted to pass when moving from one to the other side of the disk as the lever 17 is switched from its operative position to its inoperative position and vice-versa.

The disk 38 is mounted for loose rotation on the shaft 4 and rotatably rigid with a pinion 40 having one tooth every *n* teeth truncated down to the pitch circle, this pinion 40 being constantly in meshing engagement with another pinion 41 formed with a toothed segment and a smooth segment of a diameter slightly smaller than that of the pitch circle; this pinion 41 is rotatably rigid with the input pinion 33 rotating through a full revolution each time it is in its operative position.

By properly combining the diameters of the meshing pinions 40 and 41, the number of teeth of pinion 41, and the positions and dimensions of the notches 39 and disk 38, these notches 39 may be adapted to permit the passage of the stud 37 carried by the extension 36 of lever 17 only after the shaft 4 has accomplished a predetermined number of revolutions.

Thus, if a pair of notches 39 spaced 180 degrees apart are formed in the disk 38 as shown in Fig. 4, if the ratio between the pinions 40 and 41 is 24:26, and if the pinion 41 has six teeth, upon each complete revolution of the pinion 41 the other pinion 40 as well as the disk 38 will rotate through an angular distance of six teeth, i.e. one fourth of a revolution; therefore, it is only after two complete revolutions that the other notch 39 will permit the passage of the stud 37 to enable the lever 17 to move back to its inoperative position.

If without altering the ratio of the pinions 40 and 41 the pinion 41 has eight teeth and the disk 38 a single notch, as shown in Fig. 5, upon each complete revolution of the pinion 41 the other pinion 40 as well as the disk 38 will rotate through an angular distance of eight teeth, i.e. one-third of a revolution; therefore, it is only after three revolutions that the notch 39 will permit the passage of the stud 37.

With the same ratio between the pinions 40 and 41, and with only six teeth on the pinion 41, if the disk 38 has only one notch 39, as shown in Fig. 6, upon each complete revolution of the pinion 41 the pinion 40 as well as the pinion 38 will rotate through an angular distance of six teeth, i.e., one-fourth of a revolution; therefore, after only four revolutions the stud 37 will again engage the notch 39.

It will be observed that in the foregoing the terms "number of teeth" of the pinion 41 having a toothed segment and a smooth segment do not indicate the actual number of teeth formed on this pinion but the number of teeth by which its toothed segment causes the associated pinion 40 to rotate, this segment having one tooth every *n* teeth truncated down to the pitch diameter, when it effects a complete revolution about its axis, its smooth or plain segment subsequently locking this pinion when it is in meshing engagement therewith.

Of course, the forms of embodiment shown in the attached drawings and described hereinabove are given only by way of example and should not be construed as limiting

the scope of the invention, as many modifications and alterations may be brought thereto without departing from the spirit and scope of the invention.

If the ratio between the pinions 40 and 41 is 20:30 and the pinion 41 has 4 teeth, the disk 38 having only one notch 39, as illustrated in Fig. 7, upon each full revolution of this pinion 41 the other pinion 40 will rotate through an angular extent corresponding to four teeth, i.e. one fifth of a revolution, as will the disk 38; therefore, it is only after five revolutions that the notch 39 will permit the passage of the stud 37.

By resorting again to the ratio 24:26 between the pinions 40 and 41, and providing 4 teeth on the pinion 41, the disk 38 having only one notch 39, as indicated in Fig. 8, upon each complete revolution of the pinion 41 the pinion 40 will rotate through an angular extent of four teeth, i.e. one-sixth of a revolution, as well as the disk 38; therefore, it is only after six revolutions that the stud 37 will be able to clear the notch 39.

What I claim is:

1. In a calculating machine having a toothed, counter input gear and a driving output shaft, in combination, a first disc mounted displaceable axially on said driving shaft for rotation therewith, said first disc having at least some peripheral teeth for meshing with said gear, means for moving said first disc axially on said driving shaft into an operative position in which its teeth mesh with said input gear and to an inoperative position out of engagement with said gear comprising, an auxiliary shaft driven synchronously by said driving shaft, means coupling the auxiliary shaft to the driving shaft for synchonous driving therefrom, a second disc mounted axially displaceable on said auxiliary shaft for rotation therewith, a pivoted lever rockable between two terminal positions cooperative with said second disc for displacing the auxiliary disc axially on the second shaft to two axially spaced positions constituting an operative position and an inoperative position corresponding to the operative and inoperative positions of the first disc respectively, means including said lever operatively coupling the first and second discs for controlling axial displacement of the first disc from said second disc, means constantly biasing said lever toward a first terminal position for moving the second disc to said inoperative position, means driven by the driving shaft for moving said lever to a second terminal position at predetermined intervals representative of given number of revolutions of the driving shaft for moving the second disc in its operative position.

2. In a calculating machine having a toothed, counter input gear and a driving output shaft, in combination, a first disc mounted displaceable axially on said driving shaft for rotation therewith, said first disc having at least some peripheral teeth for meshing with said gear, means for moving said first disc axially on said driving shaft into an operative position in which its teeth mesh with said input gear and to an inoperative position out of engagement with said gear comprising, an auxiliary shaft driven synchronously by said driving shaft, means coupling the auxiliary shaft to the driving shaft for synchronous driving therefrom, a second disc mounted axially displaceable on said auxiliary shaft for rotation therewith, a pivoted lever rockable between two terminal positions cooperative with said second disc for displacing the second disc axially on the auxiliary shaft to two axially spaced positions constituting an operative position and an inoperative position corresponding to the operative and inoperative positions of the first disc respectively, means including said lever operatively coupling the first and second discs for controlling axial displacement of the first disc from said second disc, means constantly biasing said lever toward a first terminal position for moving the second disc to said inoperative position, means driven by the driving shaft for moving said lever to a second terminal position at predetermined intervals each representative of given number of revolutions of

the driving shaft for moving the second disc in its operative position, and means for maintaining said lever in said second terminal position for a predetermined number of revolutions of said driving shaft.

3. In a calculating machine having a toothed counter input gear and a driving output shaft, in combination, a first disc mounted displaceable axially on said driving shaft for rotation therewith, said first disc having at least some peripheral teeth for meshing with said gear, means for moving said first disc axially on said driving shaft into an operative position in which its teeth mesh with said input gear and to an inoperative position out of engagement with said gear comprising, an auxiliary shaft driven synchronously by said driving shaft, means coupling the auxiliary shaft to the driving shaft for synchronous driving therefrom, a second disc mounted displaceable axially on said auxiliary shaft for rotation therewith, said second disc having a radially extending camming radial projection, a first pivoted lever operatively coupling said first and second discs and rockable between two angularly spaced oppositely disposed positions, a second pivoted lever rockable between two angularly spaced oppositely disposed positions and having a laterally extending projection positioned to cooperate with the first-mentioned camming projection for controlling axial displacement of the second disc between two axially displaced positions in dependence upon the position of the second lever in its two opposite positions, the last-mentioned opposite positions corresponding to the operative and inoperative positions of the first disc respectively, means driven by the driving shaft for rocking the second lever angularly, at predetermined intervals of rotation of said driving shaft, to an angular position corresponding to the operative position of said first disc to cause the second disc projection to engage the projection on the second lever, thereby to move the second disc axially on the auxiliary shaft and move the first disc to said operative position, and means constantly biasing the second lever to its other angular position corresponding to a position for placing the first disc in its inoperative position.

4. In a calculating machine having a toothed counter input gear and a driving output shaft, in combination, a first disc mounted displaceable axially on said driving

shaft for rotation therewith, said first disc having at least some peripheral teeth for meshing with said gear, means for moving said first disc axially on said driving shaft into an operative position in which its teeth mesh with said input gear and to an inoperative position out of engagement with said gear comprising, an auxiliary shaft driven synchronously by said driving shaft, means coupling the auxiliary shaft to the driving shaft for synchronous driving therefrom, a second disc mounted displaceable axially on said auxiliary shaft for rotation therewith, said second disc having a radially extending camming radial projection, a first pivoted lever operably coupling said first and second discs and rockable between two angularly spaced oppositely disposed positions, a second pivoted lever rockable between two angularly spaced oppositely disposed positions and having a laterally extending projection positioned to cooperate with the first-mentioned camming projection for controlling axial displacement of the second disc between two axially displaced positions in dependence upon the position of the second lever in its two opposite positions, the last-mentioned opposite positions corresponding to the operative and inoperative positions of the first disc respectively, means driven by the driving shaft for rocking the second lever angularly at predetermined intervals, of rotation of said driving shaft, to an angular position corresponding to the operative position of said first disc to cause the second disc projection to engage the projection on the second lever thereby to move the second disc axially on the auxiliary shaft and move the first disc to said operative position, means constantly biasing the second lever to its other angular position corresponding to a position for placing the first disc in its inoperative position, and means to maintain the second lever in the first-mentioned angular position for a predetermined number of revolutions of said driving shaft.

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