Oct. 27, 1925.

1,558,676

J. T. HURLEY

COMPUTING MACHINE

Filed July 25, 1925

3 Sheets-Sheet 1

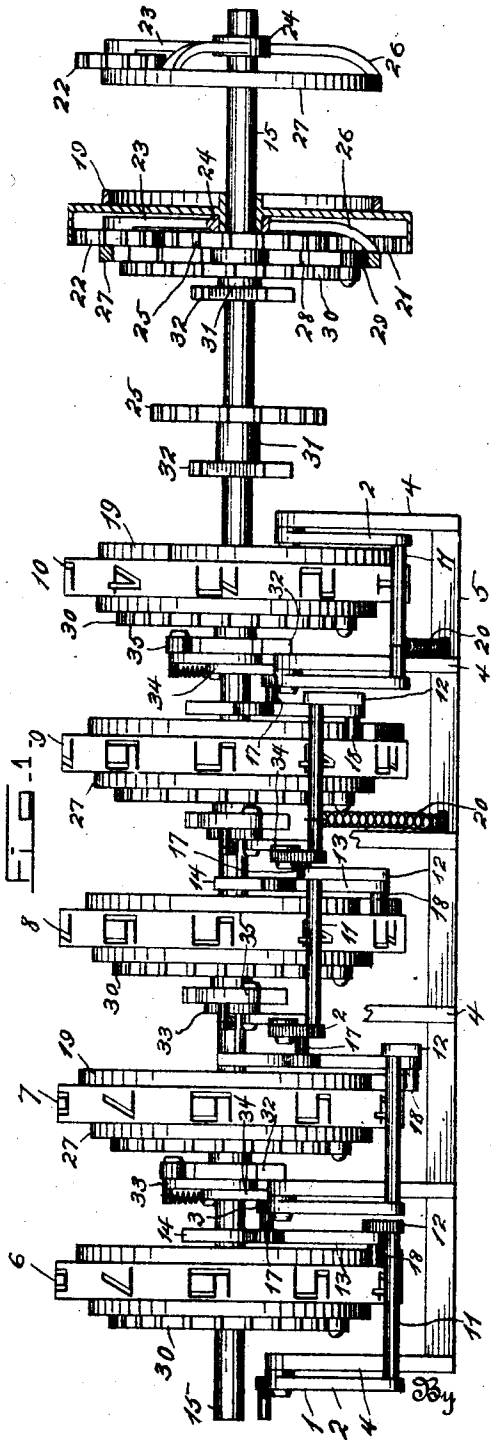


Fig. 1.

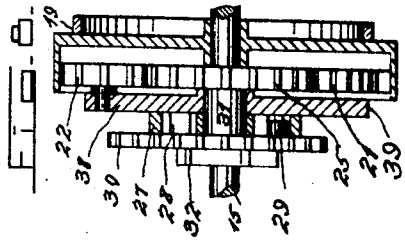


Fig. 5.

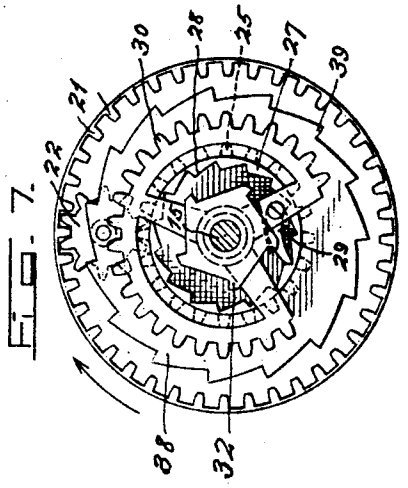


Fig. 7.

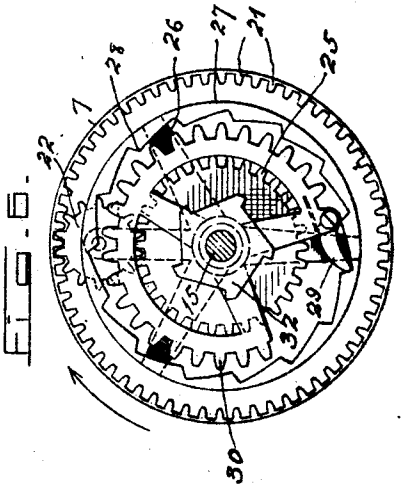


Fig. 6.

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Fig. 2.

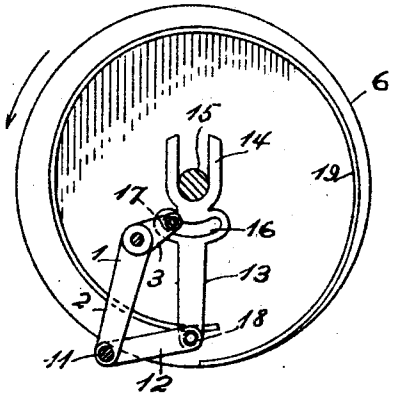



Fig. 3.

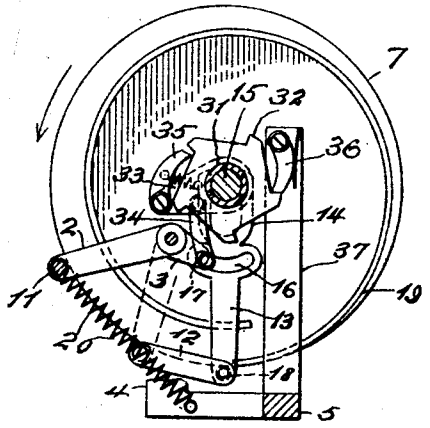



Fig. 4.

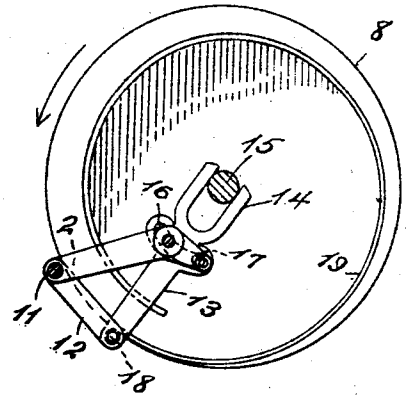
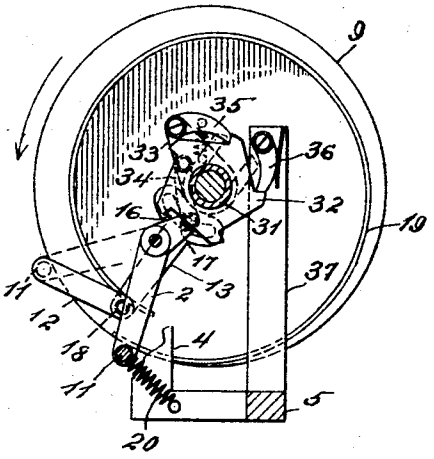



Fig. 5.




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Oct. 27, 1925.

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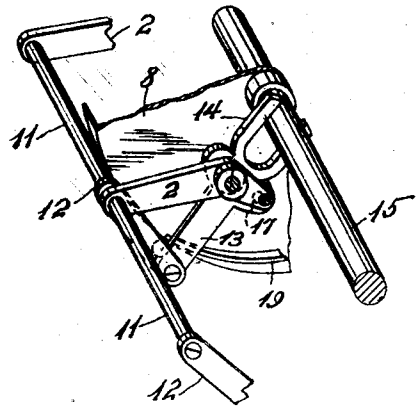
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Fig. 9.




INVENTOR

Austin T. Hurley

Patented Oct. 27, 1925. 1,558,676

# UNITED STATES PATENT OFFICE.

JUSTIN T. HURLEY, OF ELIZABETH, NEW JERSEY.

## COMPUTING MACHINE.

Application filed July 25, 1925. Serial No. 46,169.

*To all whom it may concern:*

Be it known that I, JUSTIN T. HURLEY, a citizen of the United States of America, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Computing Machines, of which the following is a specification.

My improvements relate to devices co-operating with transfer mechanism for the purpose of supplying an increment of transfer movement to the digit wheels without disengaging the wheels from the driving devices, and for moving en masse to the zero position those wheels which indicate ninth position when transfer movement is due. The particular form of transfer mechanism employed for this purpose may be found in an application filed by me July 18th, 1919, Serial No. 311,726.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Fig. 1 is a rear elevation of the digit wheel group illustrating the transfer mechanism in association therewith; Fig. 2, a view of the transfer device in normal position; Fig. 3, a view with the digit wheel in zero position and the transfer device in displaced position; Fig. 4, a view with the digit wheel in ninth position and the transfer device in displaced position; Fig. 5, a view with the wheel in ninth position and the transfer device with transfer movement completed; Fig. 6, a view of the digit wheel and its operating gears; Fig. 7, a modification of Fig. 6; Fig. 8, a vertical sectional view of Fig. 7, and Fig. 9, is a broken perspective view of wheel 8 and attendant mechanism.

Similar designating numbers indicate similar parts throughout the several views.

In the above mentioned application is described quite fully the mode of operation of the transfer structure embodied herein and the inter-relation of the various parts in effecting en masse movement of the digit wheels to which transfer movement is due. The transfer device consists of the bell-crank 1, composed of a downwardly extending arm 2 and a forwardly extending arm 3. One of these bell-cranks is located adjacent each digit wheel and is pivoted to a support 4 which extends from the base-plate 5. For convenience of description the digit wheels are designated 6, 7, 8, 9, and 10. The arm 2 and rod 11 for the units wheel, not shown herein, are stationary.

Secured to each arm 2 and extending beneath and slightly to the rear of the median line of each digit wheel, not necessarily including the wheel 10 which is highest in the order, is a connecting rod 11, whose other end is pivoted to a transfer link 12. The other end of the link 12 is in pivotal association with a setting link 13 which is provided with a yoke 14, that slidably and rotatably straddles the axial rod 15 upon which rotate the several digit wheels. The pivotal arrangement of links 12 and 13 with each other and with the rod 11, provide what is known as a "toggle." The wheel axis rod 15 is ordinarily fixed in the side frames of the machine and which are not shown herein. The setting link 13, arranged alongside the bell-crank 1, is supplied with a slot 16 that is engaged by a pin 17, which projects laterally from the arm 3 corresponding to the next higher order wheel. The slot 16 compensates for the radial swing of the arm 3 on its pivotal support and for the longitudinal and angular oscillations described by the link 13.

A roller stud 18 is attached to the pivotal connecting point of link 13 with the link 12 and normally rests, as shown in Fig. 2, against the inner end of a spiral transfer spline 19 which is attached to the side of each digit wheel. The spline 19 beginning at its inner end, or that end which is nearest the axis of the wheel, forms a volute whose other end is preferably flush with the periphery of the wheel, and when the wheel is being rotated from zero position, Fig. 2, to the zero position, Fig. 3, the stud 18 will be cammed outwardly, or away from the axis of the wheel, and the link 13, conforming with this camming movement, will slide its yoke 14 upon the wheel axis rod 15. The pin 17 engaging in the slot 16, causes the arm 2 representing the next higher order wheel, to be moved to the displaced position shown in Fig. 3, and as the stud 18 passes over the outer end of the spline 19 the spring 20, which extends from the base 5 to the rod 11, will restore the parts to the position illustrated in Fig. 2, resulting in transfer being effected from wheel 7 to wheel 8.

In any other than zero position of a wheel the spline 19 will have conformably displaced the members 13 and 12 and the member 2 for the wheel next higher in the order,

but no transfer can be effected until the stud 18 passes over the outer end of the spline. Thus all of the wheels which are variously advanced beyond the zero position at any particular time will have their transfers variously displaced, or in a degree commensurate with the pitch of the cam at the point at which the wheel may be, and this "building up" against the tension of springs 20 will be gradual throughout the rotation of the wheels. However, if wheel 7 reaches zero, as shown in Fig. 3, its spline 19 will, through the link 13, have moved the arm 2 to the position shown, and the connecting rod 11, through the medium of link 12, will have angularly displaced the link 13 associated with wheel 8 to the position illustrated in Fig. 4, which corresponds to the 9 position on the wheel. In effecting this angular position of link 13 for wheel 8, the roller stud 18 with which it is associated will be caused to roll one space upon the spline 19 of wheel 8, and ordinarily, if the wheel 8 is in other than position 9, will be moved back one step as wheel 7 transfers to wheel 8, without, it should be explained, in any degree affecting the position of wheel 9, for as will be understood, during the angular movement of link 13 to normally vertical position, which will occur simultaneously with consummation of transfer to its associated wheel 8, it is intended that no change will be produced in the acquired position of arm 2 for wheel 9, the slot 16 accommodating the pin 17 to permit such positional re-arrangement. If, however, wheel 8 indicates ninth position, as illustrated, when it is to receive an increment of transfer from wheel 7, the angular movement supplied by rod 11 to the link 13 appropriate to wheel 8 will have carried the roller stud 18 over the outer end of spline 19, whereupon the link 13 will restore longitudinally as shown, for example, on wheel 9, Fig. 5, and wheel 8 will then have transferred to wheel 9. Coincidentally the link 13, Fig. 4, will be restored angularly by consummation of transfer from wheel 7 to wheel 8 and the parts including the wheel will then stand as shown in Fig. 2, or in other words, wheel 8 will be at 0, its links 12 and 13 will be at normal and the arm 2 representing wheel 9 will also be at normal. At this operation wheel 9, unless it stands in the ninth position illustrated in Fig. 5 at the inauguration of transfer from wheel 8, will not transfer higher.

It will be apparent from the foregoing illustration that those wheels which are in ninth position and whose transfers are operated by lower order wheels will coincidently operate the transfers for higher order wheels, and if all of the wheels are in the ninth position they will be moved en masse to zero. The operation of the transfer is similar to that illustrated in the above mentioned application in which the transfer is controlled by a toggle and moves the wheel one step through the medium of a pawl in engagement with a ratchet.

In this instance I have associated my transfer structure with a digit wheel which is driven by what is commonly known as a planetary gear, and consists as in Fig. 6, of an internal gear 21 provided on the digit wheel rim, a planetary gear wheel 22 that meshes with the gear 21 and is pivotally attached as shown in section, Fig. 1, to an arm 23 secured to a hub 24, which is pivotally mounted on the journal rod 15. The central or sun gear wheel 25 is rotatable on the rod 15 and remains constantly in mesh with the gear 22. From the hub 24 extend the members 26 to which is secured a ring 27 having a ratchet 28 that is engaged by a spring pressed driving pawl 29 pivotally attached to the side nearest the digit wheel of a gear sector 30, which is journaled on the hub 31 of the central gear 25 and utilized as an oscillating driving sector to ratchet forward, in definite stages, the ring 27, whereby the planetary gear 22, in mesh with the stationary sun gear 25, will be given a rotative movement on its axis, together with an orbital revolution around the point 15 coaxial with the wheel 25.

The wheel 7 is, in this instance, provided with sixty teeth and the gear wheel 25 is provided with thirty teeth, although if preferable the pitch diameter of these gears may be differently arranged. The driving sector 30 may be operated by one of the several well-known driving mechanisms adapted for this purpose, and as the sector is oscillated to rotate the digit wheel, Fig. 6, one space, the pawl 29 will mesh with the next tooth of the ratchet 28; or if the digit wheel is to be advanced nine digits the pawl 29, through the ratchet ring 27, will move the gear 22 an angular distance which will be equal to nine teeth of the ring 27, which is supplied with fifteen teeth; meanwhile the gear 22 rotating on its axis will move the digit wheel the required distance.

Secured to the hub 31 of the gear 25 is a transfer ratchet wheel 32, provided with five teeth, and loose upon the rod 15 alongside the ratchet 32 is an arm 33 which is in pivotal connection with the bell-crank arm 3 by a link 34, Figs. 1, 3 and 5. Pivoted to the arm 33 is a transfer pawl 35 which engages the ratchet wheel 32. If now the setting link 13 is displaced as in Fig. 3 or Fig. 4, the arm 3, through the medium of link 34, will move the arm 33 and its pawl 35 to the position shown in Fig. 3, and when the stud 18 passes over the outer end of spline 19 and allows the link 13 to restore longitudinally, as in Figs. 2 and 5, the arm 3 will also be restored, and through the arm 33 and pawl 35 will rotate the

ratchet wheel 32 one tooth, whereby its attached gear 25 will supply an axial rotative movement of six teeth to the gear 22, and this movement being communicated to the digit wheel will advance it one digit. It will of course be immaterial whether the digit wheel is being operated by the sector 30 when transfer is thus effected, for the result will be accumulative, and as the gear 25 remains motionless, except when utilized for transfer, its purpose will be, if the digit wheel is already in motion, to augment this movement by the additional transfer. When the arm 3 restores to complete the transfer it will finally come to rest with its side against the ratchet 32 and act as an effective momentum check for the wheel 25.

To prevent retrograde movement of the wheel 25 is provided a pawl 36, which is pivoted to a support 37 and rests against the ratchet 32, Figs. 3 and 5. The modification shown in Figs. 7 and 8 has a plate 38 pivoted upon the hub of the gear 25 and carries upon its outer face the ring 27, the teeth 28 of which are engaged by the driving pawl 29, as in Fig. 6. The planetary gear 22 is, in this instance, pivotally attached to the plate 38, and this plate is provided as shown, with peripheral teeth or notches 39 to be engaged by wheel checking devices not shown herein. In the modifications, Figs. 7 and 8, the planetary gear 22 is provided with ten teeth, the gear 21 with forty teeth and the central gear 25 with twenty teeth, while the ratchet 32 has five teeth and is to be moved one tooth at a time by the pawl 35.

Referring particularly to Fig. 1, it will be noted that in each instance the bell-crank 2—3 is pivoted eccentric to the wheel axis upon a support 4, arranged between each pair of wheels. A connecting medium between the transfer devices is pin 17, fixed in the end 3 of the bell-crank and engaging the link 13 representing the preceding wheel. Any longitudinal movement of link 13 is communicated to the next higher transfer set. Longitudinal movement in one direction will be supplied to link 13 when its wheel rotates from position 0, as represented in Fig. 2, to position 0 as represented in Fig. 3, where the stud 18, having cleared the end of spline 19, allows the spring 20 to restore the bell-crank 2 and thereby restore the link 13. The normal position of parts associated with wheel 6, Fig. 2, coincides with the position of parts associated with wheel 6 in Fig. 1. Assuming that all of the wheels and transfer devices of Fig. 1 are in the normal position shown at wheel 6, it will be readily understood by one skilled in the art, that movement of wheel 6 around to 0 will cause longitudinal movement of link 13. This movement being communicated through the bell-crank will first set the pawl 35 in the position shown in Fig. 3, and as wheel 6 passes to 0 the bell-crank, impelled by spring 20, will restore the pawl 35 as in Fig. 5. The operation will advance the ratchet 32 one tooth and advance the wheel 7 one digit. This mode of transferring is readily understood.

The bell-crank and the link 13 are mutually operative. Link 13 in moving from normal (Fig. 2) to full displacement longitudinally, (Fig. 3) displaces the higher order bell-crank as shown, and when stud 18 clears the end of the member 19 the bell-crank will restore the link 13, as in Fig. 2. Another function of the bell-crank under actuation by link 13 is to displace the link 13 on the higher order wheel angularly, or from normal position 0 to position 9 of its wheel. The position of parts, Fig. 3, is similar to the position of parts intermediate wheels 7 and 8 in Fig. 1. Wheel 7 being about to transfer to wheel 8, the bell-crank is fully displaced, its rod 11 extending across wheel 8 has, through the medium of link 12, lifted its link 13 angularly to position 9 of wheel 8. As wheel 8, in this instance, stands in position 9, the link 13 will also be displaced longitudinally, (Fig. 4). Ordinarily wheel 8 when passing to 0, would transfer to wheel 9, but in receiving transfer from wheel 7 its transfer device has been advanced to position 9; therefore transfer from wheel 8 will occur while it is in position 9, and concurrently with receipt of transfer from wheel 7. Should we assume that in the order of arrangement between a pair of wheels, parts 13, 17, 2, 34 and 35 constitute a transfer set, rod 11 and link 12 would be considered the connecting medium between the several sets. In either event one of the principal objects of this structure is the provision whereby a link 13 causes the next higher link 13 to anticipate position 9 of its associated wheel. If each wheel of the series stands in position 9 and the units wheel is then rotated to 0 it is evident that the wheels will move en masse to 0, instead of in the usual consecutive manner.

I claim:

1. In a machine of the class described, the combination of digit wheels, planetary operating gears for the wheels, transfer devices in sets pivotally connected together and mutually operative, said transfer set effective when its respective wheel on the higher order side indicates ninth position, to transfer to said wheel and advance the next higher set one step to transfer from the ninth position of said respective wheel.

2. In a mechanism of the class described, the combination of digit wheels, planetary operating gears therefor, transfer devices in pivotally connected sets, each set adapted to

operate the next higher set irrespective of the indicated position of the intermediate wheel, said higher set to effect transfer when said intermediate wheel while standing in ninth position receives transfer, and concurrently with transfer to said intermediate wheel.

3. In a mechanism of the class described, the combination of digit wheels, planetary operating gears for the wheels, transfer devices in sets pivoted eccentric to the wheel axis and adapted to effect transfer to a moving wheel, each of said sets adapted to angularly oscillate the higher order set independently of the position of the intermediate wheel, toggle elements connecting said sets together, a ratchet and a pawl with intermediate connections to convey transfer movement to said wheels.

4. In a mechanism of the class described, the combination of digit wheels, a central and a planetary gear for the wheel, transfer devices in sets pivoted eccentric to the wheels, and connections to impart transfer movement through said gears to said wheels, pivotal toggle elements connecting said transfer sets, each of said sets adapted to a one step movement by a set of lower order, and said wheel to operate its appropriate set in either of two positions.

5. In a mechanism of the class described, the combination of digit wheels, a central and a planetary gear to operate the wheel, a driving element coaxial with the wheel and to move the planetary gear orbitally in ordinal stages, link connected transfer sets to be located in either of two operating positions with respect to the wheel said sets to be located in one of said operating positions by the preceding set of lower order, and elements pivoted coaxial with the wheel to convey transfer movement from either of said operating positions to said gears.

6. In a mechanism of the class described, the combination of digit wheels, a central and a planetary gear, an element to move the planetary gear orbitally and in ordinal stages, transfer elements in sets and connections operative around the wheel axis to convey movement to said gears, reciprocal toggle elements connecting together said transfer sets throughout the series, each of said sets to be given a one-step movement by the preceding lower set, and said wheels to operate said sets in either of two operating positions.

7. In a mechanism of the class described, the combination of digit wheels, planetary operating gears and oscillatory driving elements, transfer devices in sets pivoted eccentrically to the wheels and having a normal and an abnormal operating position, the last mentioned position being determined by the next lower transfer set independently of the position of the intervening wheel and said intervening wheel to operate its respective set in either of said positions, a recriprocative arm coaxial with the wheel, connections from said arm to said set, and a pawl and ratchet operative through said arm to convey movement to said gears.

8. In a mechanism of the class described, the combination of digit wheels and planetary operating gears therefor, transfer devices in sets, each set adapted to diverse angular adjustment by the preceding set irrespective of the indicated position of the intermediate wheel and to consummate transfer from any of said diverse positions, pivotal toggle elements connecting said transfer sets throughout the series and cooperating with the wheels to determine when transfer shall be effected, and reciprocal elements connecting said sets with the wheel gears to convey transfer movement while said wheels are being otherwise driven.

JUSTIN T. HURLEY.