Sept. 22, 1942. H. E. WILLIAMS ET AL 2,296,549

IMPULSE CONTROL

Filed April 21, 1941

Fig. 1.

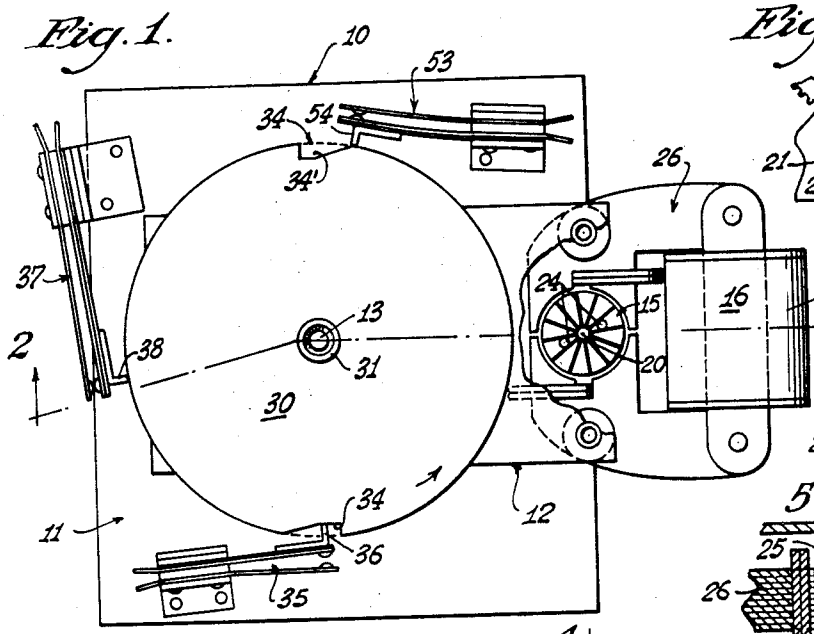


Fig. 5.

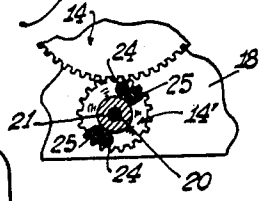
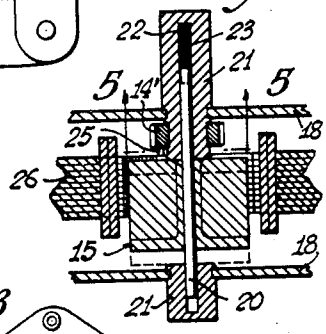


Fig. 4.



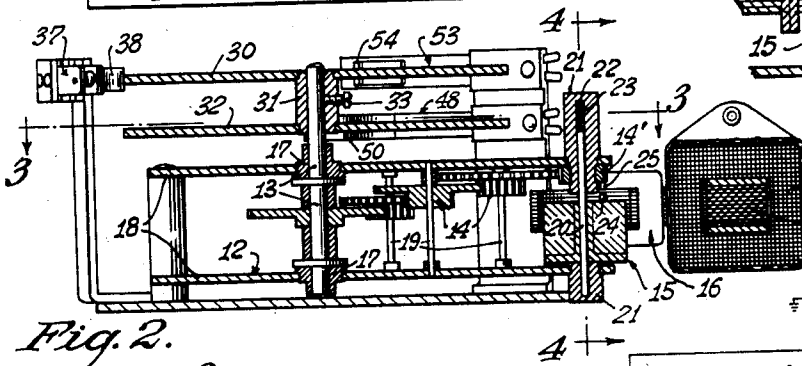
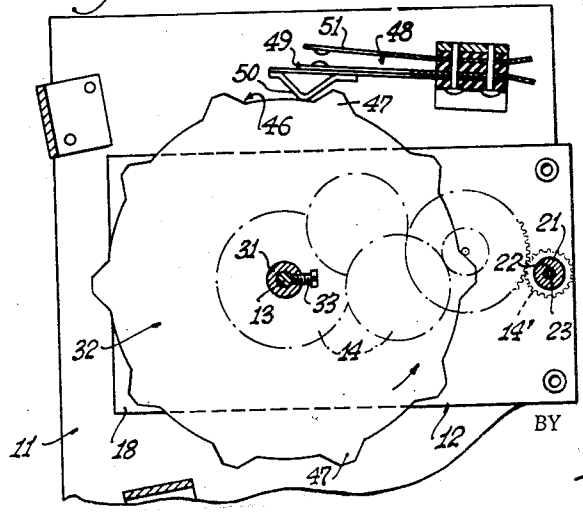


Fig. 2.

Fig. 3.



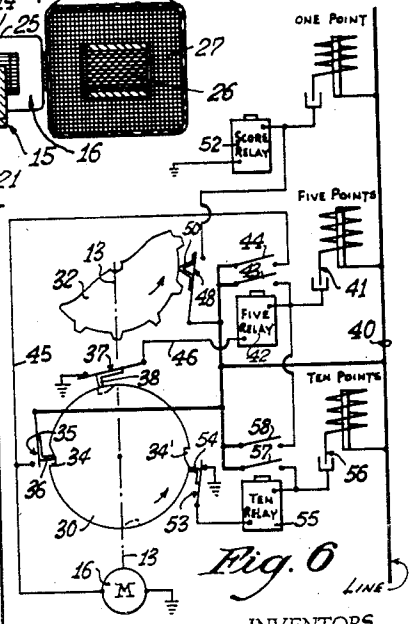


Fig. 6

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IMPULSE CONTROL

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Chicago, Ill.

Application April 21, 1941, Serial No. 389,504

1 Claim. (Cl. 172—239)

This invention relates to an impulse control unit and has for its principal object the provision of a device of this class which will be economical in manufacture and construction and highly efficient in use.

Another object of this invention is the provision of an arrangement of parts to be controlled by electrical circuits such as to create a series of electrical impulses corresponding to a predetermined value of a particular initial or starting switch.

It is another object of this invention to provide a simple arrangement of relatively few parts which will function to effect a predetermined number of electrical impulses upon each operation of the device.

It is a still further object of this invention to provide a relatively simple impulse unit which may be used in game apparatuses or the like for the purposes of stepping up a score corresponding to the value of a particular initially operated switch.

Other objects and advantages will appear more fully in the specification in view of the accompanying drawing in which:

Fig. 1 is a top plan view of our impulse unit;

Fig. 2 is a vertical sectional detail of the same as seen along line 2—2 in Fig. 1;

Fig. 3 is a fragmentary sectional detail of an impulse take-over embodied in our new structure as seen from line 3—3 in Fig. 2;

Fig. 4 is a fragmentary vertical sectional detail through clutch mechanism employed in our present invention as seen along line 4—4 in Fig. 2;

Fig. 5 is a fragmentary horizontal, detail partly in section looking up from line 5—5 in Fig. 4; and

Fig. 6 is a schematic electric wiring diagram with which our new unit may be employed.

Our new unit is indicated at 10 and comprises a main plate 11 upon which is fixed a drive unit 12 having a vertically arranged shaft 13 adapted to be driven through a train of gears 14 by the armature 15 of an electric motor 16. The drive shaft 13 is suitably mounted on bushing members 17 carried by a pair of mounting plates 18, which plates 18 likewise form bearings for cross shafts 19 upon which the several gear elements 14 are mounted. The armature 15 is rotatable with a shaft 20 which in turn is supported for rotation in a pair of bushings 21 carried on opposite plates 18 with the uppermost bushing provided with an elongated sleeve 22 within which is disposed a relatively light compression spring 23. The spring 23 normally disposes the armature 15 and shaft 20 in a lowered position as seen in Fig. 2 with a pair of lugs 24 carried on the upper face of the armature 15 out of engagement with a corresponding pair of lugs 25 on the lower face of a spur gear 14' forming a part of the train of gears 14 heretofore referred to.

The motor 16 provides a field for the armature through the medium of a laminated core 26 such that when the winding 27 of the motor is energized the armature 15 will be attracted upwardly to the position shown in Fig. 4 against the action of the spring 23 with the oppositely disposed lugs 24—25 in a position to couple the armature with the spur gear as seen in Fig. 5. The subsequent rotation of the armature 15 will thereupon be transmitted through the train of gears and to the vertical drive shaft 13 to rotate the latter.

The motor control in the present structure is provided by a disc member 30 which is carried on a hub 31 together with a second disc 32. The two discs are fixed to the hub 31 and the latter in turn is mounted upon the shaft 13 and is fixed thereto by a set screw 33 so that the discs will rotate with the shaft 13. The disc 30 has formed therein a pair of notches 34 and in the present instance these notches are formed at points diametrically opposite to each other (Fig. 1). The disc 30 cooperates with a number of switches to control the rotation of the shaft 13 through operation of the motor 16, and among these switches there is a main motor control switch 35 consisting of a pair of leaf spring switch elements, one of which has a portion 36 thereof adapted to bear against the peripheral edge of the disc 30 and normally disposed in one of the notches 34 so as to dispose the contact elements of the switch 35 in broken circuit condition. Another of the switches associated with the disc 30 is a hold switch 37 which likewise has a portion 38 thereof adapted to bear against the peripheral edge of the disc 30 to maintain the contact elements of the switch 37 in closed contact condition, and this switch is adapted to assume a broken circuit condition when the portion 38 thereof is disposed in any one of the notches 34.

The arrangement of the switches 35 and 37 with respect to the disc 30 will best be understood by reference to the diagram in Fig. 6 wherein 40 indicates a "line" from the main source of supply of electrical energy. An initial starting switch is indicated at 41, and in the present instance is shown in the form of a bumper switch such as the one described in our United States Letters Patent No. 2,184,868, issued December 26, 1939. Associated with the switch 41 is a relay 42 which is provided with a self-holding switch

43 and a switch 44 adapted to supply current from the line 40 via a conductor 45 to the electric motor 16. As soon as the switch 41 has been momentarily closed by the operation of a ball the relay 42 will be energized. Current flowing through the switch 41, relay 42 and a conductor 46 establishes a ground connection through the switch 37. Energization of the relay 42 attracts the switches 43 and 44 into closed circuit condition, the switch 43 maintaining circuit from the line through the relay 42 while the switch 44 initially establishes circuit to the electric motor 16. The disc 30 will now be rotated counterclockwise rotating the notched portion 34 out of alignment with the portion 36 of the switch 35 so that the latter will assume a closed circuit condition by reason of engaging the peripheral edge of the disc 30. The opposite notch formation 34' eventually aligns with the projection 38 so as to dispose the switch 37 in broken circuit condition thereupon breaking ground connection for the relay 42 to deenergize the latter and break the circuit at switches 43 and 44. However, the portion 36 of switch 35 is still bearing on the peripheral edge of the disc 30 to maintain the switch 35 in closed circuit condition such that current will continue to flow to the motor 16 and the disc 30 will continue to rotate until the notch 34' aligns with the projection 36 whereupon switch 35 will assume broken circuit condition and the motor cease operating. It will thus be seen that the disc 30 and shaft 13 will have made one-half revolution.

The complementary disc 32 rotates with the shaft 13 along with the disc 30, and this disc 32 has formed on its peripheral edge a series of indentations 46 and a corresponding series of projecting teeth 47. In the present instance, there is provided an impulse switch 48 having one switch element 49 provided with a cam element 50 and this cam element 50 is normally disposed in one of the indentations 46 as seen in Fig. 3 with the switch element 49 out of engagement with a corresponding switch arm 51 so as to render the switch 48 in broken circuit condition. As seen in Fig. 3, the disc 32 with its serrated edge portion rotates with the shaft 13 as explained above, by reason of the half revolution of the shaft 13, five of the projecting teeth 47 will engage the cam element 50 to intermittently close and open the switch 48 resulting in a corresponding number (five) of uniform operations of the switch 48 to set up a like number of electric impulses through that switch into an electromagnet 52 which may form a part of any suitable counter mechanism.

In the event an additional number of impulses of the switch 48 are required, there is provided an additional control switch 53 which is associated with a disc 30 and has an element 54 normally engaging the peripheral edge of the disc 30 to maintain the switch 53 in closed circuit condition.

This switch 53 is arranged on the plate 10 to engage the disc 30 at a point such that the switch 53 will be disposed in a closed circuit condition immediately upon the stopping of the rotative movement of the disc 30. With the arrangement as thus described, there is provided a relay 55 which has an initial starting switch 56 like unto the switch 41 heretofore referred to, and this switch 56 has a greater value than the switch 41. A closing of the switch 56 will set up circuit in the relay 55 which is grounded through the switch 53 to close a pair of relay switches 57 and 58. The switch 57 is a holding switch which when once closed will maintain a circuit from the line 40 through the relay 55. The switch 58 directs current from the line 40 into the relay 42 to energize the latter and attract the relay switches 43 and 44 into closed circuit condition whereupon they will complete circuit as described above to hold the relay 42 in closed circuit condition and to energize the motor 16 for rotation. Under these circumstances, when the element 38 of the switch 37 drops into the first engaging notch 34 to break circuit to the relay 42 the motor switch 35 will, as before stated, hold the circuit to the motor 16 so that the latter may continue to rotate the disc, and when the element 38 of the switch 37 again rides upon the peripheral edge of the disc 30 circuit to the relay 42 will again be established by reason of the fact that the switch 58 is still closed to supply circuit to the relay 42. Therefore, when the notched portion 34, at one-half revolution engages with the element 36 of the switch 35 to break circuit, the motor will continue to operate by reason of the switch 44 still being in closed circuit condition. The switch 53, however, will have been broken by reason of the element 54 thereof engaging in the notch 34 thus breaking circuit to the relay 55. The relay 42 then will maintain the circuit to the motor until the switch 37 is again broken by reason of engagement in a notch 34 on the disc 30 and from thence forward, the motor circuit will be maintained through the switch 35 until one of the notches 34 comes into alignment with the element 36 to break circuit at the switch 35 and thereupon the motor 16 will be deenergized and cease operating. It will thus be seen that the disc 30 upon closing of the switch 56 will rotate one complete revolution whereas the disc 30 will rotate only one-half revolution when the switch 41 is operated.

Upon a complete revolution of the disc 32 by reason of a closing of the switch 56 as just described, the impulse switch 48 will be intermittently opened and closed ten consecutive times to create a corresponding number of electrical impulses into the electromagnet 52 to operate a score commutator or any other like device with which the electromagnet may be associated.

It will be noted that by reason of the reciprocable shaft 20, with which the armature 15 is associated, driving connection between the motor 16 and the train of gears 14 will be established only when the motor is energized. From the foregoing it is obvious that during the rotation of the discs 30 and 32 as heretofore explained, there is a certain retarding effect by reason of the frictional engagement of the various elements 36, 38, 50 and 54 on the peripheral edges of the discs so that immediately upon deenergization of the motor 16 the spring 23 will function to shift the rod 20 and the armature 15 into uncoupling condition and the discs 30 and 32 will cease to rotate instantly without any over-ride.

In this present disclosure, we have provided an impulse unit requiring a minimum of parts of relatively simple construction such as to lend toward considerable economy. By reason of the employment of a clutch type motor there is entirely eliminated in this device of any need for a brake mechanism for the rotating discs. In the present disclosure it is preferable, though not necessary, that the shaft 13 rotate approximately 20 R. P. M. At such a speed the discs 30 and 32 being of a relatively small diameter do not create

any considerable amount of kinetic energy and whatever momentum may be created is overcome by the frictional engagement of the various elements **36**, **38**, **50** and **54** such that immediately upon disengagement of the clutch **24—25**, the shaft **13** and discs **30** and **32** will cease rotation and remain stationary at the desired position (Fig. 1).

While the present unit has been explained as being associated with a game apparatus in which there are bumper type switches, it is obvious that this present device is equally adapted for use in such devices as money changers in which finger depressed buttons may control switches of varying values such that when, say, a button is pushed to close the switch **56** the switch **48** will effect a number of impulses corresponding to the valve of the particular button pushed to energize either a magnet or solenoid **52** of the ejector type which will eject a corresponding number of coins payable as change.

While we have illustrated and described the preferred form of construction for carrying our invention into effect, this is capable of variation and modification without departing from the spirit of the invention. We therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of such variations and modification as come within the scope of the appended claim.

Having thus described our invention, what we claim as new and desire to protect by Letters Patent is:

In an impulse unit, a body, motor means on said body, a rotatable shaft, a train of gears for driving said shaft, coupling means in said motor and normally disposed out of engagement with said train of gears and adapted, when said motor means is energized, to drivingly engage said train of gears, motor control means comprising a disc rotatable with said shaft and having diametrically opposed notch formations in its peripheral edge, a plurality of switch members adapted to assume circuit breaking condition when disposed in engagement with one of said notches and adapted to assume circuit completing condition when engaging the periphery of said disc, said plurality of switches consisting of a motor switch arranged on said body and normally disposed in engagement with one of said notches, a starting switch arranged on said body to normally engage the periphery of said disc midway of said notches and an auxiliary switch arranged on the body to normally engage said peripheral edge of the disc such as to maintain the auxiliary switch closed until after said starting switch has been effected by one of said notches, means connected in circuit through said starting switch for initially energizing said motor for rotating said disc a circumferential distance between the notches, and a relay operatively connected in circuit through said auxiliary switch and adapted to effect operation of said last named means.

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