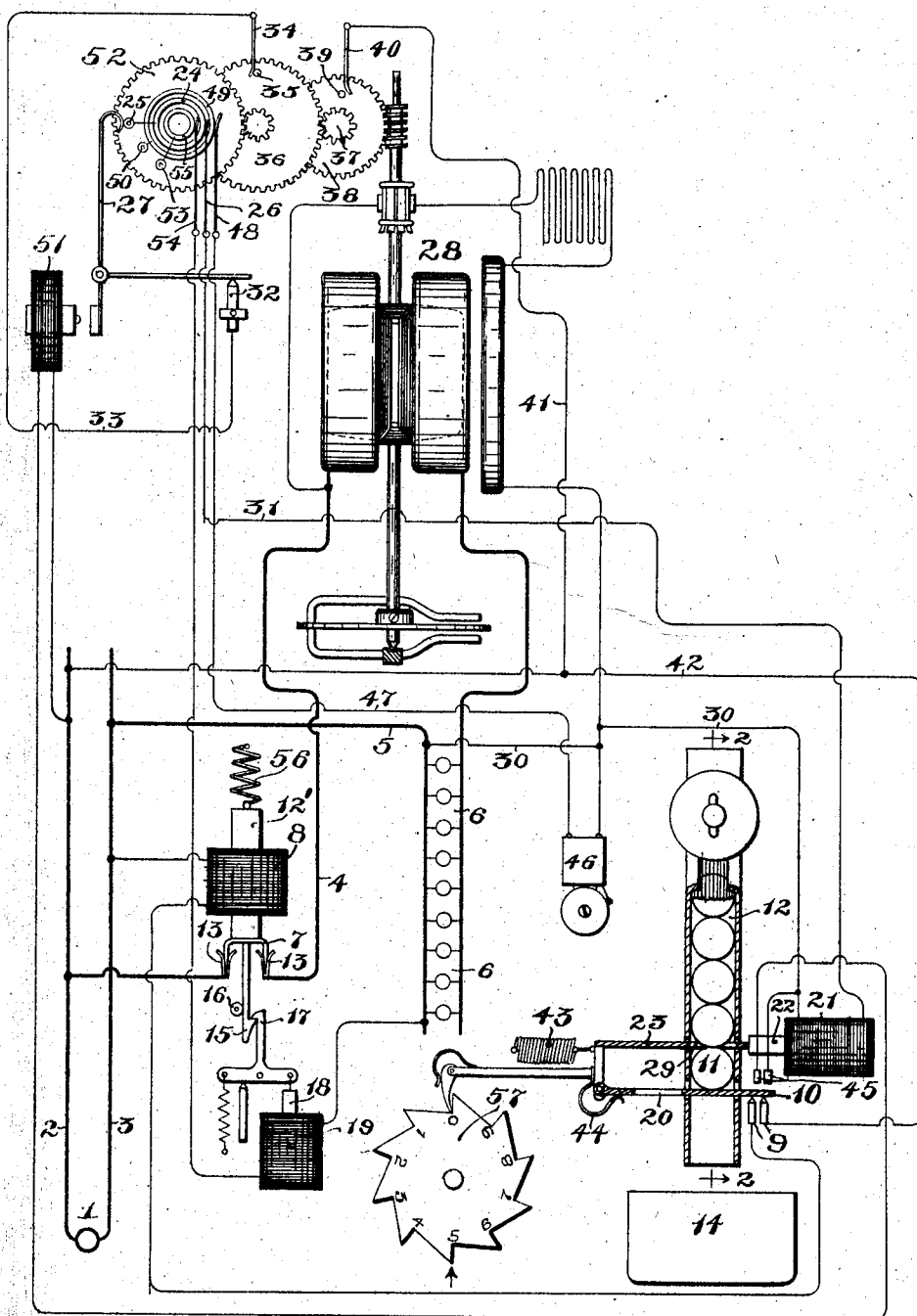


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PATENTED AUG. 1, 1905.

T. DUNCAN.
METER.

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Witnesses

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UNITED STATES PATENT OFFICE.

THOMAS DUNCAN, OF LAFAYETTE, INDIANA.

METER.

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To all whom it may concern:

Be it known that I, THOMAS DUNCAN, a citizen of the United States, residing at Lafayette, in the county of Tippecanoe and State of Indiana, have invented a certain new and useful Improvement in Meters, (Case No. 47,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to prepayment-meters, and has for its object the provision of various improvements in meters of this class and the circuits operating in connection therewith.

My invention has specifically for its objects, first, the provision of means whereby circuit will be automatically established upon the lodgment of a coin in pay for a measured quantity of energy; second, the provision of means whereby an alarm will be effected shortly prior to the consumption of this energy, whereupon additional payment may be made, if desired, to secure a further and uninterrupted supply of current; third, the provision of means whereby a plurality of coins may be deposited to secure the continued supply of energy corresponding to the total value of the coins; fourth, the provision of improved means for opening the consumer's circuit when the worth of the money has been used; fifth, the provision of means whereby the deposited coins may not be removed by unauthorized persons.

In practicing my invention I prefer to employ a switch serially included in the consumer's circuit and controlled by an electromagnet connected in bridge of the main supply-conductors, which bridge includes a switch that is controlled by the coin or coins that rest thereupon prior to the consumption of the value of the coins, the coins in resting upon this switch serving to close the same. If the consumer desires to use translating devices, a coin deposited upon the switch will close circuit through the said electromagnet, thereby effecting the closure of the consumer's circuit. The meter that is associated with the consumer's circuit is preferably caused to operate a switching device, which operates an alarm, this operation of a switching device being completed shortly after the removal of the last coin from the said switch to indicate that if the translating devices are to be kept in further continued service additional money must be deposited. Means are preferably

provided whereby this alarm does not take effect until nearly the total worth of the last coin has been used.

In order that a plurality of coins may be deposited to secure an aggregate return, I preferably employ a coin-chute in combination with two slides, one located above the other, that pass transversely therethrough, these slides being provided with offset slots, which are dissimultaneously adapted to register with the coin-slot, so that when a coin is permitted to pass into a receptacle through the slot in the lower slide the slot in the upper slide is out of alinement with the slot in the coin-chute, so that the balance of the coins cannot fall through the lower side. These slides are preferably mechanically united, so as to receive simultaneous reciprocation to preserve this proper offset relation of the slots located therein. A spring is preferably employed to normally keep the slides in a position wherein the slot in the lower slide is removed from alinement with the chute. In order to effect the timely actuation of the slides, an electromagnet is employed which is preferably in the form of a solenoid, whose core is attached to the slides. The helix of this electromagnet is preferably included in bridge of the main supply-conductors and contains switching mechanism operated by the meter to close the circuit through the magnet when the said meter has nearly recorded the measurement of consumed energy to the value of a coin. The magnet thereupon effects a reciprocation of the slides, removing the slot in the upper slide out of alinement with the coin to prevent the coins above the upper slide from falling through the chute and permitting the coin between the upper slide and the lower slide to fall through the slot in the lower slide, the space between the slides being preferably only sufficient to contain a single coin.

In order that an indication may be given that the value of the coin has been nearly consumed, assuming that but one coin had been deposited in the chute, the lower slide which previously acted as a part of a switching device to effect the closure of the consumer's circuit is now moved to enable the operation of an alarm, which is given a sufficient time in advance to enable the consumer to deposit additional money to continue his service. The lower slide for this purpose is preferably pivotally mounted upon a support that is common to both slides, a spring serving to move it in one direction when relieved of the

weight of the coin to effect the alarm, while the weight of the coin opposes the force of the spring to maintain the said slide in its other position. This alarm is not operated until the last coin has left the chute, the presence of a coin in said chute preventing its operation. To indicate the energy that has been consumed, a counting device is operated by the slides each time they are reciprocated.

The opportunity allowed to the consumer within which to supply additional money having elapsed and the motor of the meter having operated in proportion to the full value of the energy, switching mechanism is thereupon operated through the agency of the meter to close circuit through an electromagnet that is preferably in the form of a solenoid which effects the release of the main consumer's switch. This consumer's switch when first closed is brought into engagement with a detent to maintain the switch in a locked position, so that it may be independent of the coins except in so far as these coins may effect adjustment of the switching mechanism controlled by the motor of the meter. When the coin-chute is free of coins, the switching mechanism is at once adjusted, so that when the motor of the meter has been sufficiently operated the solenoid at present spoken of is energized to release the detent controlled thereby and effect a disengagement of the consumer's switch.

My application, Serial No. 141,728, filed February 3, 1903, discloses my improved fraud-protective mechanism which is claimed therein.

I will explain my invention more fully by reference to the accompanying drawing, which is a diagrammatic view of a system of distribution and a prepayment-meter with its associated apparatus connected therewith.

Any suitable source of current 1 is indicated as being connected with the supply-mains 2 3, from which are led the consumer's mains 4 and 5 to supply the consumer's translating devices 6 with current. A switch 7 is arranged to be automatically operated through the agency of an electromagnet 8, connected in bridge of the supply-mains and including switch-contacts 9 9, that are closed by a pivoted or swinging switch lever or arm 10 when a coin, as a coin 11, has been passed through the coin-chute 12 to rest upon the said lever and force it into metallic connection with the said contacts. When the bridge-circuit containing the helix of the electromagnet 8 is thus closed, the core 12' of the electromagnet, which is preferably in the form of a solenoid, is moved to force the switch 7, carried thereby, into engagement with the bifurcated contacts 13 13, whereupon the consumer may cause his translating devices—as incandescent electric lamps, for example—to operate. If it were not planned to afford the consumer notice shortly before his money's worth has been

consumed, the continued closure of the switch 7 might be made to depend upon the continued engagement of the lever 10 with the contacts 9, which engagement would be immediately broken upon the passage of the coin from the chute 12 into the receptacle 14 under conditions to be hereinafter set forth, and there being no coin to replace the coin fallen through the chute connection between the contacts 9 would be broken and the switch 7 released. It is, however, desired to maintain the switch 7 closed a short time after the coin has fallen through the chute and to release the same through other agency. I therefore preferably employ some such means as that illustrated, comprising a catch 15, carried by the core and guided by a roller 16 into engagement with a pawl 17 when the core 12' has been attracted to close the switch 7. This pawl 17 is preferably controlled by an electromagnet, which desirably is in the form of a helix whose core 18 is connected with the pawl and whose helix 19 is included in bridge of the main supply-conductors, which bridge contains a switch, to be hereinafter set forth, which is operated when the money's worth of current has been consumed to release the switch 7. The switch-lever 10 is preferably mounted to be reciprocated, being provided with a slot 20, normally out of alinement with the passage of the coin-chute, this slot being preferably only brought into alinement with the passage of the coin-chute when the value of the coin has about been consumed. To effect the reciprocation of the switch-lever 10, which thus constitutes a slide, I preferably associate the same with an electromagnet 21, desirably in the form of a solenoid and connected in bridge of the supply-mains, the core 22 of which solenoid is connected with the slide 10, preferably through the agency of a second slide 23. The electromagnet 21 effects the reciprocation of the slide 10 when the coin immediately supported thereby is to fall from the chute 12 into the receptacle 14.

In order to properly time the operation of the magnet 21, I prefer to include the same in circuit with a switch that preferably includes a slip-ring 24, the contact-button 25, the contact-brush 26 for effecting connection between the electromagnet and the said slip-ring, and a switch-spring 27 for connection with the button or contact 25 and effect an engagement between the switch-contacts 27 and 25 by means of a wattmeter-motor 28, that is adjusted to operate at a rate proportional to the energy consumed and the value thereof, the field of the motor 28 being included in series in a consumption-main, while the armature is connected in bridge of the consumption-mains. The motor 28 having operated to bring the contact parts 25 and 27 into connection, causes the energization of magnet 21, thereby effecting a reciprocation of the slide 10 to bring the slot 20 into

alignment with the chute 12 to permit a coin to fall within the receptacle 14. To prevent additional coins that may be in the slot from also falling through the coin-chute into the receptacle, the slide 23 is provided with a slot 29, that is maintained normally in alignment with the coin-chute when the magnet 21 is deenergized, but which is brought out of alignment therewith to effect a closure of that portion of the coin-chute above the coin that is to fall through the slot 20, that has now been brought into alignment with it while the said magnet is energized. The bridge-circuit, including the magnet 21, may be traced from the supply-main 3 by way of the consumer's main 5, through branch conductors 30, the winding of the said electromagnet, conductor 31, the spring 26, the collector-ring 24, the contact 25, the spring-contact 27, the anvil 32, the conductor 33, the contact-brush 34, contact-pin 35, wheels 36, 37, 38 of a train operated by the motor, contact-pin 39, brush 40, conductors 41 and 42, to the transmission-main 2.

The circuit through the magnet 21 is broken shortly after it is made by the brushes 34 and 40, so that the spring 43 may effect the return of the slides 10 and 23 to the position indicated. Assuming that there are no further coins in the coin-chute, the spring 44 will force the slide or switch-lever 10 into engagement with the contacts 45 to cause the completion of the circuit through the alarm 46, which is preferably an audible signal. This circuit, which is preferably a bridge-circuit, may be traced from the supply-main 3 by a consumer's main 5, the branch conductor 30 immediately connected therewith, the signal 46, the branch conductor 47, the spring-brush 48, the collector-ring 49, contact 50, the brush 27, the contact 32, the conductor 33, the brushes 34 and 40 and parts in connection therewith, (the pins 35 and 39 having again been brought into contact with these brushes,) the conductors 41 and 42, to the other transmission-main 2. The contacts 45 45 preferably do not enter directly into the signaling-circuit, but close another bridge-circuit, including the electromagnet 51, upon whose armature the spring 27 is mounted, this magnet being then energized to force the spring 27 toward the contact 50, that is farther away from the said spring 27 than is the contact 25. The object of thus displacing the contacts 25 and 50 and effecting a movement of the spring 27 is to prevent the alarm 46 from sounding unless the coin-chute is free of coins. The final wheel 52 of the train operated by the motor 28 continuing in its rotation brings the contact 53 opposite the contact-brush 27. If there are no further coins in the coin-chute, the electromagnet 51 will still be energized by reason of the closure of the contacts 45, whereby engagement between the contacts 27 and 53 will be effected. A closure of the contacts 27 and 53

completes circuit through the helix 19, which circuit includes a brush 54 and a slip-ring 55, in connection with the contact 53. The energized electromagnet will cause the detent 17 to separate from the catch 15, whereupon the spring 56 will withdraw the switch 7 from its contacts to open the consumer's circuit. The contacts 25, 50, and 53, in cooperation with the spring 27, thus act in succession in the order named to effect automatically the deposit of a coin in the coin-receptacle to convey an alarm if other coins are not in the coin-chute and to open the consumer's circuit if the alarm is not responded to. The delays between these different operations may be regulated as required, and it is for the purpose of effecting appreciable intervals of time between the various results thus controlled by the motor 28 that I equip this motor with a wheel-train and provide the switching apparatus upon the final wheel of the train. In order that the various circuits closed by the spring 27 and the contacts engaging the same may not be continued throughout too great a length of time, the brushes 34 and 40 are included in circuit with contact parts carried by the more rapidly moving wheels 36 and 38.

It is understood that in the preferred arrangement the amount of energy for which the coin is to pay is not consumed until engagement is effected between the parts 53 and 27. In order that the consumer may keep track of the coins deposited in the receptacle, a counting-wheel 57 is actuated each time the arms 10 and 23 are reciprocated. In this manner the consumer may keep track of the collections that are made by the official collector.

The operation of my apparatus will be very apparent. Assuming that there are no coins in the chute 12, the upper slide 23 will be in position to have its slot in line with the chute, whereupon a deposited coin will pass through this slot in the slide 23 and engage the solid portion of the slide 10, effecting a depression of this latter slide against the force of the spring 44, whereupon the said slide 10 effects closure of the circuit, including the magnet 8, at the contacts 9, this magnet being in bridge effecting the attraction of the core of the magnet 8, and thereby a completion of the conductor 4 by the switch parts 7 and 13, supplying the load at the consumer's station and effecting the operation of the meter. The meter operates the train of gears and effects thereby the connection of the spring 27 with the button 25, that is connected with the ring 24, against which the brush 26 bears. This engagement occurs shortly before the worth of the coin in electrical energy has been consumed, closure of the circuit, including the magnet 21, being thereby effected to attract the slides or arms 10 and 23 to bring the slot 20 into line with the chute to effect a deposit of the coin. If there are no other coins in

the chute, the spring 44 will break the circuit at 9, and thereby deenergize the magnet 8, so that the switch 7 may thereafter be separated from the contacts 13. When circuit at 9 is broken, another circuit at 45 is made, which latter circuit includes the magnet 51, whereby the arm 27 is moved farther toward the contact-rings upon the wheel 52, so that contact of said arm with the button 50 is more thoroughly assured. As the train of gears continues in operation the button 50 is engaged with the arm 27, causing the operation of the alarm 46, said button 50 being connected with the ring 49, that engages the brush 48, constituting a terminal of the circuit including said alarm. If the consumer does not deposit an additional coin, the button 53 upon engaging the arm 27 will effect closure of circuit through the helix 19, causing the catch 17 to be disengaged from the catch 15, such closure being effected by the arm 54 engaging the ring 55, that is electrically connected with the button 53. The conductor 33 includes the brushes 34 and 40 and the pins 35 and 39. It will be apparent that the contacts 35 and 39 have different rates of travel and are so positioned with respect to each other that they will simultaneously cooperate to effect closure of the conductor 33 for only a slight fraction of time, so that there will be as little consumption of current as possible.

In order that the consumer may know how many coins there are remaining in the coin-chute, a portion of the chute may be made of glass.

It is obvious that changes may readily be made from the precise embodiment of my invention herein particularly set forth, and I do not, therefore, wish to be limited to the precise arrangement herein set forth; but,

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a prepayment-meter system, the combination with a source of current, of supply-mains connected therewith, consumers' mains branching from the supply-mains, coin-controlled mechanism for completing the consumers' mains, a coin-operated lever or arm entering into the coin-controlled mechanism, an alarm, a motor in the consumer's circuit, and means jointly controlled by the motor and the coin-controlled lever for effecting the operation of the alarm, substantially as described.

2. In a prepayment-meter system, the combination with a generator, of supply-mains leading therefrom, consumers' mains branching from the supply mains, a switch for closing circuit through the consumers' mains, an electromagnet for effecting the closure of the switch, a switch-lever within a coin-chute adapted in one position to retain the coin in the chute and in another position to permit the coin to fall from the chute into a receptacle, a circuit closed by the switch-lever when

supporting a coin to effect the operation of the said electromagnet to close the consumer's supply-circuit, a second electromagnet for effecting an adjustment of the said switch-lever, whereby, according to such adjustment, the coin may be supported by the switch-lever or permitted to fall into its receptacle, a third electromagnet for causing the operation of the switch in the consumer's circuit to open the said circuit, a motor in the consumer's circuit, a signal included in a circuit, a switching appliance 27 common to the second and third electromagnets and the said signal, terminals 25, 50 and 53 for circuits including the second electromagnet, the signal and the third electromagnet, the terminals 50 and 53 being further displaced from the switch part 27 than the terminal 25, a fourth electromagnet whose armature when attracted serves to effect the movement of the switch part 27 toward the terminals 50 and 53, a circuit for the fourth electromagnet, and terminals in the circuit closed by the said switch-lever when relieved of the weight of the coin, whereby the said coin may not only be deposited in its receptacle but an alarm may be conveyed and if not responded to the consumer's circuit may be opened, the aforesaid motor governing the operation of the switching mechanism 27, 25, 50 and 53, substantially as described.

3. In a prepayment-meter system, the combination with a generator, of supply-mains leading therefrom, consumers' mains branching from the supply-mains, a switch for closing circuit through the consumers' mains, an electromagnet for effecting the closure of the switch, a switch-lever within a coin-chute adapted in one position to retain the coin in the chute and in another position to permit the coin to fall from the chute into a receptacle, a circuit closed by the switch-lever when supporting a coin to effect the operation of the said electromagnet to close the consumer's supply-circuit, a second electromagnet for effecting an adjustment of the said switch-lever, whereby, according to such adjustment, the coin may be supported by the switch-lever or permitted to fall into its receptacle, a third electromagnet for causing the operation of the switch in the consumer's circuit to open the said circuit, a motor in the consumer's circuit, a signal included in a circuit, a switching appliance 27 common to the second and third electromagnets and the said signal, terminals 25, 50 and 53 for circuits including the second electromagnet, the signal and the third electromagnet, the terminals 50 and 53 being further displaced from the switch part 27 than the terminal 25, a fourth electromagnet whose armature when attracted serves to effect the movement of the switch part 27 toward the terminals 50 and 53, a circuit for the fourth electromagnet, terminals in the circuit closed by the said switch-lever when relieved of the weight of the coin, whereby the said coin may

not only be deposited in its receptacle but an alarm may be conveyed and if not responded to the consumer's circuit may be opened, the aforesaid motor governing the operation of the switching mechanism 27, 25, 50 and 53, a wheel-train operated by the motor, a wheel of the train serving to effect connection between the switch parts 27 and 25, 50 and 53, and switch parts governed by an intermediate wheel included in the conductor containing the part 27, substantially as described.

4. In a prepayment-meter system, the combination with a generator, of supply-mains leading therefrom, consumers' mains branching from the supply-mains, a switch for closing the consumer's circuit, electromagnetic means for opening and closing the said switch, a coin-chute, slides extending transversely thereof and provided with offset coin-slots, an electromagnet for effecting reciprocation of the said slides, a circuit closed by a slide when moved by the weight of coin to effect the operation of the switch included in the consumer's circuit to close this circuit, a motor, and switching mechanism governed thereby for governing the magnet that controls the reciprocation of the slides, substantially as described.

5. In a prepayment-meter system, the combination with a generator, of supply-mains leading therefrom, consumers' mains branching from the supply-mains, a switch for closing the consumer's circuit, electromagnetic means for opening and closing the said switch, a coin-chute, slides extending transversely thereof and provided with offset coin-slots, an electromagnet for effecting reciprocation of the said slides, a circuit closed by a slide when moved by the weight of coin to effect the operation of the switch included in the consumer's circuit to close this circuit, a motor, switching mechanism governed thereby for governing the magnet that controls the reciprocation of the slides, and switching mechanism gov-

erned by the motor for opening the consumer's circuit, substantially as described.

6. In a prepayment-meter system, the combination with a generator, of supply-mains in circuit therewith, consumers' mains branching from the supply-mains, means for opening and closing the consumer's circuit, a coin-chute, mechanism controlled by the coin for governing the operation of the aforesaid means, slides extending transversely through the coin-chute provided with offset coin-slots, an electromagnet for effecting reciprocation of the slides whereby the slots in the slides may be brought alternately into alinement with the coin-chute, the said slides being separated to accommodate coin between the same, a motor in the consumer's circuit, and switching mechanism controlled thereby for governing the operation of the magnet that controls the slides, substantially as described.

7. In a prepayment-meter system, the combination with a generator, of supply-mains in circuit therewith, consumers' mains branching from the supply-mains, means for opening and closing the consumer's circuit, a coin-chute, mechanism controlled by the coin for governing the operation of the aforesaid means, slides extending transversely through the coin-chute provided with offset coin-slots, means for effecting the reciprocation of the said slides, and a motor in the consumer's circuit governing the operation of the latter means, whereby the slots in the slides may be brought alternately into alinement with the coin-chute, the said slides being separated to accommodate a coin between the same, substantially as described.

In witness whereof I hereunto subscribe my name this 20th day of November, A. D. 1901.

THOMAS DUNCAN.

Witnesses:

SAMUEL R. BACHTEL,
FRANK V. NELSON.