Aug. 29, 1939. M. V. GREEN 2,171,124

MAGNETIC IMPULSE CONTACTOR

Filed Aug. 20, 1935 4 Sheets-Sheet 1

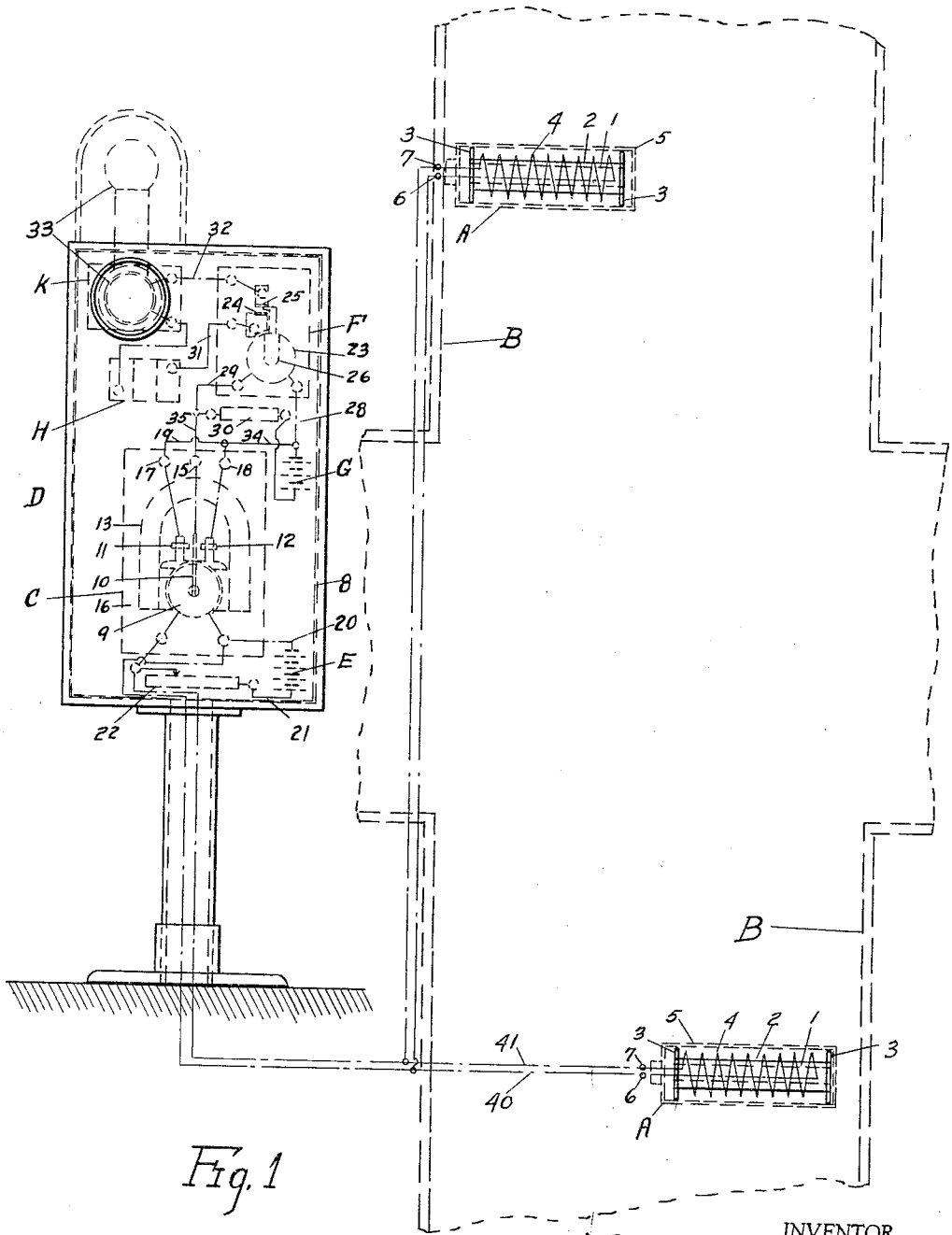


Fig. 1

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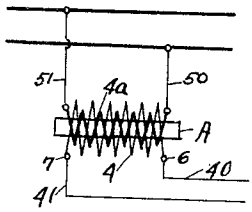


Fig. 7

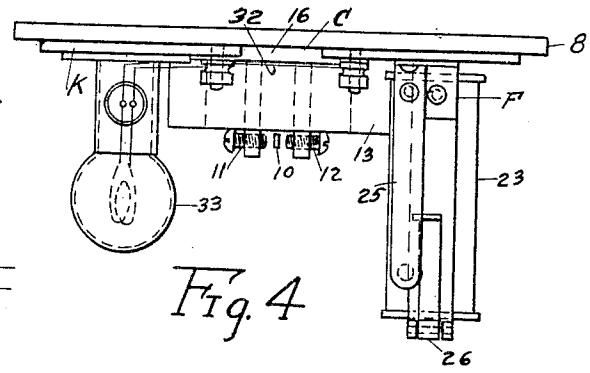


Fig. 4

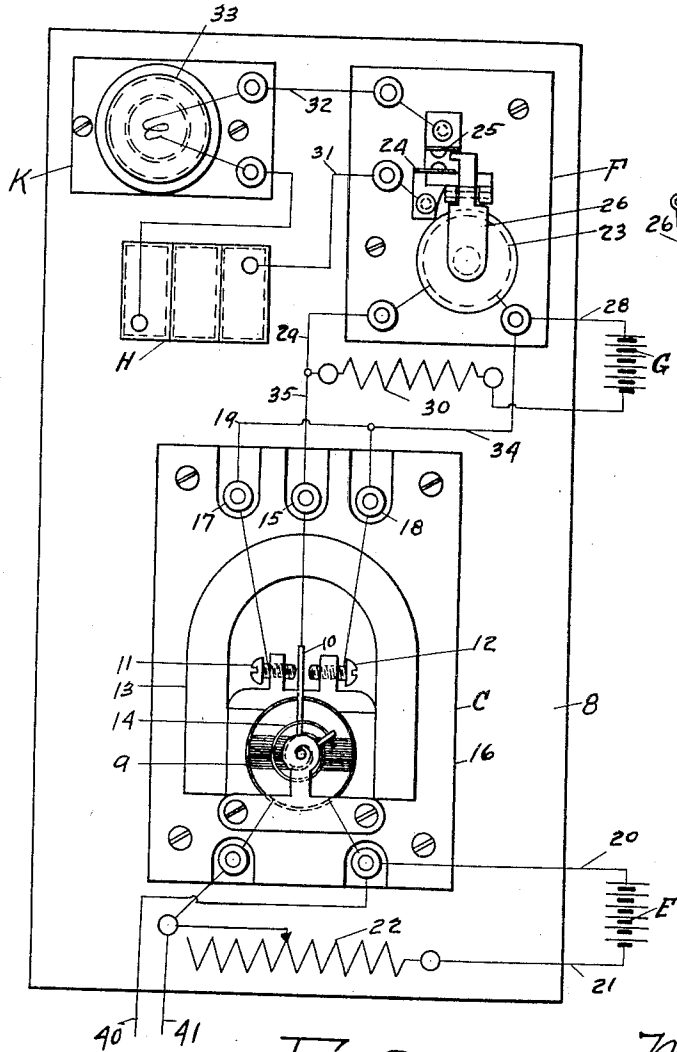


Fig. 2

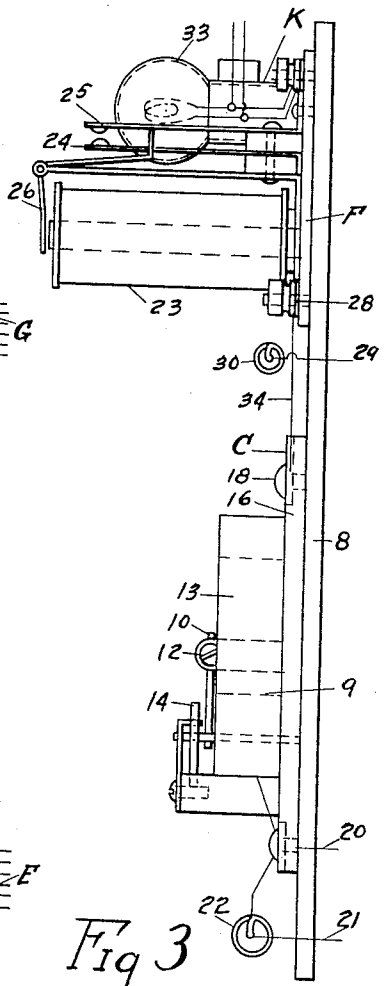


Fig 3

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MAGNETIC IMPULSE CONTACTOR

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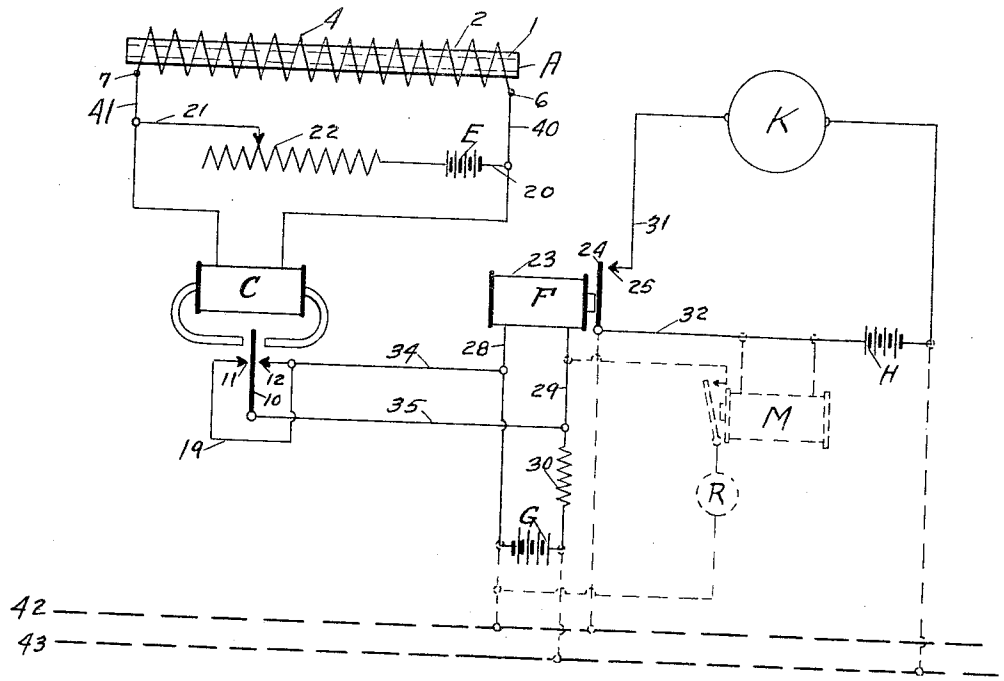


Fig. 5

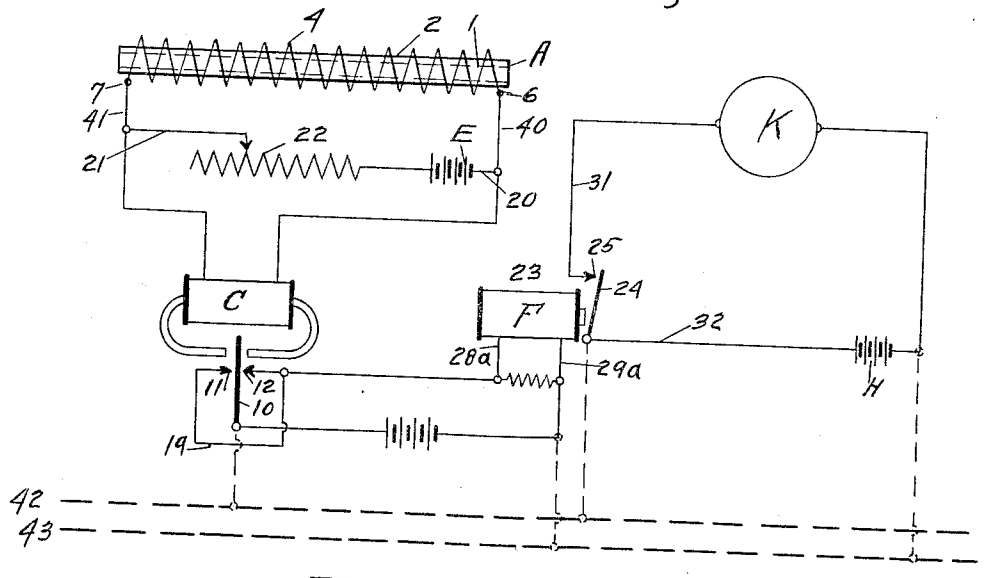


Fig. 6

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MAGNETIC IMPULSE CONTACTOR

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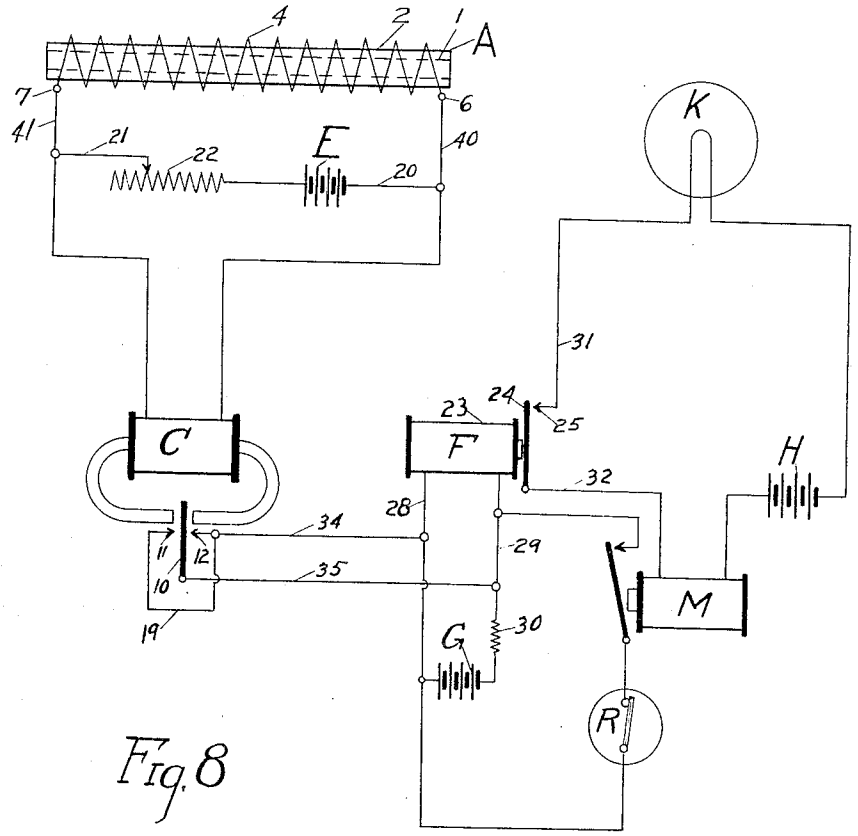


Fig. 8

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Patented Aug. 29, 1939

2,171,124

UNITED STATES PATENT OFFICE

2,171,124

MAGNETIC IMPULSE CONTACTOR

Mason V. Green, Lansing, Mich., assignor, by mesne assignments, to Hayes Electric Manufacturing Company, Lansing, Mich., a corporation of Michigan

Application August 20, 1935, Serial No. 36,997

5 Claims. (Cl. 177—339)

This invention relates to a magnetic contactor device, and is an improvement of my former contactor unit as set forth in my patent application Serial No. 743,490, filed Sept. 10, 1934, this being provided with special electric explored circuits for indicating and signaling any circuit defects.

The object of my invention is to produce a magnetic impulse registering device that will operate either electric signals or tabulating units as may be connected thereto.

Another object is to produce a magnetic impulse contactor that will function for opening or closing electric circuit switch units, whenever a metallic object is passed by one of the connected magnetic impulse units, the device being assembled with electrically explored circuits.

A further object is to produce a magnetic impulse registering device for operating electric circuit control units especially adapted for street or highway signal units and actuated by passing automobiles, and to automatically signal any broken or defective circuits.

These several objects are attained in the preferred form by the construction and arrangement of parts more fully hereinafter set forth.

Similar parts on all drawings are marked by similar numerals or letters.

Fig. 1 is an assembled view of my device showing the operating units as mounted within a protective casing, and illustrated as applied to a street or highway pavement.

Fig. 2 is a plan view of the assembled switch unit showing the general arrangement of the various operating parts, and means for electrically connecting same.

Fig. 3 is a side view of the assembled switch unit showing the relative position of the relay and signal instruments and controlling circuit coils.

Fig. 4 is a top view of the switch unit showing the auxiliary relay contacting terminals and the circuit connecting means.

Fig. 5 is an electric wiring diagram for assembling the various electric units within the various electric circuits.

Fig. 6 is a modified wiring diagram of the assembled electric units and connecting electric circuits, but with the exploring circuit omitted for the auxiliary relay.

Fig. 7 shows a modified wiring diagram for double magnet winding.

Fig. 8 is a wiring diagram showing a modification of Fig. 5, for the inclusion of a circuit timing unit therein.

It is scientifically known that permanent magnet sets up a surrounding magnetic field extending between the magnetic poles, and if the magnet is formed of a straight bar of suitable metal, the magnetic field will extend along all sides of the bar and the full length thereof. It is further known that such magnetic fields may be created in bars of magnetic metal by induction coil winding there around and an electric current passed through said coils. When the bar is made of the proper metal, the magnet will remain permanent, and a permanent magnetic field will exist between its poles after the electric current is discontinued. Should this magnetic field be disturbed by passing metallic objects, or sudden displacement of the field, an induced electric current will be set up in the surrounding induction coil winding and may be transmitted back to any connected electric instrument, and this current is of sufficient strength to operate sensitive relay instruments. This principle is utilized in the construction of the impulse unit controlling the operation of my device.

In general, my device comprises a special permanent magnet bar of suitable length, inclosed by continuous induction coil winding of numerous turns of fine insulated wire. The terminals of the induction coil winding are connected directly to the operating coil of a sensitive electric relay instrument, said circuit being electrified, and regulated by a variable resistance unit effective to both coil and instrument. A secondary or auxiliary relay instrument is provided having its operative coil continuously connected within a separated electric circuit also regulated by a suitable resistance unit, said auxiliary coil circuit being shunted from the relay coil by connected circuit wires leading to the operating contact members of the sensitive relay, designed to function and de-energize said auxiliary coil whenever an electric impulse is passed through the sensitive relay instrument. The operating contact members of the auxiliary relay instrument are connected in another separated electric circuit leading to any chosen electric signal or tabulating unit that will function by electric impulses, such as street warning signals, or various types of counting or tabulating units. The continuous electrically explored circuits affords means for automatically signaling any circuit trouble or defects.

My device is herein illustrated as applied to a street crossing signal unit, although it is to be understood that any other type of impulse signal unit or device may be used in its place equally as

well. The drawings illustrate the magnetic impulse unit installed on opposite sides of a street, approaching a street intersection, for signaling the approach or for counting passing automobiles. The passing of the automobile through the magnetic field is sufficient to operate the device. The term, "circuit," in all cases, means "an electric current circuit."

I will now describe more fully the detailed construction of my device, referring to the drawings and the marks thereon.

The magnetic impulse unit A is made of a magnetic metal core bar 1, preferably of hard steel capable of retaining strong magnetic properties after being once highly magnetized, forming a permanent magnet thereof, said core 1 being of suitable size, and of required length to cross, or nearly cross, the path of the metallic object of which registration is desired, the same being illustrated herein as a street crossing. The core bar 1 is preferably inclosed within a soft iron casing 2 of low permeability as soft iron offers less resistance to the change of the magnetic lines of force than the inclosed hard steel permanent bar 1, thus greatly increasing the efficiency and operation of the unit. The combined sections are provided with suitable end collars 3 securely mounted over both bar ends. The induction coil winding 4 is then wound thereon, applying numerous turns of fine insulated wire, and may be wound continuously from one end of the magnet bar to the other, or wound in sections if so desired, and the assembled unit inclosed within a suitable casing 5 of any suitable material such as lead or Bakelite, preferably made waterproof if the unit is to be installed in damp places, as in the street or highway. The coil winding terminals 6 and 7 are projected out of the casing end suitable for connecting within an electric circuit. The unit A is placed across the street B, or across a specified section thereof, herein illustrated with one unit positioned on each side of the intersection and directly in the line of travel or near the line of travel said unit A being placed just beneath the pavement, and as illustrated in the Fig. 1 of the drawings. The induction coil winding 4 is extended through the end terminal wires 6 and 7 and are connected to a sensitive polarized relay instrument C mounted on a base 8 and inclosed within a suitable casing D. The casing and instruments may be placed at any desired location. The terminal wires 6 and 7 are directly connected by the circuit wires 40 and 41 to the relay rotor member 9 which is provided with a terminal contact arm 10 mounted thereon, said contact arm 10 being positioned between two stationary contact points 11 and 12 mounted within the inclosed relay magnet 13. The rotor 9 and attached contact arm 10 are provided with a connected sensitive spiral spring 14 mounted on the instrument casing, providing means for adjusting said contact arm 10 to a neutral position between the contact points 11 and 12, said contact points being normally open. The circuit wires 40 and 41 are also connected in a very weak electric circuit, herein illustrated as a battery circuit with battery E, by the circuit wires 20 and 21, said circuit being provided with a variable resistance unit 22 connected therein, also known as adjustable resistance but effective operatively only in the sensitive relay rotor 9. The variable resistance unit 22 may be adjusted until just sufficient electric current flows through the relay rotor 9 to deflect same and cause a full electric contact between the rotor contact arm 10 and one of the terminal points 11 or 12. Then the connected sensitive spiral spring 14 may be adjusted to return said contact arm 10 to a normal open position between said terminals 11 and 12. This will allow said circuit to be constantly explored for any defect or trouble resulting therein. If at any time there is an over, or under, electric charge or impulse, such as a short circuit, or a broken circuit, the terminal arm 10 will close and contact one or the other of the terminal points 11 or 12, and automatically signal trouble in the circuit, and will continue until the defect is corrected or adjusted. The required E. M. F. and current flow is very low when throttled by the resistance 22, and neither aids or bucks the magnetic field, but serves to deflect slightly the relay rotor 9 and arm 10, which is again balanced by readjustment of the spiral spring 14 as previously described. Any further electric impulse through the rotor 9 as may result from a disturbed magnetic field in the unit A, when the circuit is properly balanced or adjusted, will close the terminal arm 10 with the terminal point 11 or 12 depending on the direction of the electric impulse caused by a passing automobile, and will so remain momentarily until said automobile has passed over the magnetic impulse unit A. This device is operative through the unbalancing of its continuous explored circuits, by the various relay spring pressures operating against the respective relay magnetic field resistance. Inasmuch as the magnetic field is double, the same being on both sides of the magnet bar 1, the crossing of the two alternate fields will simultaneously alternate the current through the sensitive relay rotor 9 and contacting both terminals 11 and 12 alternately with each passing of the automobile. The relay arm 10 is connected electrically with the terminal post 15 mounted on the insulated instrument base 16, and the relay fixed terminal points 11 and 12 are connected to like terminal posts 17 and 18 respectively also mounted on the base 16, but are herein shown connected together by a circuit wire 19 so as to make said terminals operative in different direction, and to make the unit effective for continued electric exploring of the circuit for defects.

An auxiliary relay instrument F is also mounted on the base 8, adjacent the sensitive relay C, and comprises an energizing coil 23 formed with a magnetic core, and is provided with two insulated spring terminal arms 24 and 25 mounted adjacent said coil, said terminals as herein illustrated being normally closed when the coil 23 is de-energized. An L-shaped operating arm 26 is pivotally mounted above the coil end and with one arm adjacent the coil core end and capable of being magnetically effected thereby, and with the opposite arm end designed to engage one of the spring terminal contact arms 25. The operating arm 26 will turn on its pivot mounting when the coil 23 is energized, thus opening any electric circuit connected through the terminal arms 24 and 25. The auxiliary relay coil 23 is connected within a continuous electric circuit by the circuit wires 28 and 29, and herein illustrated as a battery circuit through battery G, and is provided with a correspondingly low resistance unit 30 connected therein, of just sufficient strength to allow the relay F to function. The coil 23 remains normally energized and thereby retains the spring terminals 24 and 25 normally open. The contact arms 24 and 25 are connected within another separated electric circuit,

also herein illustrated as a battery circuit through battery H, by the circuit wires **31** and **32**, said circuit being connected to an impulse registering unit K, herein shown as a simple electric light bulb **33**, operative any time said circuit is closed. It is to be understood that any kind or type of electric impulse or signal unit may be substituted for the bulb **33** shown. The exact type or kind of unit K is not material to my invention. If desired, the signal unit K may be removed to any other location such as may be adapted to street signal posts positioned in the center of the street, or elsewhere.

The circuit wires **28** and **29** of the auxiliary relay F are also connected to the double terminals **11**, **12**, and the terminal arm **10** of the sensitive relay C, by the circuit wires **34** and **35** and the intervening terminal posts, and will operate to shunt the electric current away from the auxiliary relay coil **23** whenever the sensitive relay terminals are closed, thus shunting sufficient current therefrom to de-energize the coil **23** and allow the spring terminal arms **24** and **25** to close together, automatically closing the circuit to the registering or signal unit K, said unit K continuing as long as the sensitive relay terminals are closed, or for a longer period if a timing unit M is also included within its circuit, as indicated by Fig. 8 showing the timing unit R connected therein.

By retaining the auxiliary relay coil **23** normally energized, the circuit may be constantly explored for circuit defects, and should the circuit be broken, the coil **23** will instantly be de-energized, allowing the terminal arms **24** and **25** to contact together and signal the defective circuit through the signal unit K, and continuing same until the defective circuit is corrected or adjusted. However, if desired, the continuous electric circuit through the coil **23** may be omitted, and the relay points **24** and **25** left normally open, the coil **23** being connected in an electric circuit directly with the sensitive relay terminals **10**, **11** and **12** by the circuit wires **28***a* and **29***a* as is illustrated in the modified wiring diagram shown in the Fig. 6 of the drawings. The signal operation with the unit K will be the same as in the former case, but the circuit exploring feature will be lost.

When my device is installed in any desired location, whether used with a signal or tabulating unit, such unit K for each operative electric impulse as may be caused by disturbing the magnetic field of the unit A.

The relay instruments shown and described herein are merely illustrative of such similar instruments as are applicable to my invention, and they may be substituted by any other type of suitable similar instrument. Also any electric source may be substituted for the battery circuits herein illustrated, by applying suitable transformers and necessary rectifier units within the circuit.

In cases where the magnetic field is sufficiently increased by surrounding electric fields, such as between street car rails, the auxiliary relay F and its connected circuit may be omitted entirely, and the terminal points of the sensitive relay C connected directly with the electric signal or impulse registering unit K.

A modification of the magnet winding is illustrated by the wiring diagram in Fig. 7, showing the induction winding **4** preceded by a primary coil winding **4***a* connected by intervening wires **50** and **51** into an electric charging circuit. If this double winding is used, the magnet A may be made of soft magnetic metal, as the existing magnetic field is generated and maintained by the constant flow of electric current through the primary coil **4***a*. The installation and operation is the same as in the former case.

Should my device be used with a special tabulating unit designed for counting metallic parts, such as the machined parts dispensed from an automatic manufacturing machine, the magnetic impulse unit A should be positioned across or near the line of travel so that its magnetic field will be temporarily broken as each metallic part passes. The operation is the same as described for the illustrated street signal unit.

It is apparent that my device is subject to various modifications in both arrangement and detail design and without departing from the spirit of my invention, and I claim not only the design herein illustrated but any modification thereof that is substantially a substitution of parts or sections herein shown.

Having fully described my improved magnetic impulse contactor, what I claim as my invention and desire to secure by Letters Patent is:

1. A magnetic impulse instrument adapted for registering the passing of metallic objects and operative therewith, comprising a permanent magnet surrounded by continuous induction coil winding of insulated wire, a sensitive electric relay instrument formed with an energizing coil and external electric circuit contact terminals, intervening circuit wires electrically connecting said relay energizing coil with the magnet induction coil winding, a variable resistance unit and battery electrically connected between said intervening circuit wires, and means electrically connecting the relay external circuit contact terminals in another separated electric circuit.

2. A magnetic impulse instrument adapted for registering the passing of metallic objects and operative therewith, comprising a permanent magnet surrounded by numerous coils of continuous induction winding of insulated wire, a polarized sensitive electric relay instrument formed with an energizing coil and external electric circuit contact terminals, intervening circuit wires electrically connecting said relay energizing coil with the magnet induction coil winding, an adjustable resistance unit and electric current source electrically connected between said intervening circuit wires, a separated electric circuit, a resistance unit electrically connected within said separated circuit, an auxiliary electric relay instrument formed with an energizing coil and external electric circuit contact terminals, installed with its energizing coil electrically connected within said separated electric circuit, shunt circuit wires electrically connecting said auxiliary relay coil terminals with the sensitive relay external circuit contact terminals, a second separated electric circuit leading through the auxiliary relay external circuit contact terminals, and an electric impulse registering unit electrically connected within said second separated circuit.

3. A magnetic impulse unit adapted for registering electrically the passing of metallic objects and operative therewith, comprising a permanent magnet surrounded by numerous coils of continuous induction winding of fine insulated wire, a polarized sensitive electric relay instrument formed with an energizing coil and external electric circuit contact terminals, intervening circuit wires electrically connecting said relay energizing coil with the magnet induction coil winding,

a separated electric circuit, a resistance unit electrically connected within said separated circuit, an auxiliary electric relay instrument also formed with an energizing coil and external electric circuit contact terminals, installed with its energizing coil electrically connected within said separated electric circuit, shunt circuit wires electrically connecting said auxiliary relay coil terminals with the sensitive relay external circuit contact terminals, a second separated electric circuit leading through said auxiliary relay external circuit contact terminals, and an electric impulse registering unit electrically connected within said second separated electric circuit.

4. A magnetic impulse instrument adapted for registering electrically the passing of metallic objects and operative therewith, comprising a permanent magnet surrounded by numerous coils of continuous induction winding of insulated wire, a polarized sensitive electric relay instrument formed with an energizing coil and external electric circuit contact terminals, intervening circuit wires electrically connecting said relay energizing coil with the magnet induction coil winding, a variable resistance unit and battery electrically connected between said intervening circuit wires, a separated electric circuit, a resistance unit electrically connected within said circuit, an auxiliary electric relay instrument formed with an energizing coil and external electric circuit contact terminals, installed with its energizing coil electrically connected within said separated electric circuit, shunt circuit wires electrically connecting the said auxiliary relay coil terminals with the sensitive relay external circuit contact terminals, a second separated electric circuit leading through the said auxiliary relay external circuit contact terminals, an electric impulse registering unit electrically connected within said second separated electric circuit, an electric holding contactor instrument formed with an energizing coil and external electric circuit contact terminals, installed with its energizing coil also electrically connected within said second separated electric circuit, shunt circuit wires connecting the holding contactor external circuit contact terminals into the second separated electric circuit leading to the auxiliary relay coil, capable of shunting the electric current therefrom when said terminals are closed, and an electric circuit timing switch unit electrically connected within last said shunt wire circuit.

5. A magnetic impulse instrument adapted for registering electrically the passing of metallic objects and operative therewith, comprising a permanent magnet surrounded by numerous coils of continuous induction winding of insulated wire, a polarized sensitive electric relay instrument formed with an energizing coil and external electric circuit contact terminals, intervening circuit wires electrically connecting said relay energizing coil with the magnet induction coil winding, an adjustable resistance unit and electric current battery electrically connected between said intervening circuit wires, a separated electric circuit leading through the relay external circuit contact terminals, an electric impulse registering unit electrically connected within said separated circuit, an electric holding contactor instrument formed with an energizing coil and external electric circuit contact terminals, also installed with its energizing coil electrically connected within said separated electric circuit, shunt circuit wires electrically connecting said holding contactor external circuit contact terminals with the electric circuit leading through the sensitive relay energizing coil, and an electric timing switch unit electrically connected within said shunt wire circuit.

MASON V. GREEN.