E. M. SORENG.

REGULATOR.

APPLICATION FILED AUG. 25, 1916.

1,383,494.

Patented July 5, 1921.

2 SHEETS—SHEET 1.

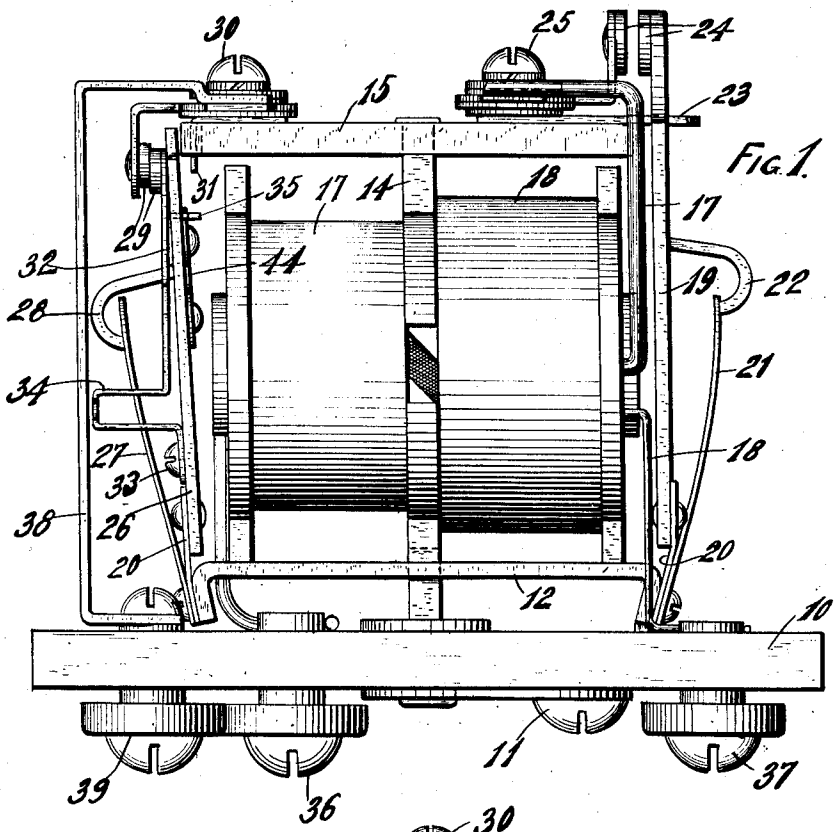


FIG. 1.

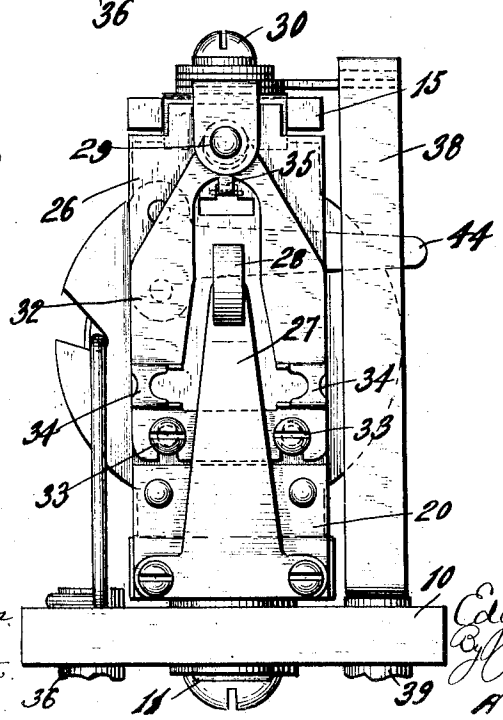


FIG. 2

WITNESSES

L. G. Thomas

Katherine Holt.

INVENTOR

Edgar M. Soreng

By R. S. Caldwell

ATTORNEY

E. M. SORENG.

REGULATOR.

APPLICATION FILED AUG. 25, 1916.

1,383,494.

Patented July 5, 1921.

2 SHEETS—SHEET 2.

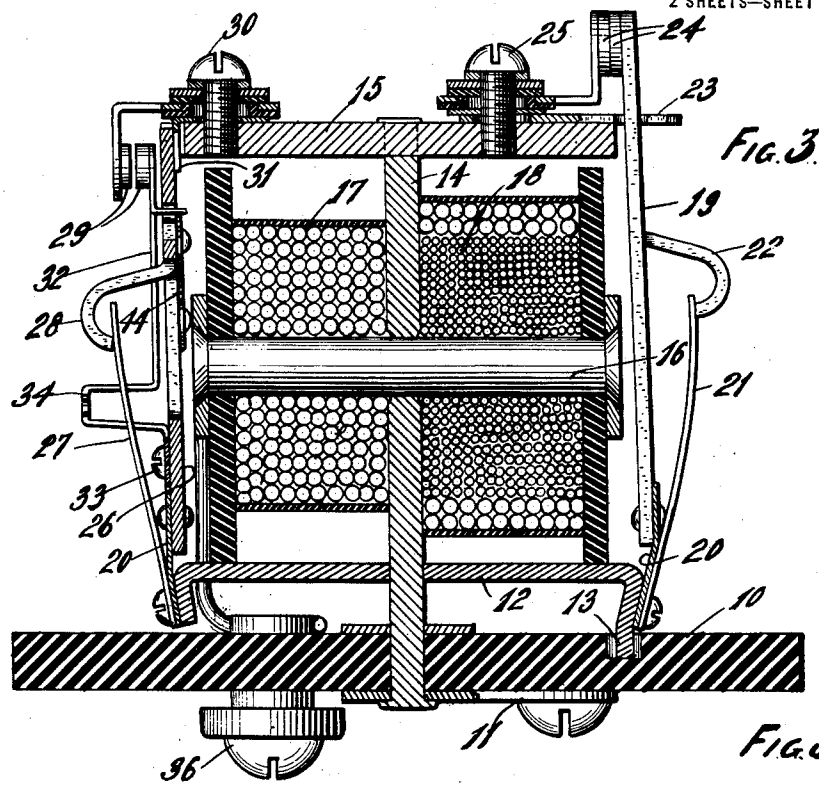


FIG. 3.

FIG. 5

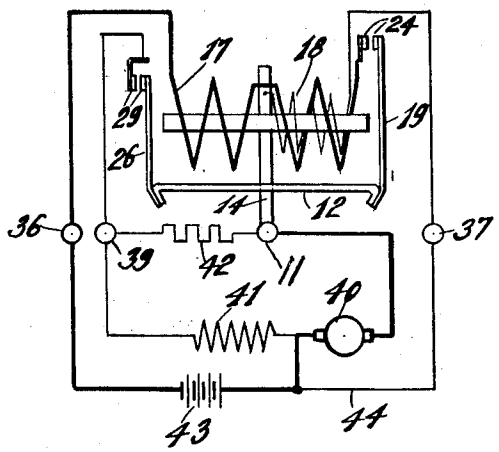
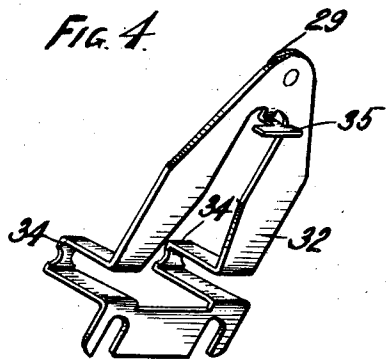


FIG. 4.



WITNESSES.

Katherine Holt

INVENTOR.

Edgar M. Soreng.

By R. S. C. Caldwell

ATTORNEY.

UNITED STATES PATENT OFFICE.

EDGAR M. SORENG, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO BRIGGS & STRATTON COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

REGULATOR.

1,383,494. Specification of Letters Patent. Patented July 5, 1921.

Application filed August 25, 1916. Serial No. 116,762.

To all whom it may concern:

Be it known that I, EDGAR M. SORENG, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Regulators, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

This invention has for an object to provide a regulator for automatically controlling the connections of a storage battery charging circuit of a generator operating under variable speeds to establish such charging circuit only when the generator attains a speed at which it develops a predetermined voltage, and to prevent the charging current exceeding a predetermined maximum value as by introducing a resistance in the field circuit of the generator at such intervals as the predetermined maximum current is reached.

A particular object of the invention is to provide the magnet of such a regulator with independent magnetic circuits for its separate windings whereby the current regulation by the series winding will not be hampered by the magnetic effect of the shunt winding and still for convenience and economy of construction a single magnet structure is employed.

A further particular object of the invention is to provide the vibrating armature of such a regulator or the like with a yieldingly supported contact so arranged as to have a wiping engagement with the stationary contact and thus keep their contact surfaces clean.

Another object of the invention is to perfect details of construction generally of a regulator of this character whereby the same may be inexpensive to manufacture, though strong and durable and efficient in use.

With the above and other objects in view the invention consists in the regulator as herein claimed, and all equivalents.

Referring to the accompanying drawings, in which like characters of reference indicate the same parts in the different views:

Figure 1 is a side view of a regulator constructed in accordance with this invention;

Fig. 2 is an end view thereof;

Fig. 3 is a longitudinal sectional view thereof;

Fig. 4 is a perspective view of the spring contact support; and,

Fig. 5 is a diagram of electrical connections.

In these drawings 10 indicates an insulating base to which is suitably secured a magnet pole piece 12 with its ends bent at an angle to form supports for the armatures, one of such downwardly bent ends having a projection 13 entering a recess in the insulating base to hold the pole piece from turning on its securing means. A vertical partition plate 14 is riveted to the plate forming the pole piece 12, and in turn has riveted to it a horizontal plate forming a pole piece 15 parallel with the pole piece 12, and as here shown, this partition plate constitutes the means for securing the magnet to the base and forms a binding post 11. Passing through an opening in the partition plate 14 is a magnet core 16 with a spool 17 of coarse wire on one end thereof and a spool 18 of fine wire on the other end, the latter spool having a few turns of the coarse wire around it constituting a continuation of the winding of spool 17. The pole pieces 12 and 15 and the partition plate 14, as well as the core 16, are of suitable magnetic material, preferably soft iron, and produce two independent magnetic circuits for the two coils 17 and 18, the partition plate 14 being common to both. An armature 19 for the coil 18 is hinged to the bent end of the pole piece 12 by means of a flexible metal hinge 20 and is given a tendency to move away from the magnet core 16 by a leaf spring 21 secured to said bent end of the pole piece 12 and engaging a hook 22 bent up from the armature 19. This spring action on the armature 19 tends to hold it against an adjustable stop 23 on pole piece 15 so as to separate contacts 24, one of which is carried by the armature 19 and the other is adjustably mounted on the pole piece 15, though insulated therefrom. A screw 25 may conveniently be employed for securing both the stop 23 and the contact 24 to the pole piece 15, slots being provided in each to permit of their adjustment.

An armature 26 is hinged at the other end of the pole piece 12 in a similar manner and has a spring 27 engaging a hook 28 thereof for holding it away from the magnet core 16. The upper end of this armature 26 has a loose mortise fit between projections on

the end of the pole piece 15 so as to have an overlapping relation therewith during a considerable portion of the travel of the armature. The spring action on the armature 26 tends to close a pair of contacts 29, one of which is carried by the armature and the other is adjustably mounted on the pole piece 15 with suitable provision for insulation. A screw 30 may conveniently be employed for securing said insulated adjustable contact 29 as well as an armature stop 31 to the pole piece 15, the armature stop being bent down into the space between the projections of the pole piece 15 and engaged by the armature 26 to limit its movements and prevent its actual contact with the pole piece.

The contact 29 carried by the armature 26 is mounted on a spring member 32 shown in detail in Fig. 4. The purpose of this spring is not only to yieldingly mount the contact 29 on the armature, but to produce an effective pivotal center distant from the hinge connection of the armature and out of the plane of the armature whereby the engagement of the contacts 29 will be accompanied by a rubbing or wiping action of one against the other to keep their contacting surfaces smooth. This spring member 32 is formed of a sheet metal stamping comprising a slotted base portion adapted to be engaged beneath the heads of screws 33 on armature 26, the center portion of the blank above the base being cut out, leaving two narrow side strips which are bent upon themselves and contracted at their bent portions to make them flexible and thus produce in effect hinge joints 34 at some distance from the armature plate. The contact 29 is carried at the upper end of this spring member and a T-shaped projection 35 is passed through a T-shaped opening in the armature to engage the armature and limit the movement of the contact away from the armature. The action of this spring member is to yieldingly hold the contact 29 spaced from the armature a distance determined by the engagement of the stop 35 with the armature, but during the outward movement of the armature away from the core of the magnet the contact points are engaged without restricting further outward movement of the armature so that such further outward movement thereof is accompanied by a swinging movement of the spring member on the arch 34 as a pivotal center, thus causing the contact 29 carried by the spring member to slide downwardly along the contact face of the other contact 29 in the manner shown in Fig. 1.

One end of the coarse wire winding of spool 17 is connected with a binding post 36, while the other end thereof is connected to the stationary contact 24. One end of the fine wire winding of spool 18 is grounded on the magnet frame with which binding post 11 is connected, while the other end thereof is connected to a binding post 37 on the insulating base. A metal strip 38 connects the stationary contact 29 with a binding post 39.

In connecting up the regulator of this invention one brush of the generator armature 40 is connected to binding post 11, while the other brush thereof is connected with one terminal of the field winding 41 of the generator, the other terminal thereof being connected to binding post 39. A regulating resistance element 42 has its terminals connected with the binding posts 11 and 39 respectively. A storage battery 43 has one terminal connected with binding post 36 and the other terminal connected with the brush of the generator armature with which the field winding is connected, while a wire 44 connects the binding post 37 with said brush of the generator armature.

In operation the generator which is driven at variable speeds, as in the case of an automobile lighting system, has the regulating resistance 42 included in its field circuit except when the vibrator contacts 29 are engaged, and as said contacts are held in engagement by spring pressure such resistance is short circuited at the commencement of operation of the generator and until a predetermined current strength is reached. The fine wire coil 18 is permanently connected across the terminals of the generator armature and as the generator voltage builds up with its increased speed such coil becomes a magnet of sufficient strength to attract the armature 19 against the action of its spring 21 and cause the closing of the contacts 24. The adjustment of the tension of spring 21 as determined by the bending of hook 22 is such that the generator voltage required for producing this action is approximately the voltage desired for charging the storage battery, and the closing of the switch contacts 24 connects the storage battery in series with the heavy wire magnet coil 17 across the armature terminals, this circuit being from one terminal of generator armature 40, binding post 11, magnet frame 12, armature 19, closed contacts 24, coarse magnet winding 17, binding post 36, and storage battery 43 to the other terminal of the generator armature. The storage battery is thus charged by the generator, and should the current flow in the storage battery charging circuit exceed a predetermined maximum it will cause the magnet winding 17 to attract the armature 26 and open the contacts 29, thus introducing the regulating resistance 42 into the field circuit of the generator, with an immediate reduction in the charging current and a corresponding re-

lease of the armature 26 to again short circuit the regulating resistance 42, which operation is repeated as a rapid vibration of the armature 26 as long as the generator speed is greater than that which is necessary to develop the battery charging rate for which the regulator is adjusted as determined by the tension of spring 27 controlled by the bending of hook 28.

The storage battery is thus cut out of the generator circuit at times when the generator voltage is below normal, and the charging rate is prevented from becoming excessive when the generator speed exceeds the normal.

By dividing the magnet into two independent magnetic circuits the influence of the magnet winding 17 on the armature 26 for producing the regulating vibrations thereof is not interfered with by the influence of the magnet winding 18 which is permanently connected across the generator terminals. Heretofore when these two magnet windings have been placed on the same core, without a separation of the two magnetic circuits, the residual magnetism of the core due to the excitation thereof by the shunt winding has occasionally been sufficient to hold the armature of the vibrator in its open position even though the generator speed drops below the point at which the contacts normally begin to vibrate. In the present invention the vibrator armature 26 is influenced by the excitation of the series magnet winding 17 only and is entirely independent of the shunt magnet winding 18 whose magnetic circuit is complete through the core 16, the partition 14, pole pieces 12 and 15, and armature 19. The magnetic circuit for the vibrator magnet 17 consists of the core 16, partition 14, pole pieces 12 and 15, and armature 26.

The object in carrying a few turns of the coarse wire 17 around the spool of fine wire 18 is to augment the attraction of the latter for holding the armature 19 in position for keeping the contacts 24 closed. This is the effect produced as long as the storage battery is being charged. At times when the voltage of the generator is reduced below that of the storage battery the flow of current through the series magnet winding 17 is reversed so that this coil around the shunt winding 18 tends to neutralize the effect of the coil 18 and so weaken the magnet as to permit the armature 19 to be withdrawn by its spring 21 to open the contacts 24 and interrupt the storage battery charging circuit.

The partition pole piece 14 by separating the magnetic circuit of the cutout magnet formed by the shunt winding 18 from the magnetic circuit of the regulating magnet formed by the magnet winding 17 avoids the possibility of one armature interfering with the operation of the other. In single magnet structures for this purpose there has been no separation of magnetic circuits, but both armatures bridge the same air gap between end pole pieces. The wear on the contacts of the cutout switch would permit the armature thereof to more closely approach the pole pieces and consequently reduce the air gap therebetween and this reduction in the resistance to the flow of magnetic flux through one armature reduced the magnetic flux through the other armature, disturbing the adjustment thereof and impairing the operation of the device. The separation of magnetic circuits with their common pole pieces 12 and 15 on opposite sides thereof further renders the instrument independent of influence by outside causes as by the presence of a body of magnetic material.

Besides the separation of the magnetic circuits tending to prevent the vibrator armature 26 from sticking, as before explained, the interfitting relation between the projections of said armature and the projections of the pole pieces serves this same purpose, these interfitting parts by their overlapping relation reducing the pull on the armature near the end of its movement by the sidewise direction of the lines of force, and consequently giving the spring 27 a more favorable opportunity to perform its function of swinging the armature away from the magnet as soon as the contacts 29 are separated.

The construction of the spring support for the contact 29 is an important feature of the invention, as it produces the wiping or sliding movement of the contact against the stationary contact, thus keeping the contact surfaces smooth and free from irregularities which tend to form and interfere with continued operation.

The regulator of this invention is inexpensive to manufacture and is strong and durable and highly efficient in operation. It provides for easy adjustment of the contacts and a simple adjustment of the tension of the springs for varying the predetermined limits for its operation.

A spring tongue 44 may be secured to the vibrator armature 26 and engaged by any suitable means, not shown, for increasing the effect of spring 27 when it is desired to expedite the charging operation, as during certain months when there is a greater demand on the battery.

As shown, the device is wired for operation as a current regulator for maintaining a fixed current strength in the battery charging circuit irrespective of the varying voltage of the storage battery, but it will be understood that by substituting a shunt magnet winding for the spool 17 voltage regulation will take place at a predetermined generator voltage, and the device will then constitute

a voltage regulator. In some cases a compound winding of a shunt coil and a series coil may be employed to obtain a mixed voltage and current regulation.

What I claim as new and desire to secure by Letters Patent is:

1. In a regulator for storage battery charging systems of the type employing a cut-out magnet and a vibrator magnet, a metal rod to constitute a common core on which both magnet coils may be wound, a metal partition on said rod between the magnet windings, a plate attached to the metal partition and constituting a pole piece, and contact-controlling armatures disposed between the common core and said pole piece.

2. In a regulator for storage battery charging systems of the type employing a cut-out magnet and a vibrator magnet, a metal rod constituting a core on which both magnet coils may be wound, a metal partition on the rod between the magnet windings, plates secured to the metal partition and constituting pole pieces for both magnets, and contact-controlling armatures disposed between the pole pieces and adjacent the ends of the core.

3. In a magnetic switch, a metal plate, a rod passing therethrough, magnet heads on the ends of the rod, coils wound on the rod between the plate and the magnet heads, pole pieces riveted to the plate, and contact-controlling armatures bridging across the pole pieces and the ends of the rod.

4. In a magnetic switch, a metal plate, a rod passing therethrough with its ends upset, magnet heads held on the rod by the upset ends thereof, coils wound on the rod between the plate and the magnet heads, a pole piece mounted on the plate, and contact-controlling armatures connecting the pole pieces with the ends of the rod.

5. In a magnetic switch, an electromagnet, an armature therefor, a stationary contact, a contact spring secured to the armature and bent away therefrom to form a U-shaped bend reduced to form a flexible joint, and a contact carried by the contact spring adapted to engage the stationary contact with a wiping action.

6. In a magnetic switch, an electromagnet, a pivotally mounted armature therefor, a stationary contact, a contact spring secured to the armature and bent away therefrom to a point where it is reduced to form a flexible joint, and a contact carried by the contact spring and normally spaced from the armature and adapted to engage the stationary contact and be caused to slide over the face of the stationary contact as the result of the movements of the armature after the contacts are engaged.

7. In a magnetic switch, an electromagnet, a pivotally mounted armature therefor, a stationary contact, a contact spring secured to the armature and bent away therefrom to form a flexible joint distant from the armature, the free end of the contact spring being normally spaced from the armature, a contact on the free end of the contact spring adapted to engage the stationary contact, and a stop bent up from the contact spring and engaging the armature for limiting the spacing of the contact spring from the armature.

8. In a magnetic switch, an electromagnet, a pivotally mounted armature therefor, a stationary contact, a contact spring having a notched base adapted to be detachably connected by screws to the armature, said contact spring having its central portion cut out leaving side strips which are bent away from the armature where they are reduced to form a flexible joint, said contact spring having its free end normally spaced away from the armature, a contact thereon for engaging the stationary contact, and a headed stop bent up from the contact spring and passing through an opening in the armature to engage the armature and limit the spacing of the contact spring from the armature.

9. A regulator for storage battery charging systems, comprising a magnet with a single core, a partition pole piece thereon, a coarse wire winding around the core on one side of the partition pole piece, a fine wire winding around the core on the other side of the partition pole piece, the coarse wire winding being continued around the core on the last mentioned side of the partition pole piece, normally open contacts controlled by one armature, and normally closed contacts controlled by the other armature.

10. In a magnetic switch, a metal plate, a rod passing therethrough and forming a core on either side of the plate, coils wound on the rod on opposite sides of the plate, pole pieces mounted on the plate, and contact-controlling armatures bridging across the pole pieces and the cores.

In testimony whereof I affix my signature in presence of two witnesses.

EDGAR M. SORENG.

Witnesses:
R. S. C. CALDWELL,
KATHERINE HOLT.