No. 611,869. Patented Oct. 4, 1898.

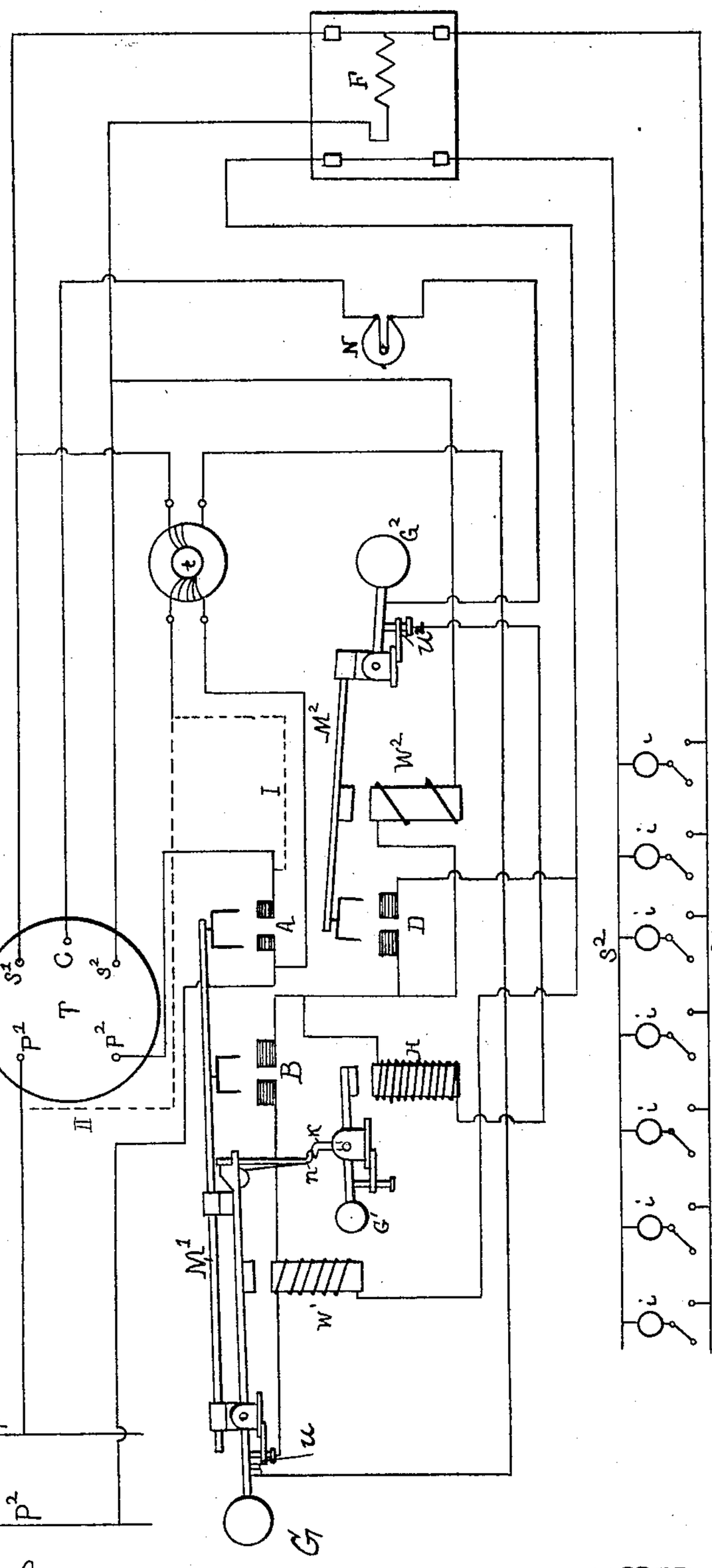
A. SCHLATTER.

AUTOMATIC SWITCH APPARATUS.

(Application filed Sept. 21, 1897.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.



WITNESSES:

F. W. Wright.

L. C. Connor

INVENTOR

ALFRED SCHLATTER

BY

Howson and Howson

ATTORNEYS.

No. 611,869. Patented Oct. 4, 1898.

A. SCHLATTER.

AUTOMATIC SWITCH APPARATUS.

(Application filed Sept. 21, 1897.)

(No Model.) 2 Sheets—Sheet 2.

FIG. 3.

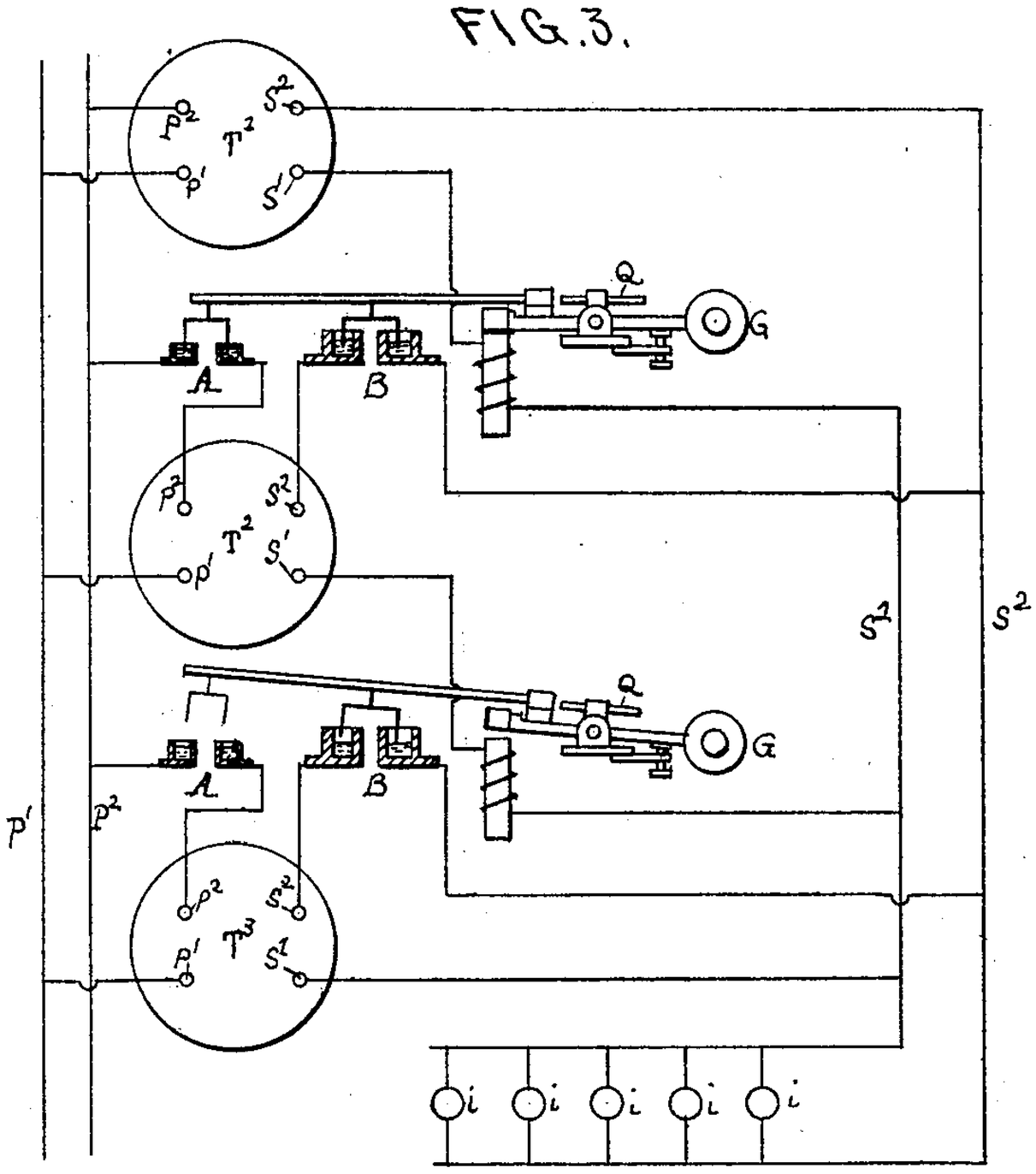
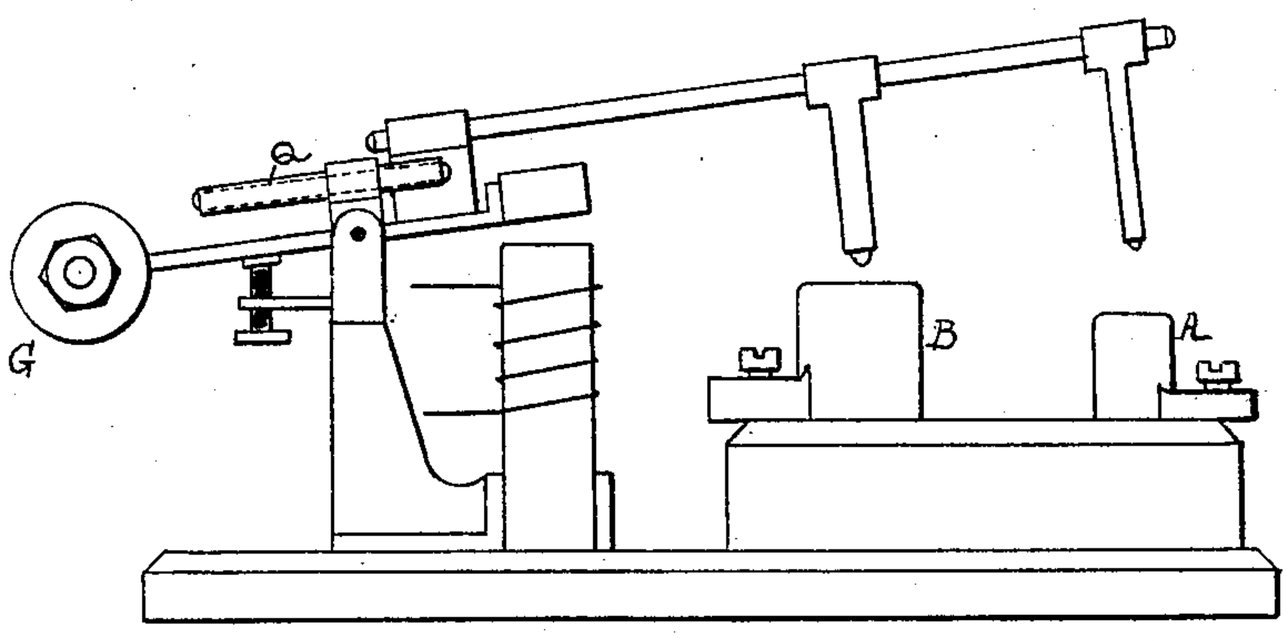


FIG. 2.



WITNESSES:
P. W. Wright.
J. C. Connor

INVENTOR
ALFRED SCHLATTER
BY
Howson and Howson
ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALFRED SCHLATTER, OF BUDA-PESTH, AUSTRIA-HUNGARY.

AUTOMATIC SWITCH APPARATUS.

SPECIFICATION forming part of Letters Patent No. 611,869, dated October 4, 1898.

Application filed September 21, 1897. Serial No. 652,474. (No model.) Patented in Italy November 18, 1895, XXX, 40,232, LXXIX, 8, and in Hungary August 19, 1896, No. 7,361.

To all whom it may concern:

Be it known that I, ALFRED SCHLATTER, a subject of the Emperor of Austria-Hungary, residing at Buda-Pesth, in the Empire of Austria-Hungary, have invented Improvements in Automatic Switch Apparatus, (for which patents have been granted in Hungary August 19, 1896, No. 7,361, and in Italy, Reg. Gen., Vol. XXX, No. 40,232, Reg. Att., Vol. LXXIX, No. 8, application filed November 18, 1895,) of which the following is a specification.

An alternating-current system which distributes electrical energy to the consumers by means of transformers suffers, as is known, from the disadvantage that the transformers remain connected with the primary network when the consumer does not require current, and there is consequently a useless consumption of energy, as the work of magnetization going on is not inconsiderable and causes a dead load at the central station. This waste of energy can, according to the present invention, be reduced considerably when the consumer does not require current by either automatically transferring the magnetizing work of the working transformer, which necessarily contains a great deal of iron, to an auxiliary or switch transformer having a minimum quantity of iron or by entirely cutting out the working transformer. In both cases the putting in circuit of the working transformer at the moment when the consumer requires a current-supply can be effected by the switch-transformer. I effect this by means of an apparatus which I will describe with reference to the accompanying diagrammatic drawings, Figures 1, 2, and 3. It consists of a greater or less number of component parts, according as it is to be applied to single transformers or to groups of transformers.

The arrangements of parts constituting an apparatus serving to control the working of a single transformer and the connection thereof with the network are shown at Fig. 1. Here P′ P² and S′ S² designate, respectively, the primary and secondary networks. T is the working transformer, and *t* a controlling or switch transformer whose primary coil is connected with the primary network. W′ W² are differently-wound electromagnets having different self-induction. Their armatures are rigidly connected to switch-levers M′ M² with contact-forks. A hook *n*, carried by the lever M′ of the magnet W′, is capable of engaging with a catch *k* on the armature of magnet H when this armature is not attracted by its magnet. A B D are mercury-cups. G G′ G² are counterweights on the armature-levers. N is a glow-lamp in the circuit of the magnet H. F is the shunt-coil of the electricity-meter, if such is provided. *i i i* are current-consuming devices connected to the secondary network.

The primary coil of the switch-transformer may be connected to the primary network either in series with the primary of the transformer T, as indicated by dotted lines I, or in parallel, as indicated by dotted lines II, Fig. 1. The electrical connections of these several parts are shown in the drawings and need not be further explained.

Fig. 1 shows a transformer-station consisting of a single working transformer, the parts being in the positions corresponding to a cessation of the consumption. In this condition a minimum primary current passes both through the coil of the working transformer T and through that of the switch-transformer *t*. The dimensions and winding of the latter are so chosen that the greater part of the primary potential difference is consumed in this device and that the iron core of the working transformer T is only slightly excited.

When the primary of the switch transformer *t* is connected in parallel with the primary of the transformer T, as indicated at II, Fig. 1, the minimum current only passes through the primary coil of the controlling or switch transformer *t*, while the working transformer is entirely without current.

The action is as follows: If a current-consuming device *i* is put in circuit, a current proportionate to the requirement of the device passes through the numerous windings of the magnet W′, which is thereby so strongly excited that it can set in motion its armature, and consequently the switch-lever M′. By this means the secondary circuit of the switch-transformer is at the same time broken at *u*, the working transformer is connected at A

directly to the primary network, and the magnet W′ is cut out of the circuit of the switch-transformer and inserted into the circuit of the working transformer. As the working current now passes also through the coil of the magnet W′, the working transformer remains included so long as a consuming device is connected to the secondary network—that is to say, so long as a current excites the magnet W′. On cutting out the last-named object the balance-weight G moves the lever M′ back into the position shown. The course of the secondary current is during the first-described position from secondary of transformer *t* to conductor from S′, leading to consuming device *i*, conductor S^2 to the coil of electromagnet W′, and through contact *u* back to the other terminal of secondary of transformer *t*. After the change by throwing the switch-lever M′ the circuit is from secondary of transformer T through conductor S′, consuming device *i*, conductor S^2, coil of electromagnet W′, contacts B, and coil of electromagnet W^2 back to the other terminal of secondary of transformer T.

The apparatus herein described can in its simplest form (with magnet W′ only) be used in all cases where the consumption of current is small and the secondary network is comparatively of large dimensions, so that the loss of pressure in the same only differs slightly with a weak and a full load. To render the apparatus also applicable for more extended working and at the same time to equalize the lamp-pressure between certain limits, notwithstanding a variable loading of the network, there may be provided in the apparatus in addition to the magnet W′ other magnets, such as W^2, in the same circuit, which have different self-inductions and whose power of attraction is so graduated that they successfully attract their armatures and switch-levers with an increasing loading of the network, and at the same time they short-circuit the winding of the preceding magnet. According to this method the lamp-current pressure in a very wide-spread network can be so regulated that the pressure with a small load (in consequence of the winding of the magnet) shall not be abnormally high nor with a heavy load abnormally low. This method is illustrated in Fig. 1 with two stages. The magnets W′ and W^2 are so wound that W^2 only attracts its lever M^2 when in consequence of increasing load and of the winding of magnet W′ the loss of pressure in the secondary network up to the lamps sinks below the normal value. The winding of W′ is then short-circuited at D. In this case care must be taken that the switch-lever M′ of the magnet W′, which is now without current, is held in its attracted position by mechanical means, which can be easily effected in various simple ways by means of the switch-lever M^2. The holding of the lever M′ when W′ is short-circuited is, however, also effected by the catch *k*, carried by the armature of the magnet H. This armature, which was attracted after the connection of the working transformer, (in consequence of the direct connection of the magnet H with the transformer T,) falls back and its catch *k* engages with the hook *n* as soon as the circuit of the magnet H is broken at *u* in consequence of the motion of lever M^2. This magnet H has, however, to perform another function besides the above. It is required to render innocuous the concussions that are unavoidable when the working transformers are switched into circuit by mechanically holding for a short time the drawn-down switch-lever M′ by means of the hook *n* and catch *k*, as above described. To effect this, the magnet is so arranged that it attracts its armature somewhat after the switching in of the working transformer. For this purpose a resistance is included in the circuit of magnet H, the value of which is decreased on the passage of the current in consequence of heating, thus allowing only a gradual increase of current. A suitable material for this purpose is the carbon filament of a glow-lamp, which is indicated by N on the diagram. The connection of this magnet H in such a manner that the current which excites it must first pass through the magnet W′ is also of importance in this arrangement. I have in this case employed this circuit for reducing the residual magnetism of the magnet W′ (which would prejudicially influence the action of the apparatus on cutting out a larger consuming device) to such an extent that the transformer T will always be cut out with certainty when the secondary network is without current.

The above-described transformer-switch apparatus can be employed as independent apparatus in all cases where the distributing-station consists of single transformers or where several thereof are to be included or cut out simultaneously; but if the transformers are in groups of two or more connected in parallel either as regards the primary or the secondary circuits, and if each transformer is to be separately included or cut out, according to the momentary requirements, the above-described apparatus must be supplemented by a new element. This element is shown separately at Fig. 2. It consists of a simple electromagnetic switch apparatus which with a certain strength of current attracts its armature, and thereby includes the transformer in the circuits.

In the example illustrated in Fig. 3 the first transformer T is for the sake of clearness assumed to be continuously attracted. The electromagnet of the next switch attracts its armature and includes the transformers T^3, &c., when these previously included are loaded to the limit of their maximum capacity. The cutting out of course takes place in the reverse order as soon as the total load has sunk to such an extent that an element of the group can be dispensed with. Although this method appears very simple, yet in the prac-

tical carrying out thereof certain difficulties are encountered. The main difficulty consists in the fact that a maximum switch apparatus made in the form of an electromagnet must be so adjusted that its armature after being attracted by a certain maximum strength will still remain attracted with certainty when the current has decreased to half its strength; otherwise the lever system remains in a continual state of oscillation, which would produce inconvenient fluctuations of pressure, as also cause the rapid wear of the contacts. To prevent these inconveniences, I construct the vibrating lever of the "tumbler" kind by increasing or decreasing the load, and thereby the moment, of the weighted lever according to its position. A tube Q, partially filled with liquid, such as mercury, which is attached to the lever in addition to the balance-weight G, effectually serves for this purpose. By this means the pull of the electromagnet can in no position—*i. e.*, neither in including or in cutting out the transformer—hold the load of the opposite lever-arm in balance. In other words, on including the transformer the continuously-increasing magnetic pull preponderates and in cutting out the continuously-increasing moment of the weighted lever-arm preponderates. Without this condition the oscillatory motion of the parts cannot be prevented.

I claim as my invention—

1. Switch apparatus for reducing the magnetizing work either of a single alternate-current transformer, or the first member of a group of transformers, consisting of the combination with the said transformer of a controlling or switch transformer arranged and operating in such a manner in conjunction with an electromagnet that the winding thereof is included alternately in the secondary circuit of the working transformer and in that of the switch-transformer, according to the position of the armature-lever of said electromagnet, and that on the inclusion of a consuming device the said magnet attracts the armature-lever and holds it during the duration of consumption, substantially as described.

2. An automatic transformer-switch apparatus having a switch-lever and a controlling-electromagnet therefor, in combination with an auxiliary magnet H, whose armature is provided with a catch for holding the switch-lever, and whose circuit is connected with the circuit through said switching-electromagnet, and a resistance included in the said circuit of such a nature that its value is reduced on heating, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALFRED SCHLATTER.

Witnesses:
DRUIM SCHOSSBERGER,
ADALBERT MAGAZINER.