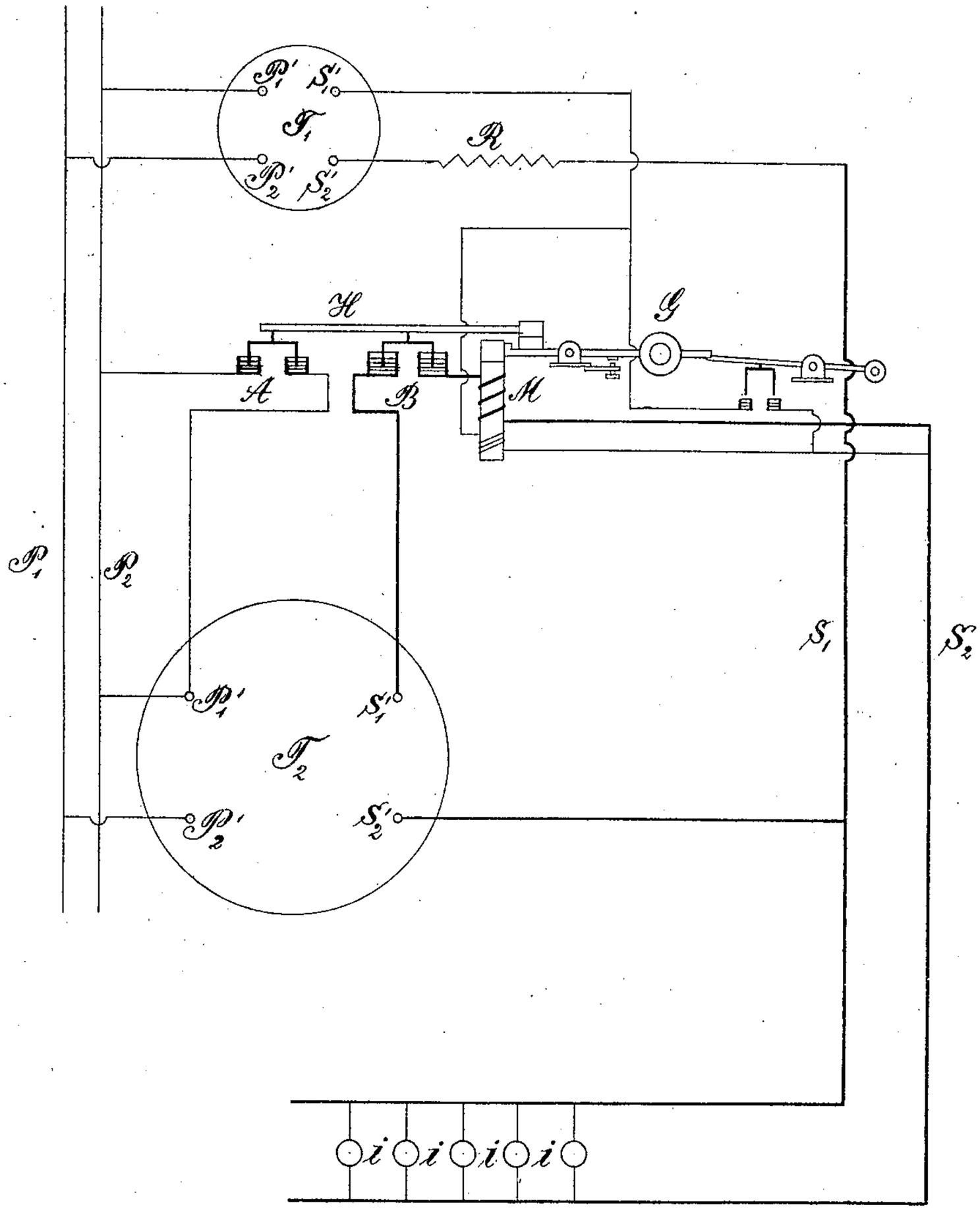
No. 672,015. Patented Apr. 16, 1901.

A. SCHLATTER.

AUTOMATIC SWITCH FOR GROUPS OF TRANSFORMERS.

(Application filed Oct. 5, 1900.)

(No Model.)



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

AUTOMATIC SWITCH FOR GROUPS OF TRANSFORMERS.

SPECIFICATION forming part of Letters Patent No. 672,015, dated April 16, 1901.

Application filed October 5, 1900. Serial No. 32,185. (No model.)

To all whom it may concern:

Be it known that I, ALFRED SCHLATTER, electrical engineer, a subject of the Emperor of Austria-Hungary, residing at Külsö v'aczi út 76, Buda-Pesth, Austria-Hungary, have invented certain new and useful Improvements in Automatic Switches for Groups of Transformers with Members of Various Capacity, of which the following is a specification.

In the specification to my United States Patent No. 611,869, of 1898, is described an automatic switch for groups of transformers the separate members of which are of such dimensions as to be of equal capacity. The means described in the said specification for preventing oscillation of the switch-lever are ineffective when the capacity of the switch-transformer and the working transformer are unequal. In such case there is, besides the circumstances operating against the proper putting in and out of circuit mentioned in the said specification, the circumstance that the total loading of the transformers connected in parallel does not distribute itself evenly among the separate members, as in the specification referred to, but in proportion to the capacity of the members. The extent of the difficulties of construction caused by this circumstance can be best explained by giving an example with figures.

Suppose the maximum switch apparatus M (Figure 3, Patent No. 611,869, of 1898) introduced into the circuit branch of a ten-kilowatt transformer and wound in such a manner that the attraction of the armature, and consequently the putting into circuit of the transformer T^2, which is of the same size as T', takes place at the magnetic excitement of eight by one hundred ampere-windings, (eight being the number of windings on both arms of the magnet and one hundred the maximum secondary current-power of the transformer in question.) As the distribution of the total loading takes place in the proportion of one to one, the armature remains attracted after the putting into circuit with four hundred ampere-windings. If, however, the counterweight G is of corresponding dimensions, the armature can be pulled off at an excitement of three hundred and eighty ampere-windings. If the transformer T', connected permanently with the primary network, is a one-kilowatt transformer, so that it can supply a maximum secondary current of ten amperes, and T^2 still has the capacity of ten kilowatts, the magnet M of the maximum switch apparatus similar in other respects must have eighty windings in order to put into circuit the transformer T^2 with T' fully loaded. After distribution of this ten-ampere total loading in the proportion of one to ten the magnet would be excited to the extent of about seventy-three ampere-windings, which, according to the above proposition, would be considerably insufficient to retain the armature. To render the transformer useful for this combination, it is not sufficient to determine the number of windings of excitement on the basis of the maximum current-power of the switch-transformer by dividing the maximum number of amperes by the number of ampere-windings required to move the armature. It would be necessary to completely alter all dimensions concerned—that is to say, number of windings, magnet-core, counterweight, and armature distance—and then to restore unison of the said dimensions; but it would still be doubtful whether the said unison could be obtained. It is, however, beyond doubt that as many different kinds of apparatus would have to be constructed as are in use, or will be introduced, in combinations of transformer groups, the manufacture and usefulness of such apparatus would therefore be greatly restricted. There is, however, a simple method and process the employment of which makes it possible to retain the constructional unison of the automatic switch protected by the principal patent in connection with any possible combination of transformer groups.

In the annexed drawing an extreme example is represented in which a 0.5-kilowatt transformer has to put into circuit a ten-kilowatt transformer at exactly the moment at which the total current has reached the power of five amperes. In this case the magnet M would have to have one hundred and sixty windings in order to attract its armature at the right moment. Even this great number of windings would not be sufficient to retain the armature after the circuit has been closed, as the distribution of the five amperes between the transformers now connected in

parallel would be entirely insufficient for the purpose intended, (with transformers of normal practical dimensions.) Instead of being excited to the extent of four hundred ampere-windings (the power required to hold the armature securely) the magnet would only be excited to the extent of thirty-eight. The required number of ampere-windings can, however, be obtained by altering the transmission proportion of the small transformer T′ in such a manner that during empty work the secondary tension is slightly higher than that of T^2. It is thus possible to arrange that after connection in parallel is effected the distribution of current is such that 2.5 amperes are supplied by T′ and the other half by T^2. By this means the number of ampere-windings required to hold the armature is obtained; but this method would be unsuitable and impracticable, because with normal interior resistance of the transformer T′ overloading of the latter would be inevitable. In order to meet this circumstance also, the resistance in the current branch of the small transformer must be increased as well as the tension, so that with the increasing power of the current the loss of energy in this branch becomes proportionately larger than in the current branch of the transformer T^2. The increased resistance can either be introduced into the current branch in form of an additional R, which can be regulated, or the thin coil of the magnet M can be apportioned in such a manner that sufficient resistance is produced. A third method is by constructing the small transformer so that care is taken that same can meet the purpose intended by proportionately higher tension and increased interior resistance. These alterations in tension and resistance in the secondary-current branch of the small transformer T′ render, however, the cutting out of circuit of the transformer T^2 when once put into circuit doubtful, as owing to its increased energy T′ cannot even become free of current when all consumers are cut out of circuit. The secondary winding of the transformer T^2 continues to represent a closed circuit in which a constant potential difference exists. A sure method of obviating this possibility is dividing the coil of the switch-magnet in such a manner that one part thereof is introduced into the circuit of each transformer and that the magnetizing effects of both coils are equally directed, as shown in the drawing with regard to M. This alteration in the transformer group itself on the one hand and in the switch-magnet on the other insures accurate working of the apparatus in every respect. In proof I refer to the figure hereinbefore mentioned by way of example. Assuming the thin coil to consist, as formerly, of one hundred and sixty windings and the number of the thick to be twelve and the tension and the resistance R in the current branch of the transformer T′ to be so regulated that after effected connection in parallel the transformer T′ supplies as a practically constant maximum 2.3 amperes and T^2 supplies the other 2.7 amperes, completing the total loading of five amperes, there result for exciting the magnet on closing the circuit $160 \times 5 = 800$, and after closing and distribution of the common loading is effected $160 \times 2.3 + 12 \times 2.7 =$ (in round figures) 400 ampere-windings, at which, according to the above assumption, the armature will be attracted without fail and held securely. The cutting out of circuit of the transformer T^2, which can take place at three hundred and eighty ampere-windings, will result without fail on a total loading of three amperes. On reducing the total loading by two amperes only the transformer T^2 can supply current worth mentioning, and consequently the excitement of the magnet M is weakened by twenty-four ampere-windings which is sufficient to release the armature, and thereby the switch-lever. It is thus proved that the automatic switch for transformer groups protected by Patent No. 611,869, of 1898, can only be used with advantage when the separate members of the group are of equal capacity. The switch can, however, be made useful for any possible combination of transformer groups having two members in which the members are of different capacity by providing the magnet M with two coils acting in the same direction, of which one is introduced into the current branch of each transformer, and by increasing the tension and the resistance in the current branch of the smaller transformer in such a manner that with reduced total loading the current-supply of same becomes more favorable for switching purposes without there being any fear of overloading with increasing total loading.

What I claim is—

1. In combination with a large and a small transformer, an automatic transformer-switch comprising a switch-magnet having two coils effective in the same direction for exciting the magnet-core, one of the said coils being in the current branch of the small transformer, and the other in the current branch of the large transformer, substantially as and for the purpose described.

2. In combination with a large and a small transformer, an automatic transformer-switch comprising a switch-magnet having two coils effective in the same direction for exciting the magnet-core, one of the said coils being in the current branch of the large transformer and the other in current branch of the small transformer, and means for increasing the drop in the current branch of the smaller transformer, substantially as and for the purpose described.

3. In combination with a large and a small transformer, an automatic transformer-switch comprising a switch-magnet having two coils effective in the same direction for exciting the magnet-core, one of the said coils being in the current branch of the small transformer,

and the other in the current branch of the large transformer, and means for increasing the tension in the current branch of the small transformer, substantially as and for the purpose described.

4. In combination with a large and a small transformer, an automatic transformer-switch comprising a switch-magnet having two coils effective in the same direction for exciting the magnet-core, one of the said coils being in the current branch of the large transformer, and the other in the current branch of the small transformer, and means for increasing the drop and the tension in the current branch of the small transformer, substantially as and for the purpose described.

In witness whereof I have signed this specification in the presence of two witnesses.

ALFRED SCHLATTER.

Witnesses:

FRANK CHESTER,

PAUL DYER.