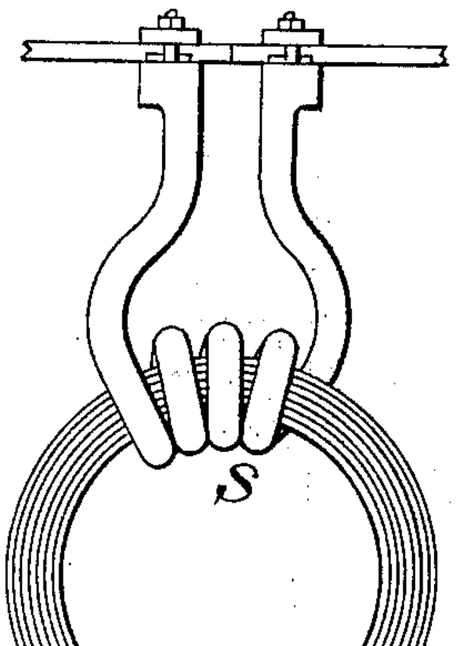
(No Model.)

# E. THOMSON.

## INDUCTION DISCHARGE PROTECTOR FOR WELDING APPARATUS.

No. 434,531. Patented Aug. 19, 1890.

Fig. 1.



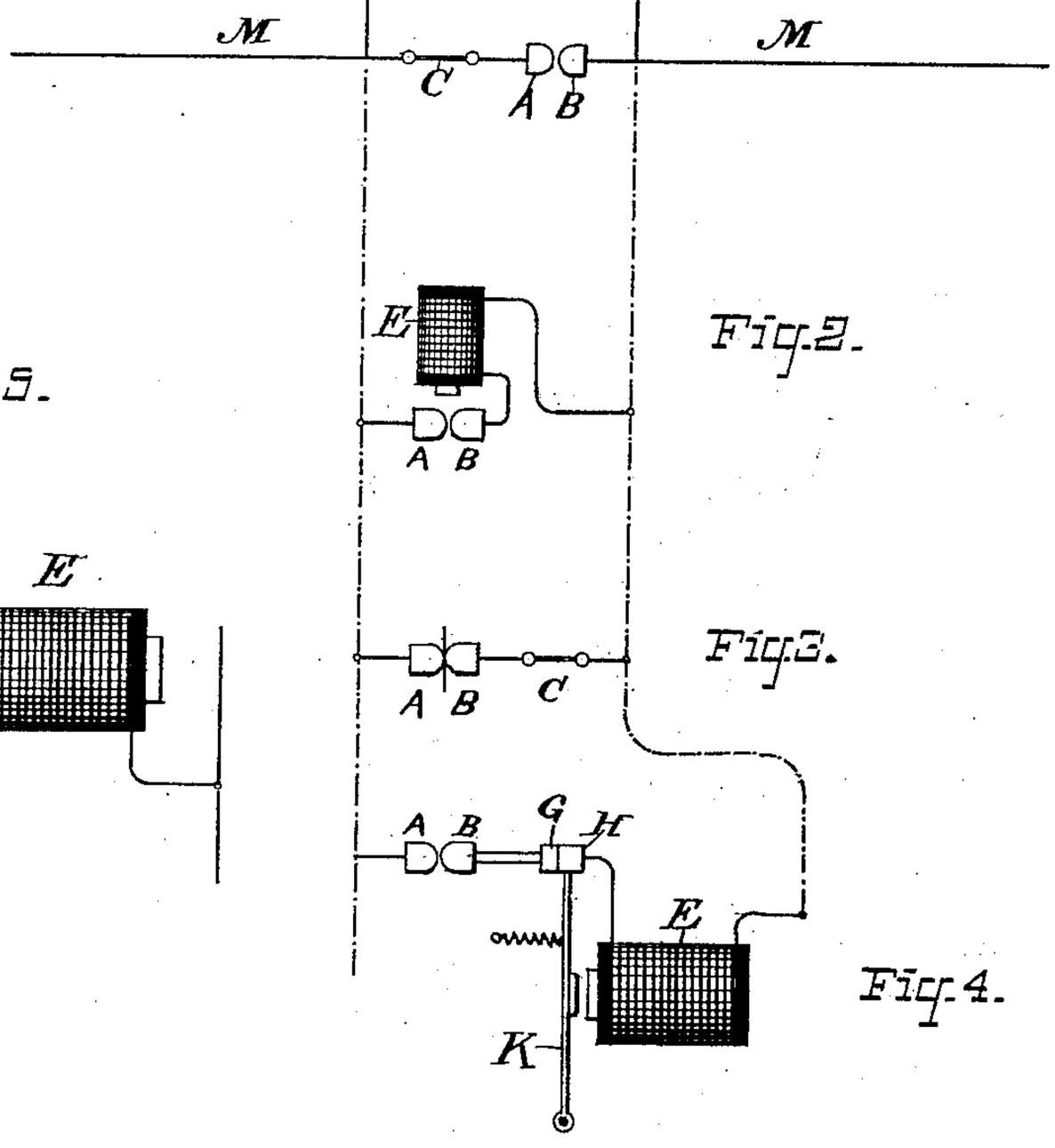
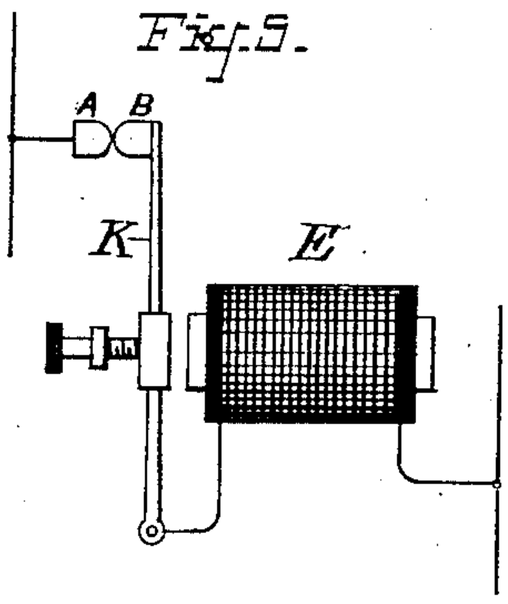




Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON ELECTRIC WELDING COMPANY, OF MAINE.

## INDUCTION-DISCHARGE PROTECTOR FOR WELDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 434,531, dated August 19, 1890.

Application filed August 8, 1889. Serial No. 320,173. (No model.)

*To all whom it may concern:*

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Induction-Discharge Protector for Welding Apparatus, of which the following is a specification.

My invention relates particularly to that class of induction-coils or transformers in which the secondary circuit is adapted to develop a current only of a very low potential, as is the case with converters or transformers constructed for electric welding or other metal-working operations. In this class of apparatus I have found that frequently a rupture of the insulation of the primary circuit of the apparatus takes place, and I have ascertained that such rupture is ordinarily due not to any change of electrical condition in the circuit supplying the primary, but to a sudden rupture of the circuit for the secondary current, arising from a melting down of the work and a rupture of the circuit at such point. I have also ascertained that the destruction of the insulation of the primary is largely due to the fact that the current of the secondary is so low in tension as to be incapable of maintaining itself even for an instant at the point of break in the work, the result being that no arc can follow the rupture and prolong the current, and consequently there is developed in the primary coil of the apparatus an extra or induction-discharge current of great potential, which breaks through the insulation of the primary coils.

My invention consists in removing the danger to the primary from a melting down of the work in the secondary circuit by placing an induction-discharge protector across the terminals of the primary and adapted to provide a path for the high-tension induction-discharge, while maintaining an insulation which will prevent a shunting of the ordinary currents passing through the primary of the coil for the purpose of setting up the low-tension currents in the secondary.

Such discharge-protector consists, essentially, of two electrodes or contacts brought into close proximity, but normally separated from one another by a thin layer of air or film of insulating material, which furnishes a sufficient obstacle to the flow of the ordinary currents on the circuit, but provides a path for the high-potential discharge-current, inasmuch as it is a path of comparatively little self-induction, so that such induction-current passes by it in preference to passing over the general circuit or across and through the insulation of the coil.

My invention consists, further, in the combination, with the induction-discharge protector placed across the terminals of the primary circuit, of a circuit-breaker of any desired character for the current of any arc following the discharge across the protector. This part of my invention is applicable to any electric apparatus or electro-magnetic coils placed in the circuit from any generator, and provided with an induction-discharge protector across its terminals for the high-potential extra current developed in the magnetic coils or apparatus. The arc which follows the passage of the discharge-current across or through the discharge-protector is produced by the current from the generator supplying the magnetic coils or other apparatus, and obviously requires to be removed in order that damage to the protector or generator may be obviated.

The circuit-breaker or device for breaking the current by which any arc is maintained through the protector may be of any desired character, and I include under such term not only a magnet the field of which acts to blow out or disrupt the arc itself, but also a device placed in the circuit and adapted to fuse by the abnormal current which maintains the arc, and also electric contacts movable with relation to one another and included in the normal circuit, but adapted to be separated for the purpose of interrupting the current which maintains the arc, or any other device which is adapted to produce a cessation in the flow of the current through or over the protector producing the arc.

In the accompanying drawings I have shown in Figure 1 diagrammatically an arrangement of apparatus embodying my invention. Figs. 2, 3, 4, and 5 illustrate forms of devices

which may be employed in carrying out my invention.

S indicates the secondary circuit or coil of a converter, and P the primary thereof. The secondary S is of large gage or few convolutions, and is adapted to supply a current of low potential to welding or metal-working apparatus, in which a piece or pieces of metal are heated by such low-potential current. The primary P of such converter carries a current of comparatively high potential, supplied thereto over a main M from any suitable generator, preferably an alternating-current generator.

The form of induction-discharge protector shown in Fig. 1 consists simply of two electrodes or pieces of metal A B, presented to one another but separated by a small air-space. The protector is included in a short branch circuit between the terminals of the coil P. By "short circuit" I mean one which possesses comparatively little self-induction to the passage of a high-potential current. In the circuit with the induction-protector is shown a fuse C.

In the operation of welding apparatus it is the ordinary practice to employ a secondary current insufficient to maintain an arc. When, therefore, the secondary circuit is interrupted or ceases, an exceedingly high potential current is developed in the primary P, which, if it were obliged to circulate over the main line M, wherein it would meet, considerable self-induction might in preference break through the insulation on the primary P, thus destroying the same. By means of the protector A B, however, a comparatively free path is afforded for such current of self-induction and it passes and dissipates itself over the circuit, including the electrode A B and fuse C. The passage of the high-potential current at A B, however, establishes a circuit for the current supplied over the line M from a generator, and an arc is immediately established across the electrodes A B. The current which maintains such arc, however, being of comparatively large volume, and the fuse C being properly adjusted to such current, said fuse will immediately rupture, and will thus interrupt or break the current which maintains the arc, thereby preventing damage to the apparatus.

In Fig. 2 the narrow space across which the arc is formed is shown as in the field of an electro-magnet E, which is in the circuit traversed by the arc and which by its magnetic field interrupts or breaks the circuit of the current maintaining the arc at the arc itself.

In the form of protector shown in Fig. 3 electrodes A B are separated by a film *m* of some insulating material—such as mica—but which cannot withstand the high potentials established at the electrodes A B on the development of the extra or discharge-current in the coils P. Such film, however, is sufficient to prevent the passage of the ordinary current on the main M through the branch around the coils P, just as the air-film does in Figs. 1 and 2. In Fig. 3 the circuit-breaker is a fuse C.

In Fig. 4 the circuit-breaker consists of two contacts G H, normally held in connection by a suitable spring applied to the lever K, supporting one of them. The electro-magnet E is included in the circuit with the protector and such contacts, and has an armature which is attached to the lever K. When the circuit is established through the protector before explained, the magnet E, becoming energized, draws contact H away from G, and thereby breaks the circuit for the current, which forms the arc and causes the same to put out.

In the modification indicated in Fig. 5 the electro-magnet E has an armature-lever K, which carries one of the electrodes A B. On establishment of the circuit and the formation of an arc the current which produces such arc energizes the magnet and draws the electrode B away from A to such an extent as to break the circuit for the arc-maintaining current.

Other ways will readily suggest themselves to electricians of interrupting or breaking the circuit for the current of the generator when it finds a path over the discharge-protector and through the main M.

What I claim as my invention is—

1. The combination, with a transformer or converter for electric welding or other metal-working operations, of an induction-discharge protector in a short circuit between the terminals of the primary, whereby on rupture of the secondary circuit damage to the primary may be prevented.

2. The combination, with a transformer or converter having a high-potential primary and a low-potential secondary adapted to develop a current incapable of forming a prolonged arc, of an induction-discharge protector connected to the terminals of the primary, and a circuit-breaker for the current following the discharge through the protector upon the rupture of the circuit for the low-potential secondary current.

3. The combination, with an electric welding or metal-working converter, substantially such as described, of an induction-discharge protector in a shunt across the terminals of the primary, whereby on fusion or melting down of the work in the low potential secondary the high potential developed in the primary coils may have a path independent of the insulation of the coils.

4. The combination, with magnet-coils placed on an electric circuit and traversed by current from any suitable source, of an induction-discharge protector consisting of electrodes normally separated by a narrow insulating-space, but connected, respectively, to opposite sides or terminals of such coil directly, so as to form a short-circuit path for

any inductive electric discharge-current produced in the coils themselves, and a circuit-breaker for rupturing the circuit of any arc following such induction-discharge from the coils and maintained by the electric current flowing over the main line.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 1st day of August, A. D. 1889.

ELIHU THOMSON.

Witnesses:
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