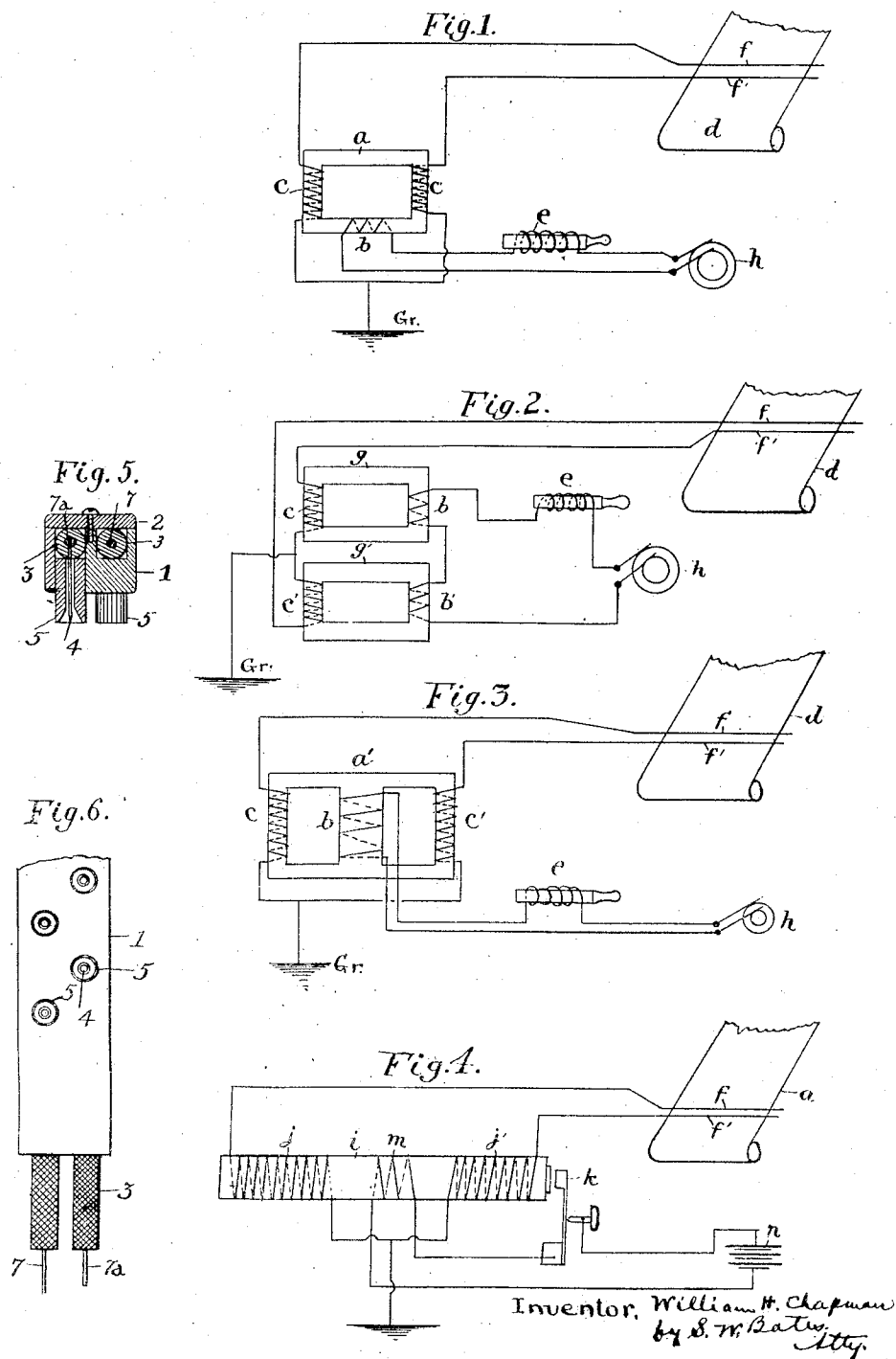


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 PROCESS AND APPARATUS FOR NEUTRALIZING STATIC ELECTRICITY.
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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM H. CHAPMAN, a citizen of the United States, residing at Portland, in the county of Cumberland and State of Maine, have invented certain new and useful Improvements in Processes and Apparatus for Neutralizing Static Electricity, of which the following is a specification.

My present invention relates to an improved method of applying alternating charges of electricity for neutralizing the static electricity in paper, cloth or other material in the processes of manufacture and is especially applicable to printing presses.

The object of my invention is to provide a means of projecting alternating charges into the air at the lowest possible voltage and to reduce the chances for break down of insulations and reduce the shock that can be obtained by a person touching the discharge wires.

In my Patents No. 777,598 and No. 777,599, I have shown a single discharge wire connected to one terminal of the high tension coil of a transformer while the other terminal is grounded. The potential of the charge on the discharge wire is therefore equal to the total potential between the two terminals of the transformer, and there is this amount of strain on the insulating supports of the discharge wire as well as on the insulations of the high tension coil of the transformer.

My present invention consists in the use of two discharge wires instead of one and maintaining on each one of them an alternating voltage or potential, only half as great as that required by my previous invention. The two discharge wires are placed in proximity to each other but not close enough for spark discharges to take place. The alternating charges on the two are so timed in relation to each other that at the instant one of them has the maximum positive potential, the other one has the maximum negative potential. Under these conditions a glow discharge takes place from both wires by reason of the difference of potential between them, although the difference of potential between either wire and the earth may be so low as not to be able to produce any glow discharge if used singly, as in the former patents referred to. The glow discharge fills the surrounding air with ions

of both kinds, positive and negative and a sheet of paper or other material charged with either kind of electricity if passed through this air will have its charge neutralized by attracting the ions of opposite sign and repelling those of like sign as itself.

My invention may best be understood by reference to the accompanying drawing in which I have shown a plurality of diagrams illustrating some of the ways in which my invention may be put into practice.

In the drawing, Figure 1 shows a means of maintaining the required conditions with a single transformer. Fig. 2 shows two transformers connected to secure the same result but with safety against shock to a person. Fig. 3 shows another form of transformer also well adapted to avoid shock to a person standing on the ground and touching one of the discharge wires. Fig. 4 shows an induction coil adapted for this work. Fig. 5 is a cross section on Fig. 6 and Fig. 6 is a plan of the under side of one of the inductors which I use in practice.

In the several figures of the drawing, like letters indicate like parts.

In Fig. 1 *a* is the iron core of a transformer *b* is the primary coil of the transformer and is connected to a generator *h* supplying alternating current of ordinary commercial voltage as used for lighting or power, *c* and *c'* are two secondary coils of the transformer connected in series with each other and having their junction connected to earth, and their other terminals connected to fine discharge wires *f f'* placed in proximity to each other and to the paper *d* or other material to be treated.

In Fig. 2 *g* and *g'* are two separate transformers having primary coils *b b'* connected to a generator *h* supplying alternating current and secondary coils *c c'* connected in series with each other their junction being connected to earth and their other terminals to the two discharge wires *f f'*.

In Fig. 3, I have a modification in which the transformer has three legs on the frame, one leg being wound with a primary winding and two legs having secondary winding whereby two magnetic circuits are established. As herein shown *a'* is the frame of a transformer connected to the generator *h* supplying alternating current. At each side of the primary winding, I have located the secondary windings *c* and *c'* one terminal of

each of the coils e and e' being connected with the fine discharge wires f f' applied as in the other forms shown in these figures.

Considering Figs. 1, 2, and 3, in practice the choke coil e which as applied to the forms shown in these figures is constructed to limit the total exciting power of the primary coil or coils b b' to about 300 ampere turns or less. Each secondary coil e and e' has usually 20,000 or more turns of wire, so that when a person stands on the ground and touches one of the discharge wires, thus forming a short circuit the maximum current he can receive in the case for instance of the arrangement shown in Fig. 1 is

$$\frac{300}{20000} = .015 \text{ amp. or 15 milli-amperes}$$

because that amount flowing through one secondary coil will just balance the exciting power of the primary coil and stop the magnetic flux. If the person instead of forming a short circuit from one discharge wire to the ground should form a short circuit from one discharge wire to the other, the maximum current he would receive is

$$\frac{300}{2 \times 20000} = .0075 \text{ amperes.}$$

In case of the arrangement shown in Fig. 3, the maximum quantity a person can receive when standing on the ground and touching one of the discharge wires as c is further reduced by the fact that the magnetic flux has an alternative course, it may all pass through the part of the transformer core which is inclosed by the other secondary coil e' . The conditions of Fig. 2 are in this respect like those of the form shown in Fig. 3 as it is provided with an alternative magnetic circuit in case of a short circuit through the body.

It will be understood that the small wires f and f' are shown to illustrate the principle but they are ordinarily replaced by some effective glow discharge inductors provided with points on corresponding inductors and being so related that the glow discharge passes across from one set of points to the other set of points.

Referring to Figs. 5 and 6, each of the discharge wires 7 and 7^a is inclosed in an insulating covering 3 making an insulated cable. These cables extend through a wooden bar 1, 2 formed in two parts with channels for the cables. The discharge wires 7, 7^a are made up of bundles of very fine wires and through these are driven at intervals common wire nails 4, the points of these nails forming the discharge points. The nails are inclosed in nipples 5 of porcelain or other insulating material which are inserted from the front of the bar, their inner ends abutting against the cables. These nipples are cored out so that they do not contact with

the nails and they are staggered on the bar in two rows so that the glow discharge takes place between the two sets of nipples. Such an inductor which is in practice used in place of the pair of discharge wires, illustrated in the above diagram, can be readily made of any desired length and it creates in its vicinity an atmosphere charged with positive and negative ions whereby the neutralizing of the material is perfectly effected.

For purposes of safety against shocks and for purposes of regulation, the choke coil e of the open magnetic circuit type already referred to has its core movable so that its choking effect may be varied in the well-known manner and regulation thereby secured of the amount of current delivered to the primary coil of the transformer. In the practical operation of my transformer or transformers, it is important to have the neutral point of the secondary coils grounded as shown, otherwise there will be an accumulation of static charge in the transformer itself of the same polarity as that of the material under treatment.

In Fig. 4, I have shown an induction coil, one advantage of which is that it may be mounted upon the individual printing press or other machine where electricity is generated and where the neutralizing effect is desired without other distributary wires to deliver current to it. Referring to Fig. 4 i represents the core having a separate primary winding m and a secondary winding made up of two separate windings j and j' connected in series with their junction connected to the ground. The operative terminals of each of the coils j and j' is connected with one of the discharge wires f and f' and a vibrator k and battery n or other source of current is connected with the primary coil. The coil is so wound or connected that while one of the service wires is charged with the positive impulse at the point of greatest intensity, the opposite wire will be charged with negative at the point of its greatest intensity as the primary current makes and breaks, thus causing an effective alternating glow discharge between the wires. This apparatus has the same advantage as is noted in the other forms shown, that is, a reduction by half of the voltage required to do the work over the old form and it also has the further advantage of being self-contained and being capable of being mounted directly on the machine while in the ordinary form of installation, high tension wires lead from the transformer to the machine, this arrangement being objected to in some plants.

I claim:

1. The process of neutralizing static electricity which consists of maintaining on each of a pair of discharge wires, an alternating charge of electricity, each charge

having simultaneous alternations of different signs, placing said wires in such close proximity that a glow discharge will take place between them and finally passing the material to be neutralized through the ionized field, thus produced.

2. In an apparatus for neutralizing static electricity, the combination of a transformer having two secondary oppositely wound or

connected coils, a terminal of each coil being connected to a discharge wire, the two discharge wires being so located in proximity that a glow discharge will take place between them and means for passing the material to be acted upon through the ionized space thus produced.

In testimony whereof I affix my signature.

WILLIAM H. CHAPMAN.