

F. S. SMITH.
ELECTRICAL APPARATUS FOR DESTROYING INSECTS.
APPLICATION FILED MAR. 13, 1911.

1,016,451.

Patented Feb. 6, 1912.

2 SHEETS—SHEET 1.

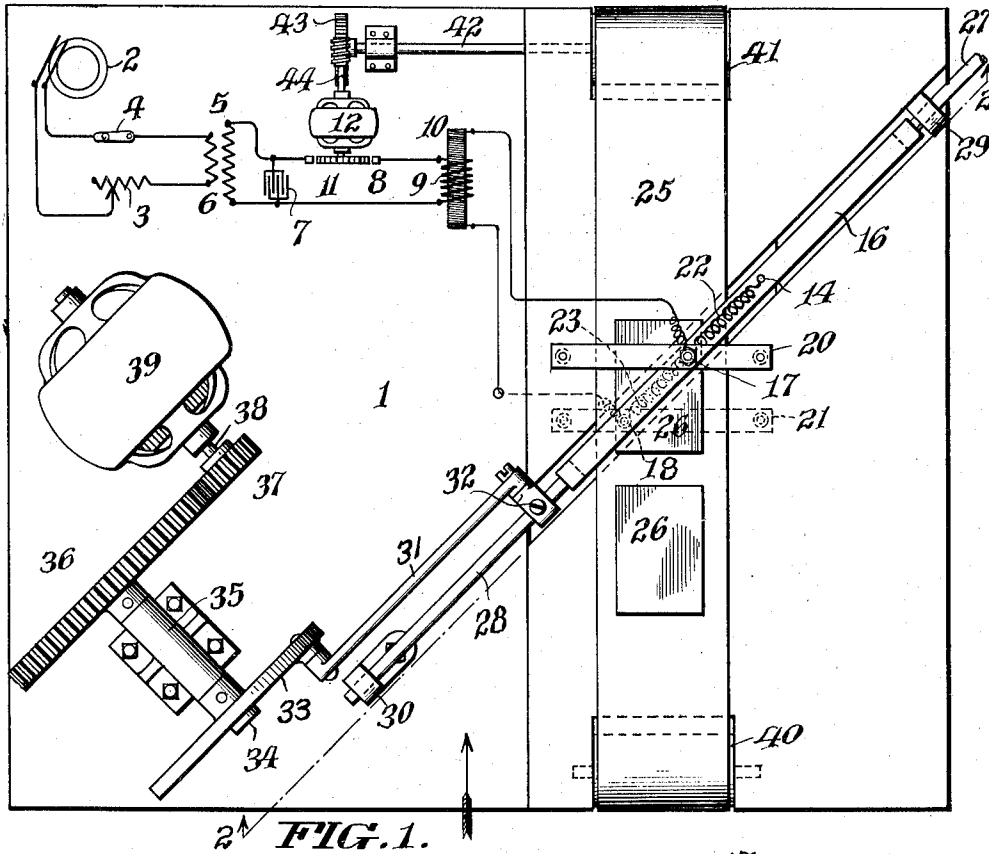


FIG. 1.

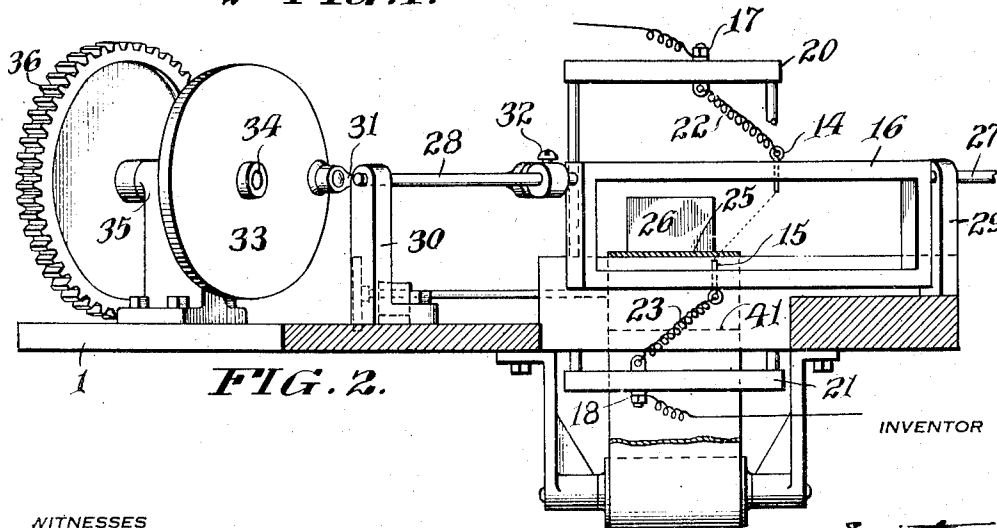


FIG. 2.

WITNESSES

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2 SHEETS—SHEET 2.

FIG. 3.

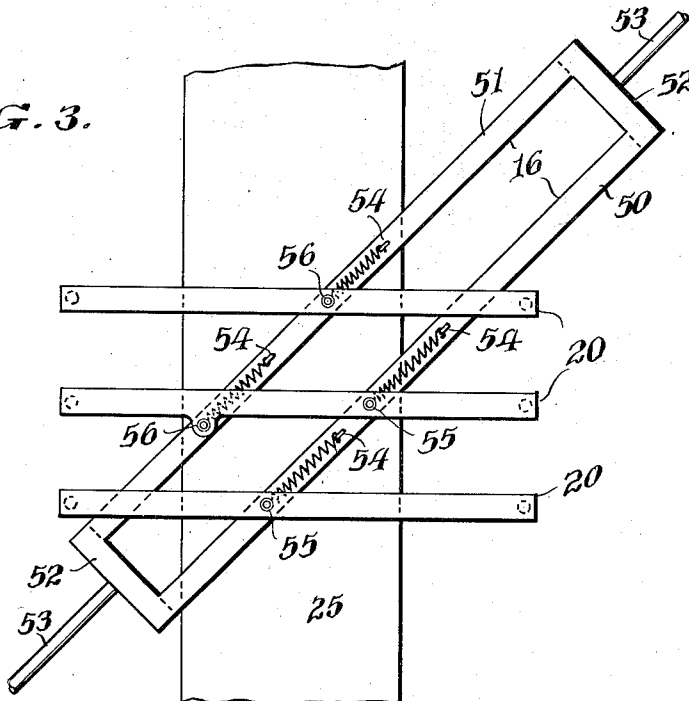
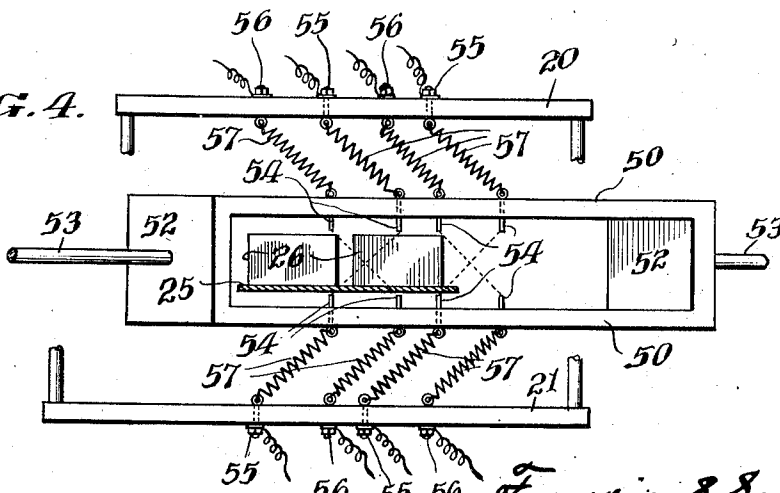


FIG. 4.

**INVENTOR**

WITNESSES

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UNITED STATES PATENT OFFICE.

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ELECTRICAL APPARATUS FOR DESTROYING INSECTS.

1,016,451.

Specification of Letters Patent.

Patented Feb. 6, 1912.

Application filed March 13, 1911. Serial No. 614,181.

To all whom it may concern:

Be it known that I, FRANKLIN S. SMITH, a citizen of the United States, residing in Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Electrical Apparatus for Destroying Insects, of which the following is a specification.

My invention relates to improvements in electrical apparatus for destroying insects, their eggs, larvæ and pupæ, and it has for its object to provide an apparatus adapted for use in the treatment of articles infested with such insects, etc., and having a high degree of efficiency and which at the same time is simple in construction and may, therefore, be economically constructed.

In my previous investigations I have discovered that by the subjection of insects to the action of electrical discharges of the character which are hereinafter described, such insects are destroyed. Heretofore the discharges have taken place between stationary terminals and the idea has been to provide a sufficient number of terminals to cause the discharges to come into contact with each and every part of the material under treatment and which was supposed to contain the insects which it was sought to destroy. It has been found to be preferable in some cases, however, to subject the articles being treated to the action of a moving electrical discharge produced between moving terminals. It has also been found to be preferable in some cases to cause the discharge to take place at an acute angle with respect to the plane of the articles being treated. This is particularly true in the case of articles in boxes because of the fact that the current between the terminals has a tendency to travel along the material of the boxes and thus fail to reach the insects which are located adjacent to the sides or ends of the boxes or which insects may be between folds of the material which are frequently found at the ends and sides of the boxes.

My invention is adapted for the treatment of various commercial products such as cereals, etc., but I shall not go into a description or statement of the various articles because the same may be ascertained by reference to my co-pending application filed January 7th, 1911, Serial No. 601,283.

Other objects and advantages of my invention will be set forth hereinafter in the

detailed description of the same or will be apparent therefrom.

In order that my invention may be more readily and fully comprehended and understood, reference should be had to the accompanying drawing in which I have illustrated a convenient form of embodiment thereof, but it will be understood that various changes in the details of construction may be made within the scope of the claims without departing therefrom.

In the drawings:—Figure 1 is a top plan view of an apparatus embodying my invention, certain parts being conventionally and symbolically shown; Fig. 2 is a view looking in the direction of the arrow in Fig. 1, being partly in elevation and partly in section, the section being taken along the line 2—2 of Fig. 1; Fig. 3 is a top plan view of a portion of apparatus showing a construction in which certain of the parts shown in Figs. 1 and 2 are duplicated; and Fig. 4 is a side elevation of certain of the parts shown in Fig. 3.

In the drawings:—1 designates a table or other suitable support upon which the various parts constituting the mechanism of my apparatus may be supported.

2 designates a source of alternating electric current; 3 designates a variable resistance; and 4 a switch in the circuit 5 which includes the primary coil of a step-up transformer 6. The variable resistance 3 and the switch 4 are in series with the source of alternating current 2 and are also in series with the primary coil of the step-up transformer 6.

7 designates a condenser which is in multiple with the secondary coil of the step-up transformer 6. The spark gap 8 which is of known construction is in series with the condenser and the primary coil 9 of the Tesla coil 10. The rotary member 11 of the spark gap is rotated by means of the motor 12, the said motor also performing an additional function to which reference will hereinafter be made. The opposite ends of the secondary coil of the tesla have connection with the terminals 14 and 15 which are carried upon the opposite side members of a reciprocating frame 16 of insulating material. In the construction illustrated, the secondary of the tesla is connected to the terminals 14 and 15 in the following manner,—the opposite ends of the secondary coil thereof are connected to binding posts

or screws 17 and 18 secured upon stationary supports 20 and 21 which binding posts are in turn connected to the terminals 14 and 15 by means of coiled springs 22 and 23.

It will be observed upon reference to Figs. 1 and 2 of the drawings that the terminals are not located directly opposite to each other but are so arranged that a line drawn from the end of one to the end of the other makes an angle with a vertical line or plane or a horizontal line or plane of approximately 45 degrees. This is for a purpose to be hereinafter stated.

In order that the articles to be treated may be subjected to the action of sparks which may be discharged between the terminals 14 and 15, I have provided a conveyer 25 of any suitable insulating material upon which the said articles indicated at 26 may be supported and conveyed between the said terminals. It will be observed that in the construction as illustrated in Figs. 1 and 2, the frame 16 is rectangular in shape. This frame is arranged at an angle of about 45 degrees to the direction of travel of the conveyer 25.

The frame 16 is provided with rods 27 and 28 extending from its opposite ends through openings or perforations in the supports 29 and 30. These rods are slidable longitudinally in their bearings whereby the said frame may be reciprocated. The means employed for causing reciprocating movement of the said frame consists of a rod 31 having adjustable connection at 32 to the rod 28. The opposite end of the said connecting rod 31 is connected to a revoluble disk 33 the revolution of which causes reciprocating movement of the terminal carrying frame 16. The disk 33 is mounted upon a shaft 34 journaled in bearings 35 and which shaft is also provided with a gear wheel 36 driven by a pinion 37 upon the shaft 38 of a motor 39. The adjustable connection between the disk 33 and the rod 28 may be otherwise made if desired.

The conveyer 25 is supported upon drums 40 and 41, the latter drum 41 being supported upon a shaft 42 having a pinion 43 driven by a worm on the shaft 44 of the motor 11.

Upon reference to Fig. 1 of the drawings, it will be observed that as a package moves forward between the opposite sides of the reciprocating terminal carrying frame 16 a corner or edge thereof (due to the angular relation between the plane of movement of the spark and the direction of travel of the package in the belt) first strikes the plane of movement of the spark between the terminals. As the package is moved forward by the conveyer each and every part thereof is brought progressively into the path of movement of the said spark. By reason of the fact that the spark takes effect between

the terminals along a line which is at an angle to a vertical plane or line or to a horizontal plane or line, the spark also first cuts or strikes the uppermost left-hand corner or edge (when the arrangement is as shown in Figs. 1 and 2 of the drawings) of the packages. The inclination of the spark between the terminals with respect to a perpendicular or a horizontal plane may vary, but I prefer that the inclination should be at about an angle of 45 degrees.

It is desirable that the action of the sparks upon the packages be maintained for a longer period at the sides and edges where the boxes are folded than at the center. This desirable feature is effected by reason of the fact that when the terminals are in such position that the sparks strike the edges and corners of the boxes containing the substance being treated whether the reciprocating frame is in its outermost or innermost position the said frame is at those times moving at its lowest rate of speed by reason of the fact that the connecting rod 31 has at those times reached its position of greatest throw.

As is well known, the movement of the reciprocating terminals carrying the frame 16 would be slowest at such times as the operating connecting rod 31 is nearest to a horizontal position. The terminal carrying frame 16 is moving at its greatest speed when the line from the point of connection of the rod 31 to the disk 33 to the axis of revolution of the said disk is at a right angle to the direction of movement of the frame 16. When the parts are in the latter position, the spark is taking effect through the body portion of the packages and between the outer edges thereof.

In Figs. 1 and 2 I have illustrated a construction in which only two terminals are provided but it will be understood that the number of terminals may be increased as desired.

In Figs. 3 and 4 I have shown a construction in which the number of terminals carried by a single reciprocating frame is increased but I have also shown what in effect is a duplication of the frame 16 shown in Figs. 1 and 2 and it is to be understood that the number of frames may be still further increased should such increase be found to be desirable. In said Figs. 3 and 4 I have illustrated a reciprocating frame comprising four bars of insulating material arranged to form couples 50 and 51. The opposite ends of these bars are secured to end portions or members 52 which are provided with rods 53 by means of which the frame may be supported in bearings in the manner illustrated in Figs. 1 and 2 of the drawings. The frame in Figs. 3 and 4 may be reciprocated in the same manner and by the same means as is illustrated in Figs. 1

and 2 of the drawings. In each bar of each of the couples 50 and 51 I have provided two terminals 54 (which members may be increased as desired), which terminals are
 5 so related with respect to each other that the spark taking place between the same extends at an angle of substantially 45 degrees to a horizontal plane. In said Figs. 3 and 4 the frame is at the limit of its outward
 10 movement and the relation of the electrical discharge between the terminals with respect to the packages being treated is shown. It will be observed that two packages instead of one are being treated by
 15 means of the construction illustrated in these two figures. The terminals are so arranged in the bars constituting the couple 51 that the electrical discharges taking place therebetween extend along lines substantially at right angles to the lines of
 20 discharge between the terminals carried by the couple 50. By this means it is believed that each and every part of the package treated is more apt to be subjected to the
 25 action of the electrical discharge than if all of the sparks extended in the same direction. In this construction, as in the construction shown in Figs. 1 and 2, the opposite ends of the secondaries of the Tesla
 30 coils are connected to binding posts 55 and 56 and the said posts are connected by means of coiled springs 57 to the terminals upon the couples 50 and 51 of the said frame.

35 Having thus described my invention, I claim:—

1. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative
 40 connection therewith between which terminals electrical discharges take place and one at least of which terminals is movable, and means between said terminals for supporting articles to be treated.

45 2. In an apparatus of the character described, the combination of a source of electrical energy, synchronously movable terminals having operative connection therewith, and means between said terminals for
 50 supporting articles to be treated.

3. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative connection therewith, means for causing
 55 movement of the said terminals, and means between the said terminals for supporting articles to be treated for the purpose of destroying the insects, eggs, larvæ or pupæ with which the said articles may be infested.
 60

4. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative connection therewith, means for causing
 65 reciprocating movement of the said terminals,

and means for supporting articles between the said terminals and subjecting the same to the action of the electrical discharges between the said terminals whereby
 the insects, eggs, larvæ or pupæ with which
 70 the said articles may be infested, may be destroyed.

5. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative
 75 connection therewith, means for causing reciprocating movement of the said terminals, a conveyer extending between the said terminals and arranged at an acute angle to the plane of movement of the said terminals,
 80 whereby articles placed upon the said conveyer are moved between the said terminals at an acute angle to the plane of movement thereof, whereby the insects, eggs, larvæ or pupæ which may infest the said
 85 articles may be destroyed.

6. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative connection therewith, the said terminals being separated laterally and vertically from
 90 each other, means for causing movement of the said terminals, and means for supporting an article to be treated between the said terminals and causing movement thereof
 95 across the plane of movement of the said terminals, whereby the insects, eggs, larvæ or pupæ with which the said article may be infested may be destroyed.

7. In an apparatus of the character described, the combination of a source of electrical energy, terminals having operative connection therewith, the said terminals being separated both laterally and vertically,
 100 whereby the discharge between the said terminals extends at an acute angle to a plane at right angles to the said terminals, means for causing reciprocating movement of the said terminals, and means for conveying
 105 articles between the said terminals across their plane of movement, the said means being arranged at an acute angle to the said plane of movement.

8. In an apparatus of the character described, the combination of a source of electrical energy, a reciprocating member, terminals carried thereby and having operative connection with the said source of electrical energy, the said terminals being separated both laterally and vertically, means for
 115 causing reciprocation of the said frame, and means for supporting and conveying articles to be treated between the said terminals and across the plane of movement thereof.

9. In an apparatus of the character described, the combination of a source of electrical energy, terminals arranged in couples, the terminals in each of said couples being separated both laterally and vertically and the terminals of one couple being so ar-
 125
 130

ranged with respect to the terminals of the
 other couple that the electrical discharges be-
 tween the said couples extend at an angle
 with respect to each other, means for caus-
 5 ing reciprocation of the said terminals, and
 means for supporting and conveying articles
 to be treated between the said terminals and
 across their planes of movement, the said
 means being arranged at an acute angle with
 10 respect to the planes of movement of the
 said terminals, whereby the articles to be
 treated are presented to the said discharges
 at an acute angle to their planes of move-
 ment.
 15 10. In an apparatus of the character de-
 scribed, the combination of a source of elec-
 trical energy, terminals having operative
 connection therewith, means for causing
 reciprocatory movement of the said termi-
 20 nals, the speed of movement of the said ter-
 minals being less toward and at the ends of
 their paths of movement than at their center
 of movement, whereby the outer edges
 of the packages or articles which may be
 25 subjected to the action of the electrical dis-
 charges between the said terminals receive
 the action of said discharges for a greater
 period than the central portions thereof,
 and means for supporting and conveying
 30 articles to be treated between the said ter-
 minals and across their plane of movement.
 11. In an apparatus of the character de-
 scribed, the combination of a source of elec-

tric current, movable terminals having op-
 erative connection therewith, means for sup- 35
 porting and conveying an article between the
 said terminals and across their plane of
 movement.

12. In an apparatus of the character de-
 scribed, the combination of a source of 40
 alternating electrical current, a Tesla coil,
 terminals having operative connection with
 the opposite ends of the secondary of the
 said coil, means for causing reciprocation of
 the said terminals, and means for support- 45
 ing articles and conveying the same between
 the said terminals and at an acute angle to
 their plane of movement, whereby the in-
 sects, eggs, larvæ or pupæ with which the
 said articles may be infested may be de- 50
 stroyed.

13. In an apparatus of the character de-
 scribed, the combination of a source of elec-
 tric energy, means having operative con- 55
 nection with said source for generating in-
 duced electric currents, oscillating terminals
 having operative connection with said
 means, and means between said terminals
 for supporting articles to be treated.

In testimony that I claim the foregoing 60
 as my invention, I have hereunto signed my
 name this 11th day of March, A. D. 1911.

FRANKLIN S. SMITH.

In the presence of—

CARRIE E. KLEINFELDER,
 CYRUS N. ANDERSON.