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HIGH VOLTAGE ELECTROSTATIC MACHINE

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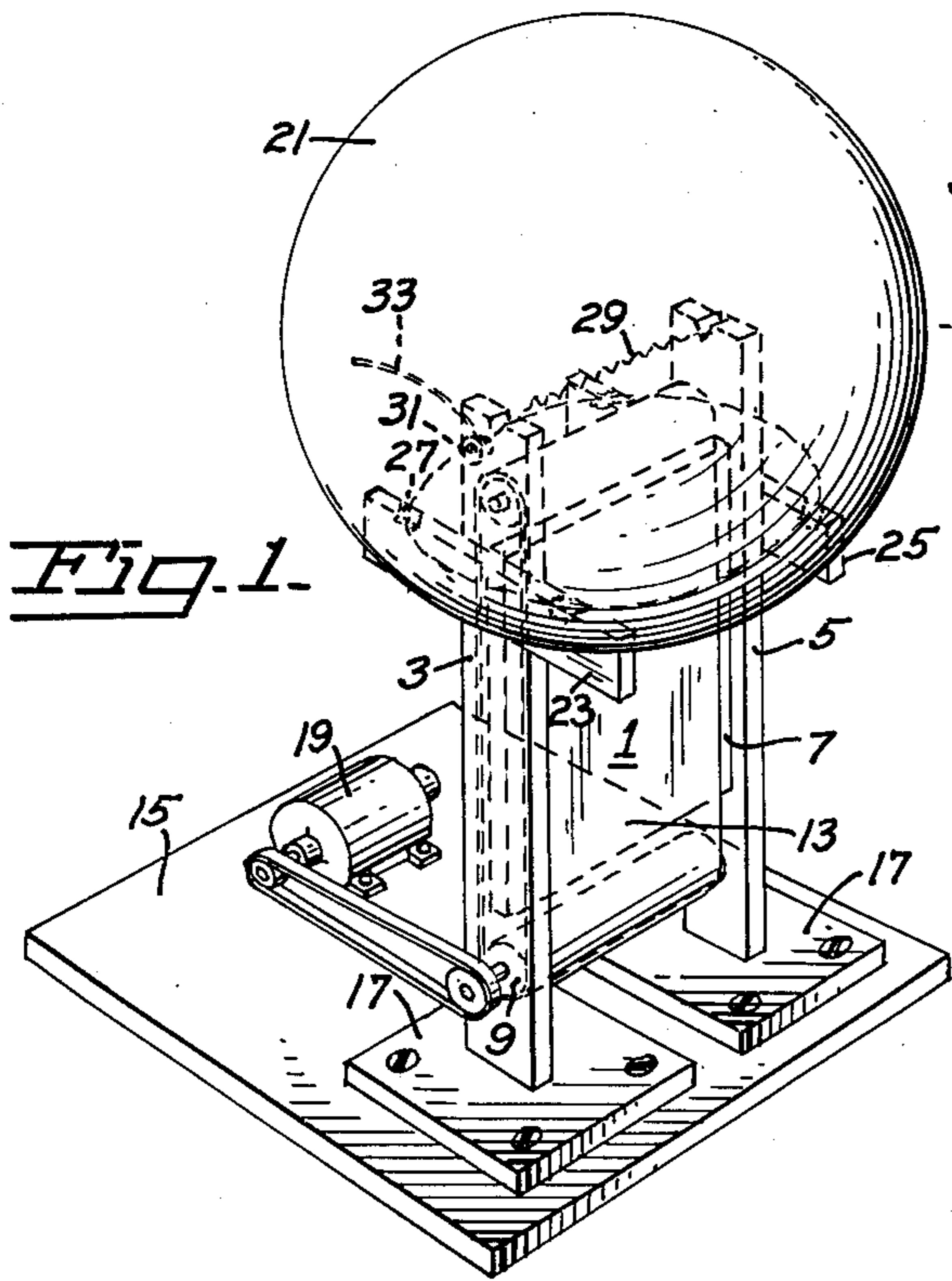


Fig. 1.

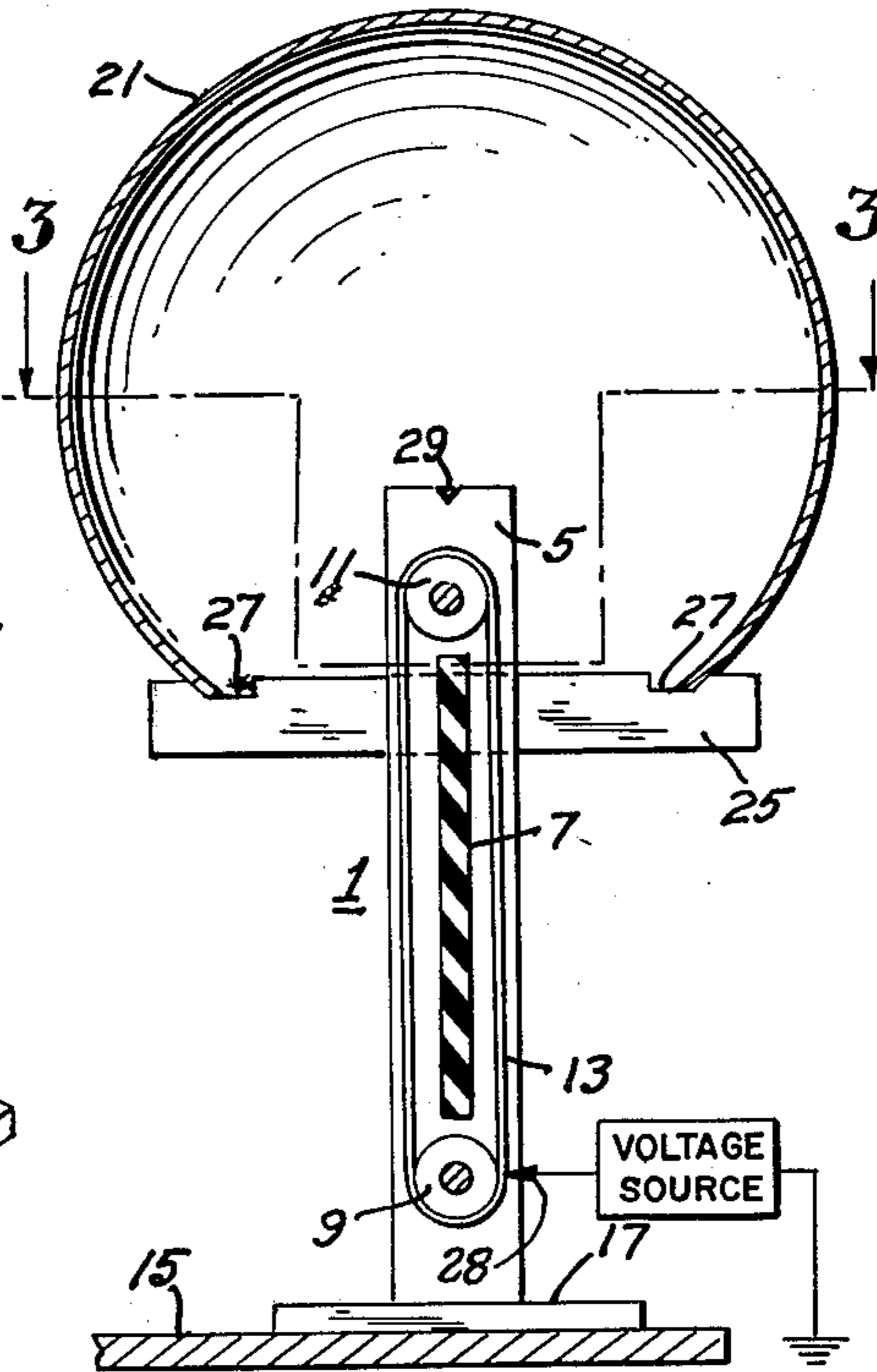


Fig. 2.

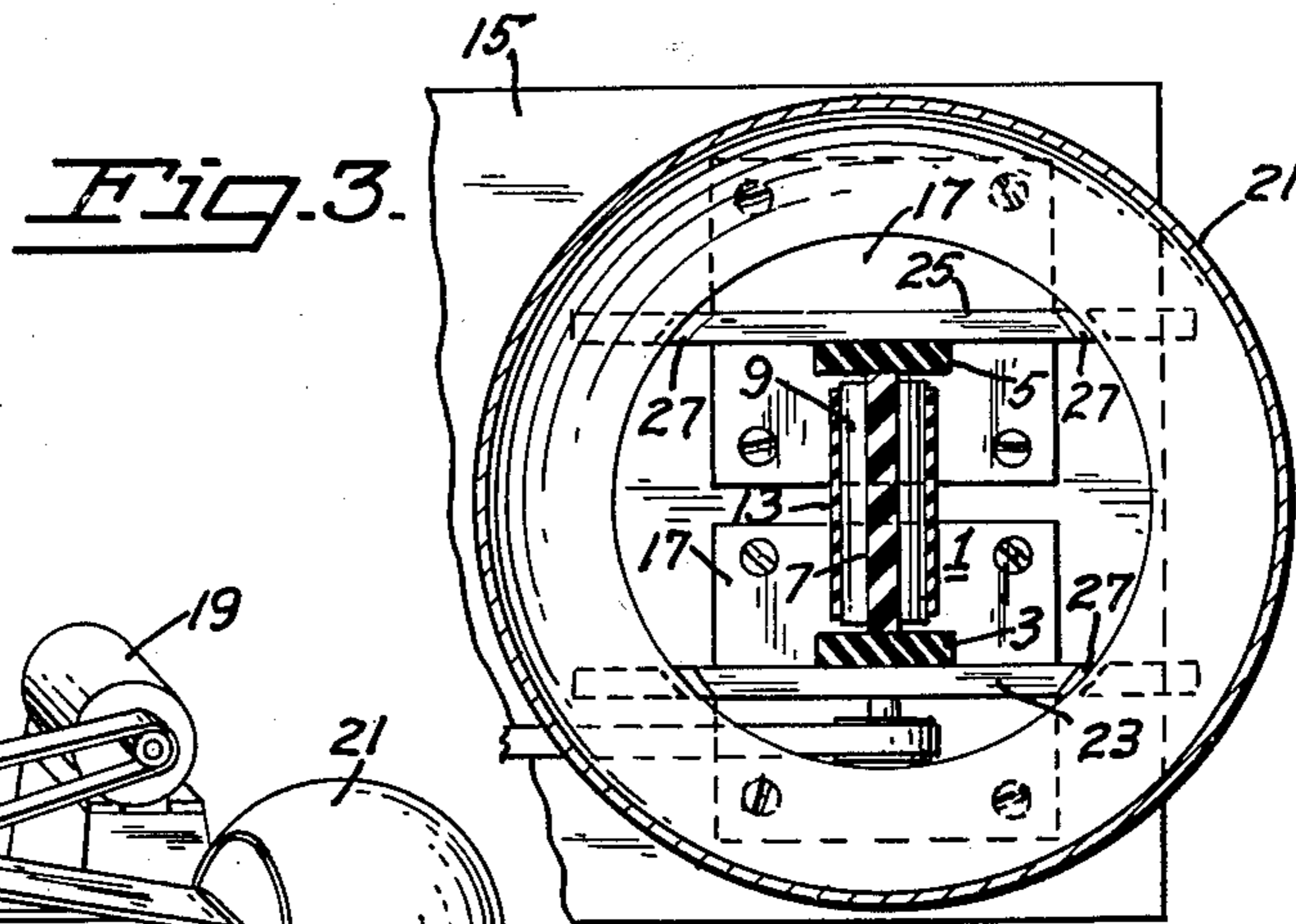


Fig. 3.

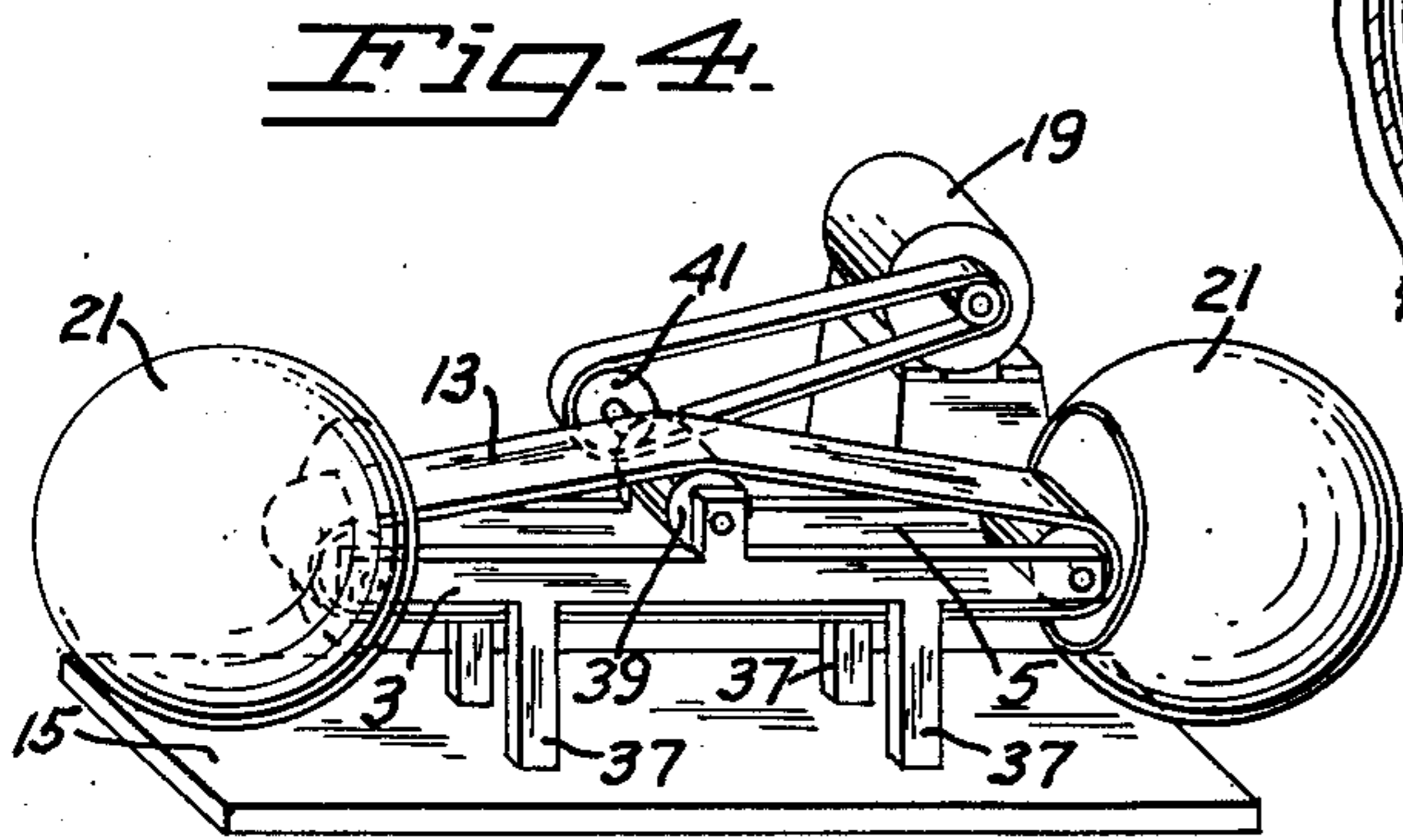


Fig. 4.

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HIGH VOLTAGE ELECTROSTATIC MACHINE
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My invention relates to electrostatic machines and more particularly to high voltage electrostatic machines of the Van de Graaff type.

High voltage electrostatic machines of the Van de Graaff type comprise a ball of conductive material which is charged from an endless belt mounted on end rollers, one of which is the drive roller and the other an idler.

In the typical construction of such machine, the conductive ball is supported on the upper end of a vertical cylinder of insulating material such as plastic, which in turn at its lower end rests upon a base housing to which it is affixed. The drive pulley is mounted within the base housing while the idler pulley is supported on insulation within the conductive ball. The belt which encircles these rollers thus extends from within the base housing, up through the plastic column and is entirely enclosed within the machine.

To assemble such machine, thus becomes a problem, and in the event it becomes necessary to change belts, the necessary dismantling of the entire machine, and consequently the necessity of rebuilding the same, becomes quite a chore. Further, considerable ozone may be developed within the machine and in the vicinity thereof during operation, which could have a deleterious effect on the belt, thereby shortening its otherwise useful life and necessitating more frequent replacements.

Among the objects of my invention are:

(1) To provide a novel and improved construction for a high voltage electrostatic machine of the Van de Graaff type;

(2) To provide a novel and improved Van de Graaff high voltage electrostatic machine of simple construction and one which may be fabricated economically;

(3) To provide a novel and improved Van de Graaff high voltage electrostatic machine in which the belt may be readily changed; and

(4) To provide a novel and improved Van de Graaff high voltage electrostatic machine having long belt life.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same taken in conjunction with the accompanying drawings, wherein

FIGURE 1 is a three-dimensional view of the machine of the present invention in its preferred form;

FIGURE 2 is a view in section taken in the mid-plane of the machine of FIGURE 1;

FIGURE 3 is a view in section taken in the planes 3-3 of FIGURE 2;

FIGURE 4 is a view depicting a possible variation of the machine of FIGURE 1.

Referring to the drawings for details of the invention, the preferred form as depicted in FIGURES 1 through 3 of the drawings, comprise an endless belt assembly 1 including a frame having a pair of side members 3, 5 of insulation such as plastic, which are maintained in substantially parallel spaced relationship by, preferably, a web or panel 7 of like material, extending between and interconnecting the two side members along an intermediate portion thereof, leaving the side members extending beyond the interconnecting means at each end.

A roller 9 is mounted adjacent one end of the frame between the side members, while a similar roller 11 is mounted adjacent the other end of the frame between the side members, and these constitute the end rollers which support an endless belt 13 which encircles them.

The rollers are preferably of insulating material such

as plastic or the like, while the belt is preferably of stretchable material such as rubber or the like, the stretchable characteristic of the belt being of vital importance in connection with one of the features of the present invention.

The endless belt assembly 1 is removably supported in a vertical position on a base 15, which may be of the simplest construction, the mounting means involving a separate attachment 17 for the lower end of each side member of the frame independently of the other side member. The specific manner of attaching the lower end of each side member, independently of the other, to the base is not of particular importance in so long as the side members are independently attached. I have symbolically illustrated such manner of attachment in the form of a plate screwed to the base and in which plate the lower end of the associated side member is anchored.

In its assembled upright position on the base, the lower roller 9 may then be belt connected to a drive motor 19, or may be fitted with a handle for manual rotation thereof, and thus becomes a drive roller, while the upper roller 11 then becomes the idler.

The upper end of the endless belt assembly 1 is adapted to be enclosed within a ball 21 of conductive material. For this purpose, the ball is provided with a hole of sufficient diameter to permit the ball to slip over and receive with clearance, the upper end of the endless belt assembly.

To support the ball in such position, I provide a cross arm 23 on one of the side members 3 of the frame in proximity to the upper end thereof and a similar cross arm 25 on the other side member 5 at a corresponding location thereon. These cross arms are preferably provided with notches 27 at the points of intersection by the ball, when the ball is symmetrically resting thereon. The notches thus serve to properly position the ball when the ball is assembled over the upper end of the endless belt assembly, and prevent the ball from shifting from its proper position.

The cross arms should, like the side members 3 and 5, be of material of high insulating quality, such as plastic or the like.

Electrical charges may be applied to the belt in any known manner, one of which has been schematically shown by Sears and Lemansky in FIG. 26-9 appearing on page 439 of their text entitled University Physics, copyrighted 1949 by Addison-Wesley Publishing Company, Inc. Referring to applicant's drawings, this involves a terminal 28 maintained at high negative potential to ground by a suitable source of potential.

To efficiently transmit charges from the belt 13 to the ball 21, I provide a conductor 29 across the upper ends of the side members 3 and 5, one end of the conductor being permanently affixed to one of the side members, while the other end is preferably anchored to a terminal 31 provided on the other side member and from which the conductor may be extended into contact with the inner surface of the ball or the equivalent, as a separate piece of wire 33 may be provided.

The foregoing construction of a Van de Graaff type high voltage electrostatic machine incorporates many features of advantage over the conventional type of construction of such machine. For one thing, the construction has been considerably simplified, and in the form depicted and described, the conductive ball 21 makes but a minimum of physical contact with the rest of the structure, such contact involving merely the points of intersection of the ball on its supporting cross arms 23 and 25, thus leaving the ball practically entirely air insulated from its supporting structure which means less leakage

and consequently higher voltages developed under comparable conditions.

The normally costly cylindrical supporting column of plastic has been entirely eliminated, and in lieu thereof, a structure is utilized which involves pieces that may be cut from flat stock material and assembled without difficulty. The resulting structure, furthermore, leaves the belt 13 unconfined and, therefore, not exposed to the deleterious effects of ozone which may be generated in and around such machine during operation thereof.

Of further and of considerable importance is the fact that the construction depicted and described readily and conveniently permits of replacement of belts. Toward this end, the ball 21 is simply lifted off from its cross arm supports 23, 25, the conductor 29 disconnected from its terminal 31, which permits the belt 13 then to be stretched over the upper end of the side member 5 and dropped to the base 15. Then by unscrewing one of the attaching plates and perhaps loosening the other, the belt may be removed by slipping it between the two attaching plates. By a reverse procedure, a new belt may be installed.

In FIGURE 4 I have depicted a possible variation of the invention in the form of a horizontally disposed machine permitting of the utilization of a conductive ball 21 at each end of the endless belt assembly 1. In this embodiment, the side frame members 3 and 5 may be supported individually on legs 37 from the base, the belt 13 may be driven from an intermediate third roller 39 supported slightly above the side frame members on posts extending upwardly from such side members. This roller may be hand driven through any suitable crank attached to the shaft of the roller, or a pulley 41 mounted on the roller shaft may be connected by a belt to a drive motor 19.

From the foregoing description of my invention, it will be apparent that the same fulfills all the objects attributed thereto, and while I have illustrated and described my invention in considerable detail, the same is subject to further modification and alteration without departing from the underlying principles involved, and I accordingly do not desire to be limited in my protection to the specific details so illustrated and described, except as may be necessitated by the appended claims.

I claim:

1. A Van de Graaff type high voltage electrostatic machine comprising an endless belt assembly including a frame having a pair of side members, a roller mounted adjacent each end of said frame, and a stretchable endless belt encircling said rollers; a base; means removably supporting said endless belt assembly on said base, said removably supporting means including a separate attachment for each side member independently of the other side member; means for driving said belt; a hollow ball of conductive material having a hole therein of sufficient size to permit said ball to be assembled over and receive with clearance, an end of said endless belt assembly; and means supporting said ball in such assembled position, said ball supporting means including a cross arm on one side member of said frame in proximity to the upper end thereof, a similar cross arm on the other side member, said cross arms being notched at the points of intersection by said ball when symmetrically resting thereon.

2. A Van de Graaff type high voltage electrostatic machine comprising an endless belt assembly including a frame having a pair of side members and means for holding said side members in substantially parallel spaced relationship, a roller mounted adjacent each end of said frame, and a stretchable endless belt encircling said rollers; a base; means removably supporting said endless belt assembly in a vertical position on said base, said removably supporting means including a separate attachment for the lower end of each side member of said frame in-

dependently of the other side member; means for rotating the resulting lower of said end roller; a hollow ball of conductive material having a hole therein of sufficient size to permit said ball to be assembled over and receive with clearance, the upper end of said endless belt assembly; and means supporting said ball in such assembled position, said ball supporting means including a cross arm on one side member of said frame in proximity to the upper end thereof, a similar cross arm on the other side members, said cross arms being notched at the points of intersection by said ball when symmetrically resting thereon.

3. A Van de Graaff type high voltage electrostatic machine comprising an endless belt assembly including a frame having a pair of side members and means for holding said side members in substantially parallel spaced relationship, a roller mounted adjacent each end of said frame between said side members and journaled therein against removal, and a stretchable endless belt of rubber or the like encircling said rollers; a base; means removably supporting said endless belt assembly in a vertical position on said base, said means including a separate attachment for the lower end of each side member of said frame independently of the other side member; means for rotating the resulting lower of said end rollers; a hollow ball of conductive material having a hole therein of sufficient size to permit said ball to be assembled over and receive with clearance, the upper end of said endless belt assembly; means supporting said ball in such assembled position, said ball supporting means including a cross arm on one side member of said frame in proximity to the upper end thereof, a similar cross arm on the other side member, said cross arms being notched at the points of intersection by said ball when symmetrically resting thereon; and means for transferring electrical charges from said belt to said ball.

4. A Van de Graaff type high voltage electrostatic machine comprising an endless belt assembly including a frame having a pair of side members and means for holding said side members in substantially parallel spaced relationship, said means involving a web extending between and joined to said side members along an intermediate portion thereof, a roller mounted adjacent each end of said frame between said side members and journaled therein against removal, and a stretchable endless belt of rubber or the like encircling said rollers; a base; means removably supporting said endless belt assembly in a vertical position on said base, said removably supporting means including a separate attachment for the lower end of each side member of said frame independently of the other side member; means for rotating the resulting lower of said end rollers; a hollow ball of conductive material having a hole therein of sufficient size to permit said ball to be assembled over and receive with clearance, the upper end of said endless belt assembly; means supporting said ball in such assembled position, said ball supporting means including a cross arm on one side member of said frame in proximity to the upper end thereof, a similar cross arm on the other side member, said cross arms being notched at the points of intersection by said ball when symmetrically resting thereon; and means for transferring electrical charges from said belt to said ball, said charge transfer means including a conductor bridging the upper ends of said side members within said ball, and extending into contact with the inner surface of said ball.

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