I. S. HIRSCH.

SPARK GAP.

APPLICATION FILED JULY 18, 1907.

898,888.

Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.

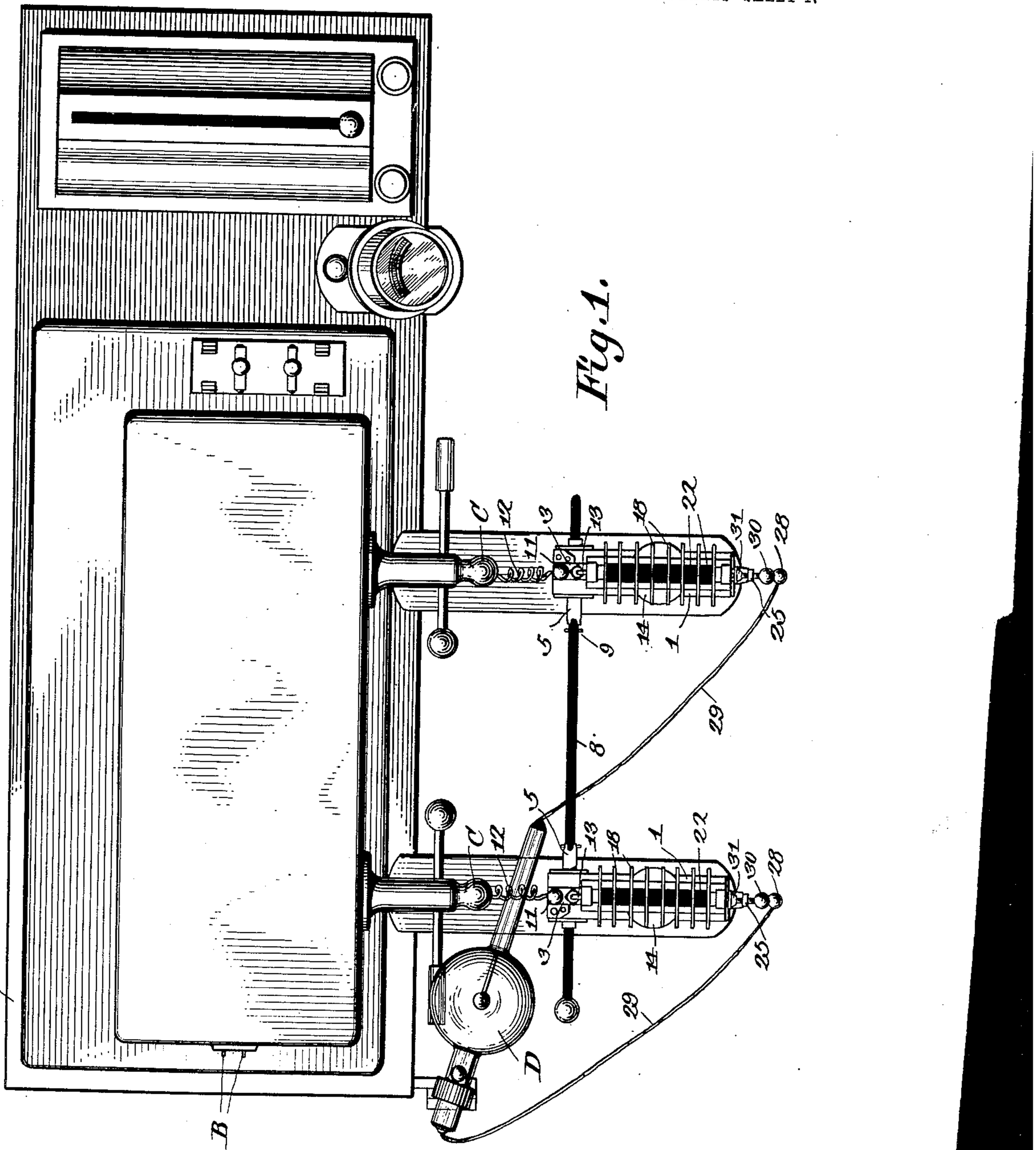

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

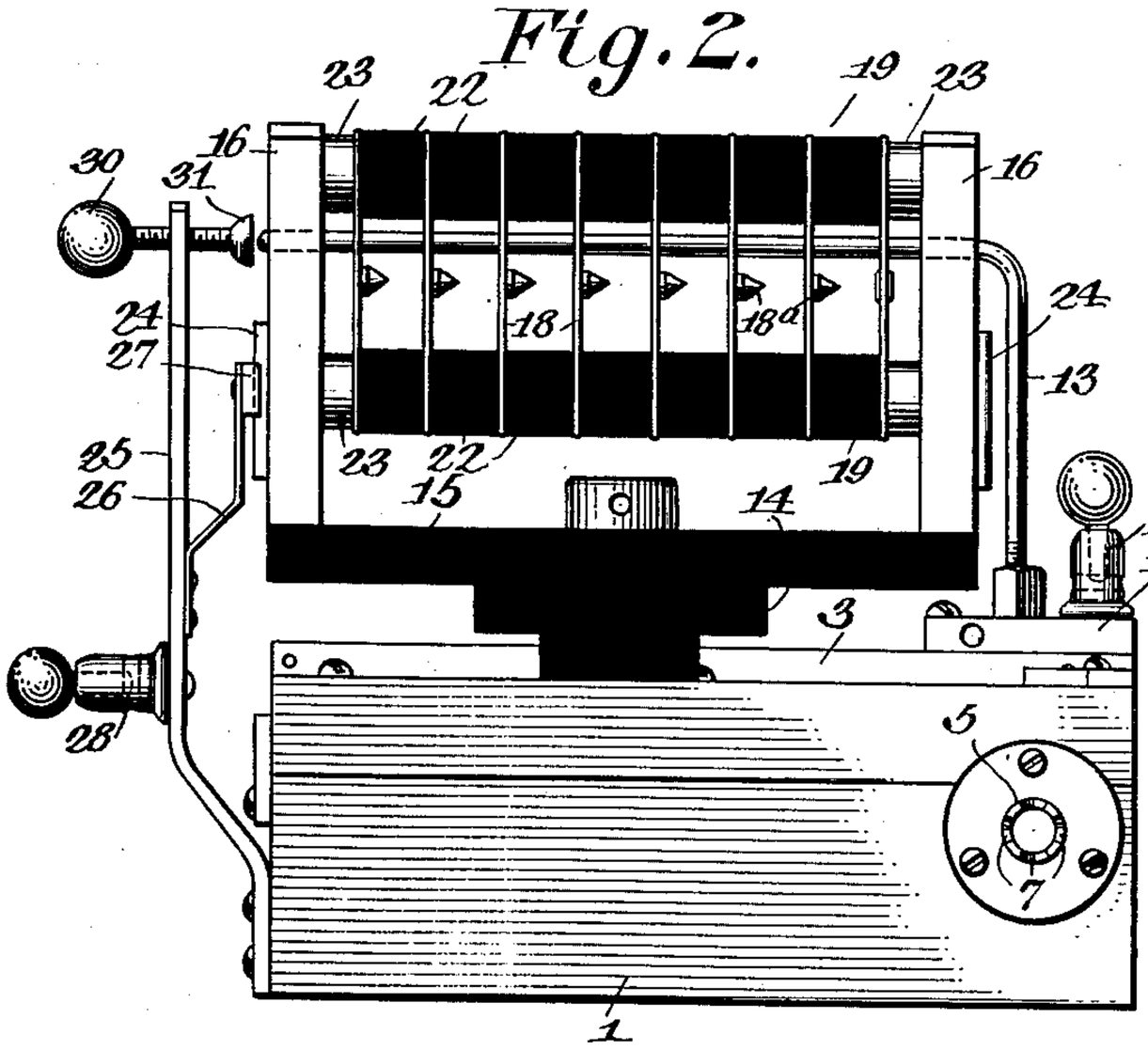


Fig. 5.

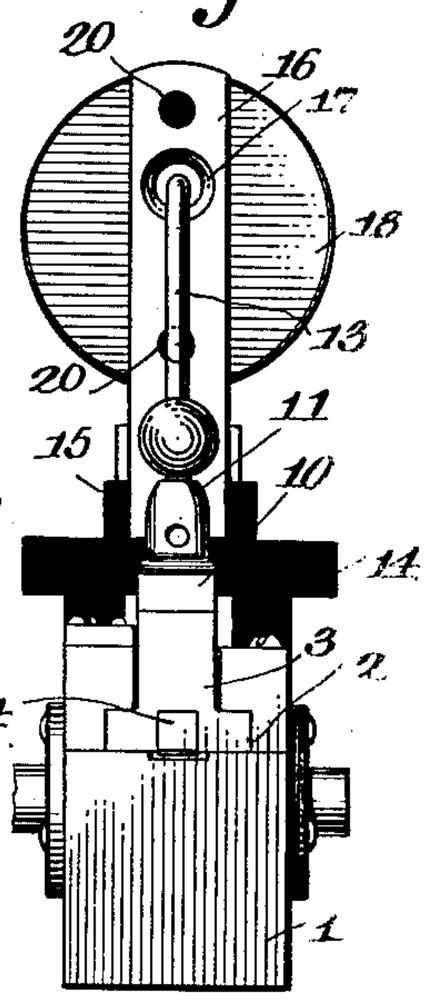


Fig. 4.

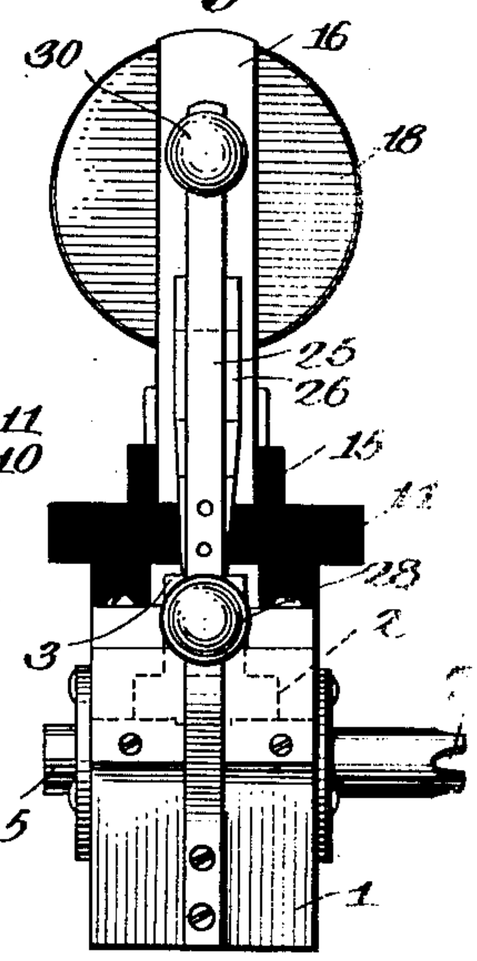
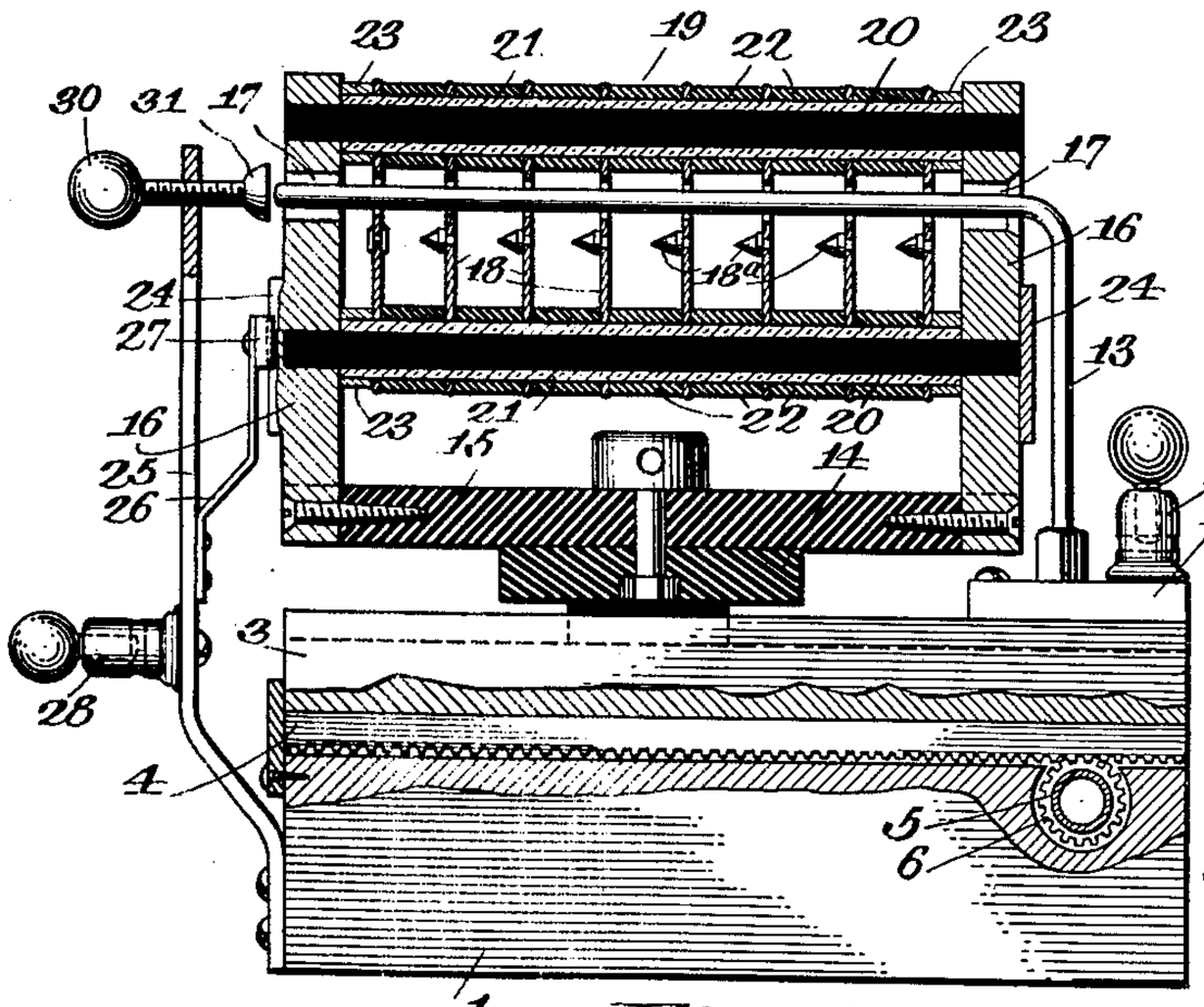


Fig. 3.



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UNITED STATES PATENT OFFICE.

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SPARK-GAP.

No. 898,888. Specification of Letters Patent. Patented Sept. 15, 1908.

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To all whom it may concern:

Be it known that I, ISAAC S. HIRSCH, a citizen of the United States, residing in the city of New York, county and State of New York, have invented certain new and useful Improvements in Spark-Gaps, of which the following is a specification.

As is known to those familiar with the operation of X-ray machines it is necessary to provide a spark-gap between each connection of the secondary winding of the induction coil and the vacuum tube in order to secure the necessary resistance to the current to obtain the desired results. Heretofore it has been necessary to turn off the current in the primary coil when it has been desired to change the resistance in the secondary circuit. By the use of my improved apparatus the resistance may be regulated as desired while the apparatus is in full operation thus securing perfect results in the minimum time.

Another feature of my invention is the mounting of the disks with the central projecting points in a revoluble frame so that the resistance can be regulated to suit the work in hand by compelling the current to pass from disk to point or from point to disk as desired, the latter offering the least resistance.

My apparatus further consists in slidably mounting one member of the gap in a frame to which is secured the other member and providing operating mechanism so constructed that the gap connected with either pole of the secondary winding of the induction coil may be operated so as to regulate the resistance to secure the best results, its principal advantage being in the fact that as the resistance can be regulated while the discharge is passing into the vacuum tube the resistance may be increased as the vacuum falls.

The construction and operation of my improved spark gap will be described in detail hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is a view of a simple form of X-ray apparatus with my improved spark-gap arranged in connection therewith, Fig. 2, a side view in elevation of one of the gaps, Fig. 3, a longitudinal sectional view, and Figs. 4 and 5, views of the two ends of one of the gaps.

In the drawings similar reference characters indicate corresponding parts throughout the several views.

A indicates the cabinet containing the induction coil used in X-ray apparatus, B the wires leading to the primary coil thereof, and C the binding posts connected with the secondary coil.

D indicates the X-ray tube.

In all apparatuses of this nature it is necessary to provide a spark-gap between the binding posts C and the tube D in order to regulate the resistance to the current from the secondary coil and my invention consists in the construction of the spark gaps which are mounted on bases 1 secured adjacent to cabinet A. Each of the bases 1 is provided with a grooved slideway 2 in which is slidably mounted a bar 3 having a rack bar 4 secured to its under side.

5 indicates a sleeve journaled in each base 1 having an annular gear face 6 thereon that meshes with the rack bar 4, said sleeves 5 being provided with notches 7 in one end thereof.

8 indicates a rod slidably and revolubly mounted in sleeves 5 and having pins 9 projecting laterally therefrom to engage notches 7 to rotate the sleeves. The bases 1 and bars 2 are constructed of a poor conductor of electricity such as wood.

10 indicates a metal plate secured to each bar 3 having a binding post 11 mounted thereon to receive one of the wires 12 connected with one of the binding posts C, and an L-shaped conductor rod 13 secured thereto with its free end extending lengthwise of the bar 3.

Mounted on the top of each base 1 is a circular plate 14 of a non-conducting material such as vulcanized fiber, or other non-conductor.

15 indicates a bar made of vulcanized fiber, or other non-conducting material revolubly mounted on plate 14 and having end posts 16 made of metal secured to said frame. The end posts 16 are provided with holes 17 to receive the free end of conductor rod 13.

18 indicates disks having points 18ª projecting centrally from one side thereof and mounted on supports 19 of non-conducting material secured to posts 16, said supports may consist of rods 20 of vulcanized fiber or other non-conductor surrounded by glass tubes 21, as shown, or any other non-conducting material may be substituted therefor.

22 indicates rings of a non-conducting material separating the disks 18 and 23 metal

rings interposed between the end disks and posts 16.

24 indicates a lug or projection on the outer sides of posts 16.

25 indicates a metal rod secured to the end of each base 1 having a spring plate 26 secured thereto with a grooved lug 27 on its free end to engage the projection 24, and a contact post 28 to which is secured a wire 29 connected with one or the other poles of the X-ray tube D.

30 indicates a screw rod mounted on the rod 25 and having a head 31 to engage the free end of L-shaped conductor rod 13 when the bar 3 is in its innermost position.

As shown in the drawings the ends of conductor rods 13 engage the heads 31 of the screw rods 30 so that there is a free circuit between the induction coil and the X-ray tube. Should it be necessary, however, to put a resistance in the circuit the bars 3 in the bases 1 are moved out by turning the sleeves 6 in said bases by means of rod 8 and pins 9 that engage notches 7 in the ends of said sleeves, so that the ends of conductor rods 13 are at a distance from the heads 31 of screw rods 30 and the current is compelled to pass from said rods 13 to the disks 18 and jump from disk to disk to the end posts 16 so as to complete the circuit. By this construction it will be understood that the resistance in the circuit may be increased or diminished as desired for the most efficient operation of the X-ray tube and that such regulation may be effected while the tube is lighted. It will also be understood that by manipulating the frames 15 so that the points 18^a on the disks 18 point in the direction of the negative, *i. e.* so that the current passes from one point to the adjacent disk, a free circuit with very low resistance is allowed, while when the points are in the opposite direction or towards the negative, so that the current passes from the flat side of the disks to the points the current is retarded or held back.

Having thus described my invention what I claim is—

1. In a spark gap, one member thereof consisting of a revoluble frame, and non-rotatable, conducting disks secured to said frame, substantially as shown and described.

2. In a spark gap, one member thereof consisting of a revoluble frame including two uprights, and disks secured between said uprights, substantially as shown and described.

3. In a spark gap, a stationary base, a horizontal bar of non-conducting material revolubly secured thereto, upright posts of metal secured to the ends of said horizontal bar, rods of non-conducting material connecting said posts, and a series of disks spaced apart on said rods, the end disks being in circuit with the posts, substantially as shown and described.

4. A spark-gap operating mechanism for X-ray machines, comprising stationary bases, bars slidably mounted on said bases, the two members of each gap secured to the bases and bars respectively, and means to actuate said bars, substantially as shown and described.

5. A spark-gap operating mechanism for X-ray machines, comprising stationary bases, one member of the spark-gap adjustably mounted on each base, the other member of the gap comprising a series of disks having central points projecting from one side thereof, said disks secured to a frame revolubly mounted on the base, substantially as shown and described.

6. A spark-gap operating mechanism for X-ray machines comprising stationary bases, a bar slidably mounted on each base, one of the two members of each gap secured to the base and the other to the bar slidably mounted thereon, a rack bar secured to the bottom of each slidable bar, a gear pinion journaled in each base and meshing with each rack-bar, and means to rotate said pinions, substantially as shown and described.

7. A spark-gap operating mechanism for X-ray machines comprising stationary bases, a bar slidably mounted on each base, one of the two members of each gap secured to the base and the other to the bar slidably mounted thereon, a rack bar secured to the bottom of each slidable bar, a sleeve journaled in each base and having a notched end, an annular gear face on each sleeve to mesh with the rack-bar aforesaid, a rod slidably and revolubly mounted in said sleeves, and pins projecting from said rod to engage the notches in the ends of the sleeves, substantially as shown and described.

8. A spark-gap operating mechanism for X-ray machines comprising stationary bases, a bar slidably mounted on each base, a rack-bar secured to the bottom of each bar, a gear pinion journaled in each base and meshing with the rack-bars aforesaid, means to rotate said pinions, one member of the spark gap secured to the slidable bar, the other member of the gap comprising a series of disks having central points projecting from one side thereof, said disks secured to a frame revolubly mounted on the base, substantially as shown and described.

9. A spark-gap operating mechanism for X-ray machines comprising stationary bases, a bar slidably mounted on each base, a rack-bar secured to the bottom of each bar, a sleeve journaled in each base and having notches in one of their ends, an annular gear face on each sleeve to mesh with the rack-bar aforesaid, a rod slidably and revolubly mounted in said sleeves, pins projecting from said rod to engage the notches on the ends of the sleeves, one member of the gap secured to the slidable bar, the other member

of the gap comprising a series of disks having central points projecting from one side thereof, said disks secured to a frame revolubly mounted on the base, substantially as shown and described.

10. A spark-gap operating mechanism for X-ray machines comprising stationary bases, a bar slidably mounted on each base, a rack bar on the bottom of each slidable bar, a sleeve journaled in each base having notches in one of its ends and a gear face intermediate of its ends to engage said rack bar, a rod slidably and revolubly mounted in said sleeves and having laterally projecting pins to engage the notches in the ends of the sleeves, a metal plate secured to each bar, a binding post secured to each plate, an L-shaped rod secured to the plate, a frame revolubly mounted on the base, a series of disks mounted on said frame, the frame and disks being perforated to receive said L-shaped rod, and a conductor secured to the base and in contact with the frame to conduct the current to or from the gap, substantially as shown and described.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

ISAAC S. HIRSCH.

Witnesses:
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M. S. CLAWSON.