

1,409,439.

Patented Mar. 14, 1922

2 SHEETS—SHEET 1.

Figure 1.

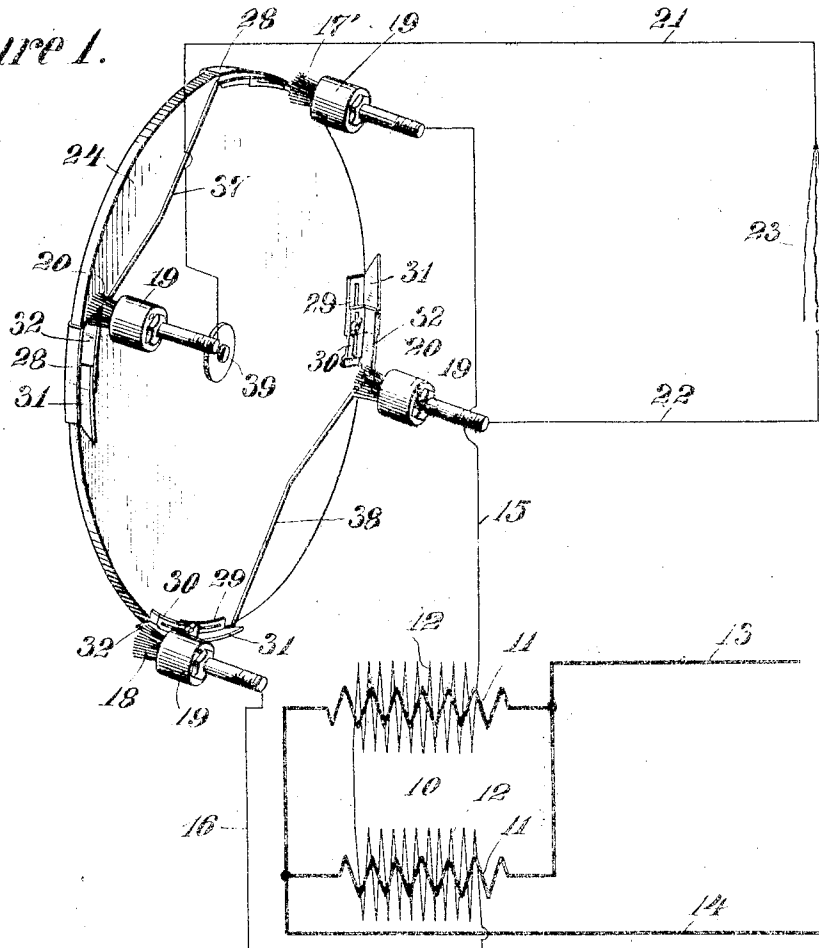


Figure 2.

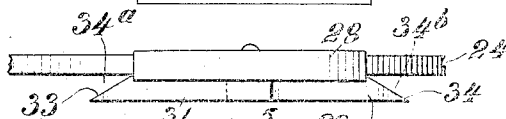


Figure 3.

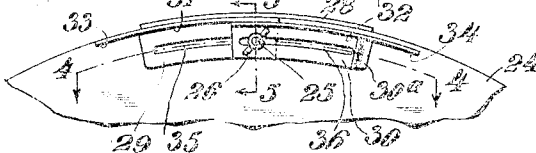


Figure 4.

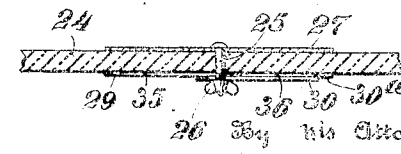
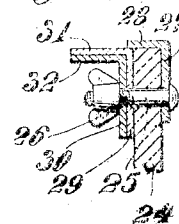


Figure 5.



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Walton Harrison.

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X-RAY MACHINE.
APPLICATION FILED AUG. 2, 1917.

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2 SHEETS—SHEET 2.

Figure 6.

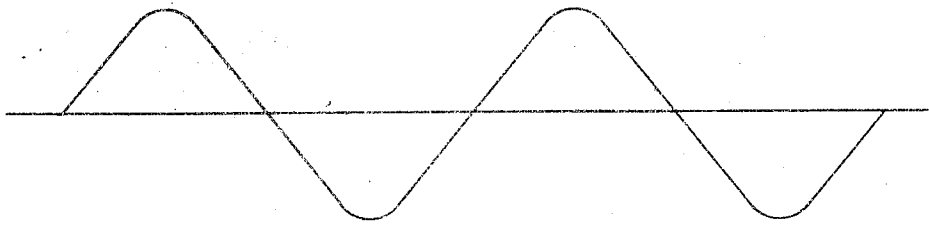


Figure 7.

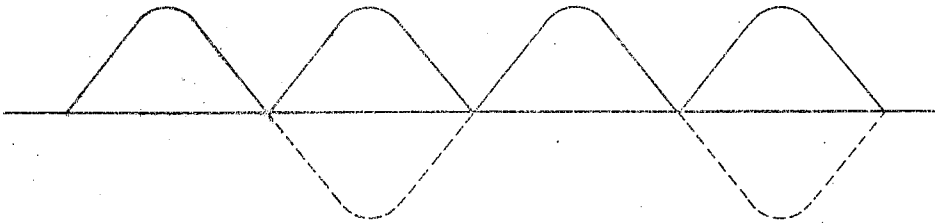


Figure 8.

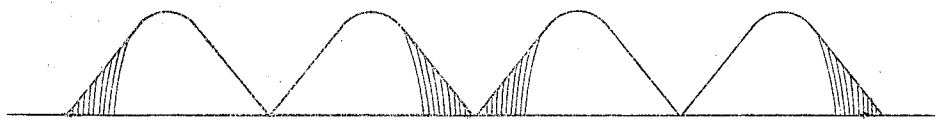


Figure 9.



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UNITED STATES PATENT OFFICE.

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A CORPORATION OF NEW YORK.

X-RAY MACHINE.

1,409,439.

Specification of Letters Patent. Patented Mar. 14, 1922.

Application filed August 2, 1917. Serial No. 134,017.

To all whom it may concern:

Be it known that I, CHARLES FAYER, a citizen of the United States, residing in the city of New York, borough of Bronx, in the county of Bronx and State of New York, have invented certain new and useful improvements in X-Ray Machines, of which the following is a full, clear, and exact description.

My invention relates to X-ray machines of the general type shown in Patent No. 992,302, dated May 16, 1911, to R. H. Wappler, and commonly designated in this art as rectifying disk X-ray machines.

By my invention I seek to attain a number of distinct objects, among them being the following:—

I. To improve the form of the contact sectors carried by the rectifying disk, in order to diminish the sparking from these contact sectors to the contact brushes associated therewith, and to reduce to a minimum both the impairment of insulation due to said sparking and the destructive action wrought thereby.

II. To improve the mountings for the contact sectors in order to prevent the formation of partial vacuums in the wake of the contact sectors as they are carried around at high speed by the disk.

III. To so proportion and arrange the contact sectors and parts associated therewith as to enable the rectifying disk to selectively prevent the passage, through the X-ray tube, of any currents except the fragmentary high-tension currents represented by the peaks of the sine waves; thus protecting the X-ray tube and prolonging the life thereof.

IV. To render the individual contact sectors each adjustable in length, in order that variations may be made in the duration and in the amperage of the currents acting upon the X-ray tube.

V. To cause the breaking of the secondary circuit to be positive and uniform, thus improving the action of the X-ray tube.

VI. To improve the general efficiency of the rectifying disk by so forming certain parts carried thereby as to eliminate a number of practical troubles.

For the sake of conciseness I will describe only a single device embodying my invention,—it being understood, however, that the structure here disclosed is merely typical.

Reference is made to the accompanying drawing forming a part of this specification and in which like letters indicate like parts in all of the views.

Figure 1 is a view partly in perspective and partly diagrammatic, showing my improved rectifying disk and certain parts associated immediately therewith.

Figure 2 is a fragmentary plan of the disk and one of the contact sectors carried thereby.

Figure 3 is a fragmentary front elevation of the mechanism shown in Figure 2.

Figure 4 is a section on the line 4—4 of Figure 3, looking in the direction indicated by the arrows.

Figure 5 is a section on the line 5—5 of Figure 3, looking in the direction indicated by the arrows.

Figure 6 is a diagram indicating by graphic symbols the form of the current generated in the secondary winding of the transformer.

Figure 7 is a diagram indicating in full lines the form of the current if simply rectified without any part of the current being suppressed, the dotted lines in this view indicating the portion of the current which is reversed by action of the rectifying mechanism.

Figure 8 is a diagram indicating the form of the current if rectified by a rectifying disk of the kind heretofore known and above mentioned—the shaded areas representing the portions of the current suppressed by the use of the lengthy contact sectors heretofore employed.

Figure 9 is a diagram indicating the form of the current as rectified by my improved rectifying disk with its improved sectors and connections, the shaded areas representing the suppressed portions of the current and the intervening unshaded portions representing the effective working components of the current as used to energize the X-ray tube.

A transformer as a whole is shown at 10, and comprises primary windings 11 and secondary windings 12. The primary windings 11 are connected to wires 13 and 14, through which alternating current is supplied for energizing them.

Connected to the secondary windings 12 are wires 15, 16, which lead to brushes 17, 18, the latter being provided with massive

metallic holders or cups 19. These brushes are of the kind shown in my Patent No. 1,048,819, dated Dec. 31, 1912. Two other such brushes 20 are connected by wires 21, 22 to the terminals of a spark gap 23, in which the X-ray tube is placed.

The rectifying disk is shown at 24, and is made of insulating material, preferably micanite. It may have any suitable speed, say 1,800 revolutions per minute. The disk is made in a single piece of homogeneous form and is free from mutilations except such holes as may be necessary to mount the disk in position and to secure upon it the simple mechanism which it carries.

Four bolts 25 extend through the disk and are spaced equidistant, each bolt being provided with a threaded portion and fitted with a wing nut 26.

The four bolts extend through four metallic plates 27, each of arcuate form and provided with an overhanging portion 28 integral with it and serving as a retaining flange. This retaining flange extends across the edge of the disk and projects therefrom to a slight extent, as indicated in Figure 5.

The disk 24 also carries, adjacent each bolt 25, a pair of metallic plates 29, 30, so bent as to form a pair of laterally-extending flanges 31, 32, integral therewith and provided, respectively, with pointed ends 33, 34. Each of these ends has the form of an acute angle, say of 36 degrees, and between each pointed end 33, 34 and the adjacent portion of the disk there is a clear space 34^a, 34^b, as shown in Figure 2. The plates 29, 30 are of arcuate form and are provided with arcuate slots 35, 36, through which the bolt 25 extends.

The plate 30 overlaps the plate 29 and is provided with an end portion 30^a, which is bent slightly so as to engage directly the adjacent surface of the disk, and thus to avoid looseness between the plate 30 and the disk.

The laterally extending flanges 31, 32, which are of arcuate form, are thus arranged in pairs, and each pair serves the purpose of a contact sector. Each contact sector as a whole may be lengthened or shortened, as desired, by loosening the wing nut 26, sliding the plates 29, 30 relatively to each other, and then tightening the wing nut.

There are four of the contact sectors, two of them being connected by a conductor 37, and the other two being connected by a conductor 38.

The disk 24 is mounted upon a shaft 39, which is the armature shaft of a synchronous motor or rotary converter. The rotation of the disk is synchronous with changes in the alternating current cycles energizing the wires 13, 14. The parts are so proportioned and arranged that each time the revolving contact sectors engage the brushes

the potential in the secondary circuit is at a maximum. As the duration of contact is very short as compared with the duration of the period in which there is no engagement between the contact sectors and the brushes, the currents flowing through the wires 21, 22 and the spark gap 23 or the X-ray tube represent merely the peaks of the sine waves of the currents rectified by action of the disk.

To make this point clear, reference is made to the diagrams shown in Figures 6 to 9 inclusive.

Figure 6 requires but little explanation, as it shows merely the conventional symbol of a sine wave curve. It here represents the form the secondary current would have in the absence of any rectifying device.

In Figure 7 I show in full lines the form of the secondary current if simply rectified without any part of the current being suppressed or interfered with in any manner. In this view the dotted lines show the phases or portions of current which are reversed by the action of the rectifying disk. If the rectifying disk were in action and no means were employed to cut out or suppress any part of the current, the graphic representation of the current would be the full lines in Figure 8.

Figure 8 shows the form of the secondary current as rectified and otherwise acted upon by an X-ray machine of the rectifying disk type heretofore commonly used. In such machines the contact sectors used are each of considerable length—usually extending a little more than a quarter of the total periphery of the disk. On this account the brushes are in engagement with the contact sectors during a considerable part of the revolution of the disk, and as a result most of the current generated in the secondary circuit finds its way through the X-ray tube. The part of the current which is eliminated or suppressed is indicated by the shaded areas in Figure 8, and even the elimination of this much of the current, selected as it is from portions of high amperage and low voltage, has a tendency to protect the X-ray tube to a great extent.

In Figure 9 is indicated by graphic symbols how, by shortening the contact sectors and increasing the number thereof, I suppress a still larger proportion of the current, while retaining those portions in which the potential is highest. In fact I retain the peaks and suppress all other parts of the current.

Contrasting Figure 9 with Figure 8, it will be seen that the shaded areas in Figure 9 have not the same form as those in Figure 8, and that there are twice as many of such areas as appear in Figure 8. It will be noted that in Figure 8 the shaded portions are in part bounded by edges which are inclined,

and also slightly curved. This is due to the dragging action of the spark, in the constructions heretofore employed. Thus, by using shorter sectors and doubling the number thereof I reduce by a little more than one-half the value of the current passing through the X-ray tube, and yet retain the maximum potential. I simply discard the ascending and descending parts of the sine curve.

The currents thus produced by my machine are excellent for X-ray work, therapy and fluoroscopy.

By making the contact sectors sufficiently short the amperage may be reduced to any desired minimum while maintaining the original or maximum potential.

I also adjust the lengths of the individual contact sectors, so that the results obtained can be greatly improved.

It will be noted that as shown in Figure 2, at 34^a and 34^b, the sharp points 33, 34 of the contact sectors are spaced laterally from the plane of the disk. On this account, any sparking which takes place from the contact sectors to the brushes must follow paths which are strictly through the air, somewhat after the manner of miniature lightning flashes. That is to say, the sparks must leap instead of following the more or less conducting surface of the disk.

In this connection it may be pointed out that the surface of practically any solid member of insulating material, even if free

of moisture, dust and dirt, is a better conductor than free air. Hence, I seek to reduce the amount of sparking by causing the sparking to take place through free air instead of along the surface of the disk.

In thus spacing the sharp points of the contact sectors away from the plane of the disk, and also by using a disk the edge of which is free from mutilations, I also improve the insulating in another way, namely, by preventing the undue formation of partial vacuums immediately in the rear of the sector as the latter is carried bodily around.

I find that in thus eliminating the air disturbances I also effect a saving in the power required to drive the machine.

I do not limit myself to the precise mechanism shown; as variations may be made therein without departing from the spirit of my invention.

I claim:—

In a rectifying disk the combination of a stationary brush, a revoluble disk disposed adjacent said brush, and a contact sector carried by said disk and provided with a sharp point, said sharp point being spaced laterally from the plane of said disk and separated from the body of said disk by an uninterrupted air space.

CHARLES FAYER.

Witnesses:

A. MUTSCHELLER,
FRANK SKROUSE.