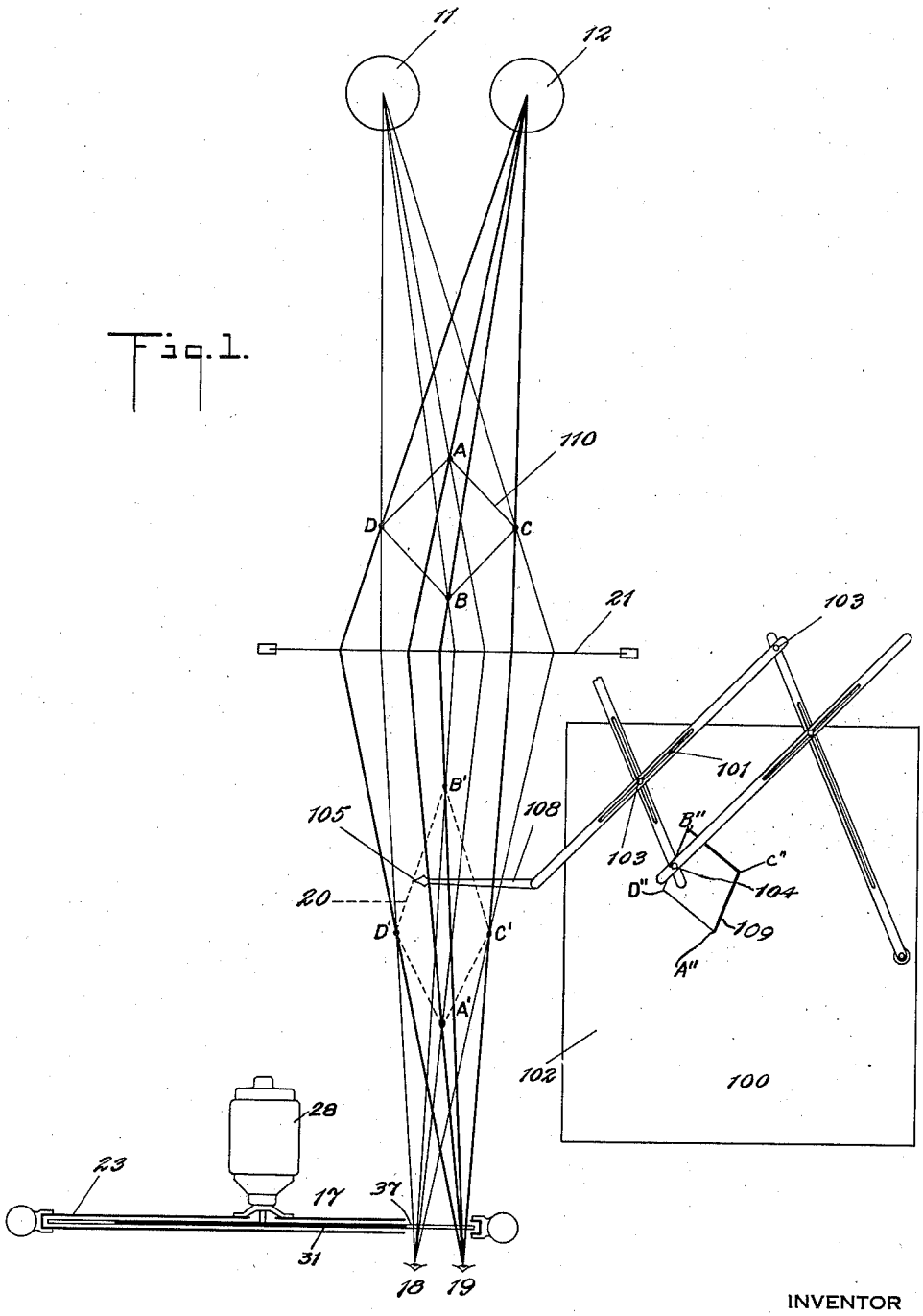
July 16, 1940. P. GONZALEZ-RINCONES 2,208,215

METHOD AND APPARATUS FOR STEREOSCOPIC FLUOROSCOPY

Filed Sept. 13, 1937 4 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

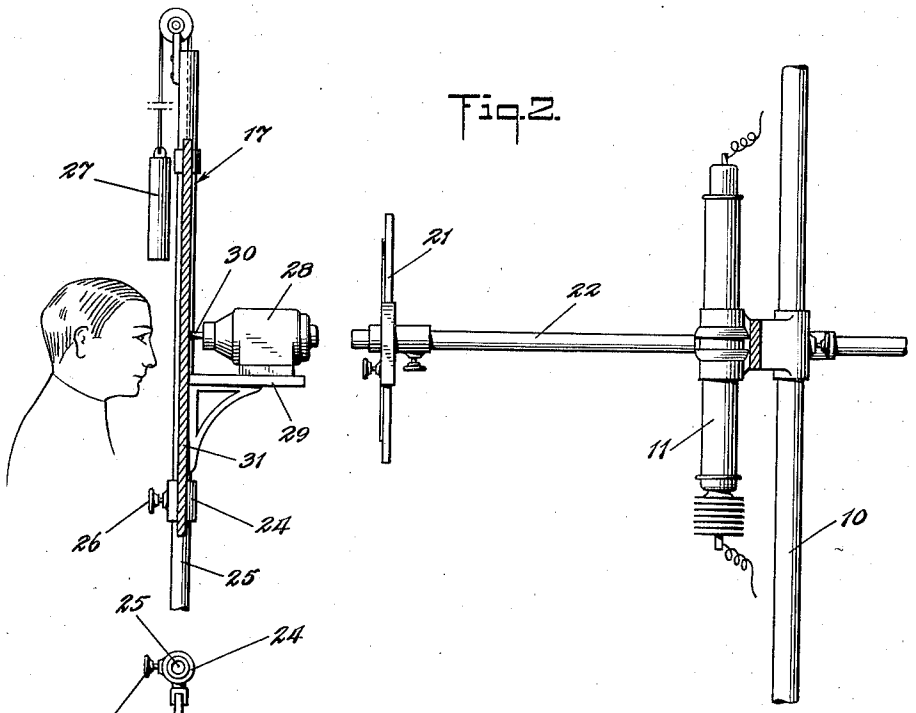
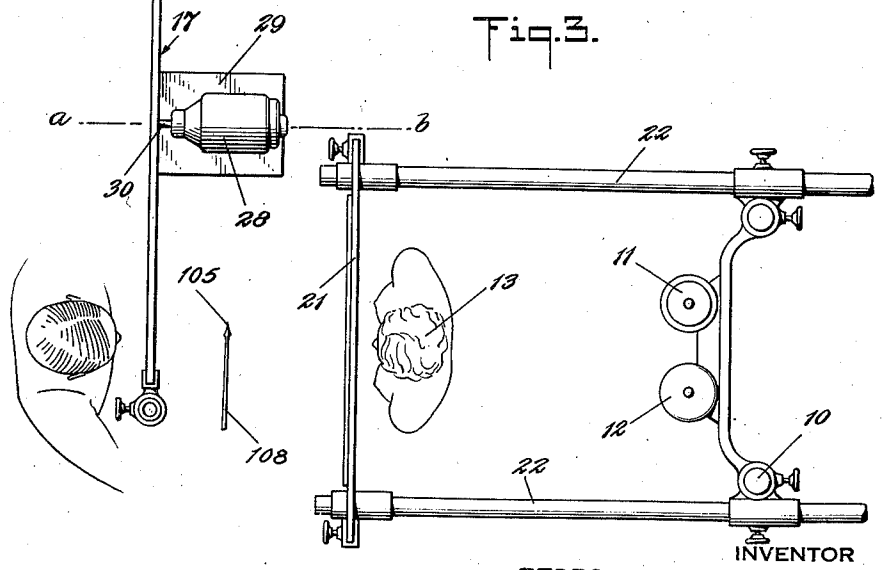


Fig. 3.



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METHOD AND APPARATUS FOR STEREOSCOPIC FLUOROSCOPY

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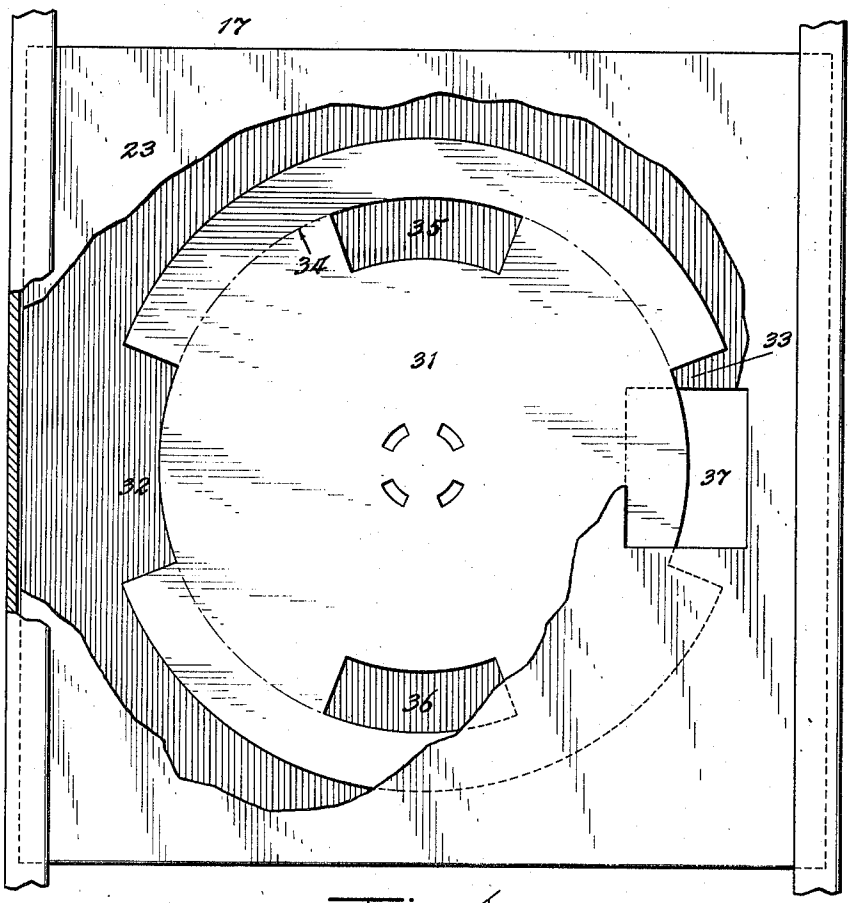


Fig. 4.

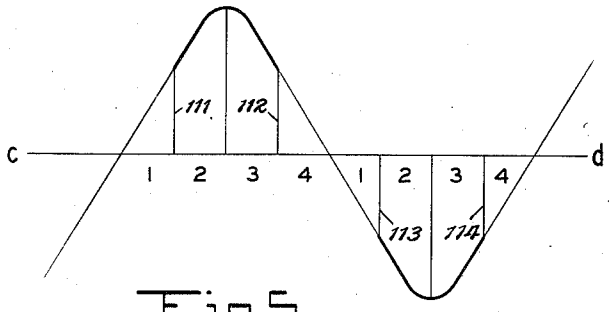


Fig. 5.

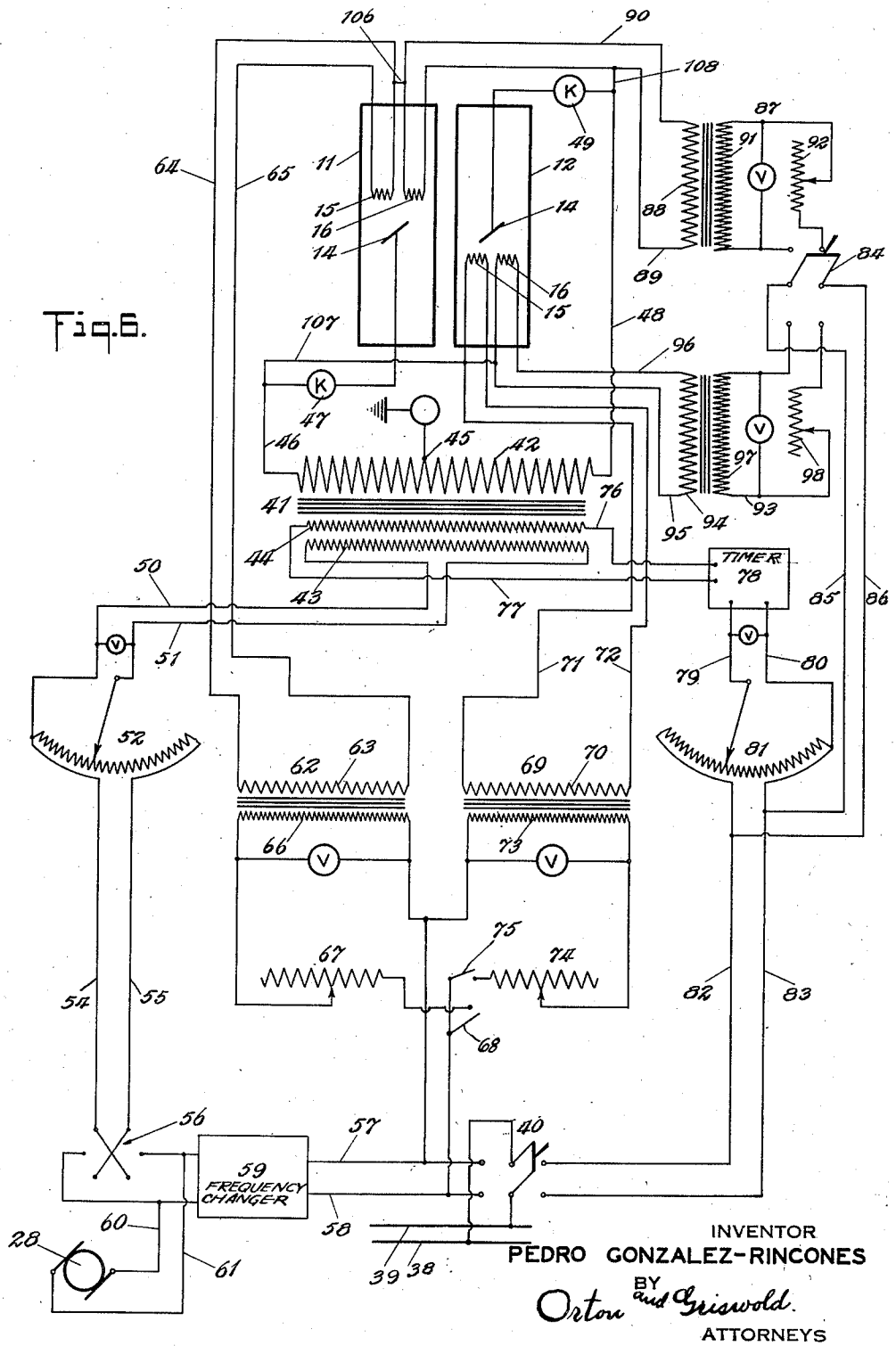
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Fig. 6.



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UNITED STATES PATENT OFFICE

2,208,215

METHOD AND APPARATUS FOR STEREOSCOPIC FLUOROSCOPY

Pedro Gonzalez-Rincones, Caracas, Venezuela,

Application September 13, 1937, Serial No. 163,625

6 Claims. (Cl. 250—60)

The invention relates in general to an improved method or technique for examining shadow images both of orthoscopic and pseudoscopic form of normally concealed objects, and to apparatus for use in practicing the method. More specifically defined, the invention relates to an improvement in apparatus of the Roentgen ray type at present used in medicine and other arts for producing images in fluoroscopic examinations and in radio-photography.

In general the invention features the combining in a simple, compact form with a simple fluoroscopic screen of two known forms of X-ray apparatus, both of which can be operated from the same pair of Roentgen ray tubes so that both apparatus may be used selectively at will without shifting the tubes or other major parts of the same.

One of the primary objects of the invention is to provide a simplified form of apparatus of the type outlined so organized that simply by throwing a conveniently located main control switch, and without otherwise changing any part of the apparatus and without disturbing the position of either the patient or other object, or the observer, the apparatus can be changed quickly from a fluoroscopic instrument with or without an associated strobo-stereoscopic attachment to a radiographic instrument, and by a simple shifting of a second switch, either of the two X-ray tubes may be utilized selectively in radiographic work.

The invention also relates to a method and apparatus for making pictorial sketches or permanent records of the produced orthoscopic image, or any desired portion thereof, and in this connection relates to a pantographic attachment to such image producing apparatus for recording in true dimension and on a reduced or enlarged scale a stereoscopic image of the object under examination in any plane selected.

Accordingly another object of the invention is to provide a simple form of recorder by means of which the image from the object being examined may be traced in whole or in part by the observer and at the same time, if desired, to provide means to compensate automatically for the usual distortion of the object as shown by the image so that the recorded tracing will be in true dimensions corresponding with the dimensions of the object.

This aspect of the invention is attained by providing a pantograph, for the most part located out of the path of the rays through the device and provided with an actuating index pointer by means of which the operator may trace the image as he sees it in space and permit the pantograph to reproduce in actual, reduced or multiplied size, the shadow image as it appears in the selected plane of the object under examination.

The invention also relates to an improvement in the strobo-stereoscopic features of the apparatus particularly in the manner in which the succeeding images are conveyed to the eyes of the observer.

An object of the invention insofar as this strobo-stereoscopic device is concerned is to provide a clear, unobstructed view of the stereoscopic images and at the same time eliminate the lag or after fluorescence of the images on the screen.

Insofar as the method features of the disclosure is concerned, an object of the invention is to suggest a simplified technique for producing pantographically a traced outline suitable for forming a permanent pictorial record in any selected plane of the concealed object, or part of the object under examination.

In furtherance of the objective to eliminate or at least minimize lag or after fluorescence of the images on the screen, the disclosure features the utilization of an alternating current to actuate both the strobo-stereoscopic device and the tubes at a frequency sufficient to preserve the desired persistency of vision to provide the stereoscopic effect but at a frequency materially less than the usual fifty to sixty cycles per second heretofore used in similar forms of X-ray machines.

Another object of the invention is to provide in an apparatus of the type above outlined a simplified means for selectively producing at will either an orthoscopic image in front of the screen or a pseudoscopic image in rear of the screen.

Broadly this aspect of the invention is attained by the use of a reversible switch or inverter in the circuit for changing the relation of the half waves energizing the Roentgen ray tubes relative to the exposure of the screen through the strobo-stereoscopic device alternately to the right and left eye of the observer.

Various other objects and advantages of the invention will be in part obvious from a consideration of the method features of the disclosure and from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one method of practicing the invention, and the invention also consists in certain new and novel

modifications of the preferred method and other features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a schematic view illustrating a preferred embodiment of the invention and with some of the component parts shown in plan and illustrating some of the light lines which form the orthoscopic shadow image from the object disclosed and also showing the pantograph feature of the record sketch of the object produced by the pantograph; it being understood that as hereinafter described with the same apparatus and with a control switch in another position a pseudoscopic image may be formed;

Fig. 2 is a view partly in elevation showing the strobo-stereoscopic device in its relation to the screen, observer and tubes;

Fig. 3 is a plan view looking down upon the showing in Fig. 2 and with an object between the tubes and screen;

Fig. 4 is a view in elevation of the part of the strobo-stereoscopic device and with parts of the frame broken away to show the shutter in its relation to the sight window;

Fig. 5 is an explanatory sine curve view of one of the wave frequencies of the alternating current energizing the tubes and shutter motor; and

Fig. 6 is a circuit chart showing the wiring of the component parts of the device and which parts are for the most part shown symbolically.

In the drawings there is shown in the rear portion of the apparatus a pair of upright standards 10 forming a support on which is adjustably mounted in parallel relation and otherwise fixed, two upstanding Roentgen ray tubes 11 and 12. These tubes are of the double focus type with radiator for cooling and mounted inversely so that the anode of one will be on the same level as the anode of the other and with the anodes of both tubes facing the object 13 under examination as is usual in such devices. These tubes each contain an anode 14 and two filaments 15 and 16 each forming a cathode, one 15 constituting a fine focus cathode and the other 16 forming the broad focus cathode.

The strobo-stereoscopic device designated as a whole by the reference character 17 is located to allow each eye 18 and 19 of the observer shown to the left of Figs. 2 and 3 to view the orthoscopic image 20 produced by the rays and shown in dash lines in Fig. 1, from only one of the tubes at a time but to permit the images to be viewed in such rapid sequence as will permit persistency of vision so as to view the image in stereoscopic relation. A fluorescent screen 21 of conventional form is adjustably positioned between the device 17 and the tubes and, following conventional practices in this respect is adjustably supported on arms 22 extending forwardly from the support 10.

The strobo-stereoscopic device comprising a flat, box-like, hollow frame 23 journalled on a sliding sleeve 24 for movement about a horizontal axis and in the plane of the drawing shown in Fig. 3. The sleeve 24 is vertically adjustable on a standard 25 to permit vertical adjustment of the frame as a whole and in which position it may be locked by a set screw 26. Counterbalancing means 27 of conventional design may be utilized to facilitate ease of vertical adjustment of the frame 23 on the standard 25. A small synchronous motor 28 is carried by bracket 29 on the side of the frame facing the screen and to its driving shaft 30 is directly mounted a thin opaque disc 31 hereinafter sometimes referred to as a shutter. The shutter, as by reference to Fig. 4, is provided at diametrically opposite points in its circular periphery with a pair of arcuate recesses forming outer openings or apertures 32 and 33 positioned externally of a circle of reference 34 concentric with reference to the axis of rotation *a—b* of the shutter and motor shaft. The shutter is also provided at diametrically opposed points with a pair of arcuate slots forming a pair of inner openings or apertures 35 and 36 located internally of the circle of reference 34. These four openings are spaced apart ninety degrees circumferentially and each have an arcuate length of forty-five degrees with an opaque angle of forty-five degrees between succeeding openings. The openings are designed to register with a sight window 37 extending in registry through both sides of the frame and in the form illustrated being of rectangular form. The dimensions of this window and openings of the shutter are a material feature of novelty in this disclosure. In one physical embodiment of the apparatus each of the openings has a radial width between its concentric arcuate edges slightly less than sixty-five millimeters, which is about an average inter-pupillar distance of operators of such machines. The openings are so related to the aligned windows each of which is just about twice this width as most clearly shown in Fig. 4 that each of the outer openings 32 and 33 registers at an instantaneous time with the right hand or outer side or half of the window as viewed by the operator. In Fig. 4 the shutter has reached that point in its rotary movement where opening 33 is centered relative to the window 37 and when the shutter has moved one hundred eighty degrees from such position opening 32 will be in the position occupied by opening 33. Similarly each of the inner openings 35 and 36 will register with the left or inner half of the window as these openings revolve past the window with the turning in one direction or the other of the motor driven shutter. The parts are so arranged in timed relation to the illuminosity of the tubes that the outer openings are successively brought into registry with the window as one of the tubes reaches its point of maximum illuminosity, and similarly the inner openings register with the window when the other tube reaches its point of maximum illuminosity. The particular tube which is active at the time either the right or left half of the window is exposed is controlled selectively by the reverser hereinafter described.

Preferably the openings in the shutter and the parts associated with the shutter are so arranged, particularly in the proportioning of the circumferential lengths of the openings 32—36, that the image 20 can not be viewed by the operator during the period of time while each tube is approaching and receding from its period of maximum intensity. In the device illustrated each half wave of the current cycle is diveded in quarter lengths and numbered 1, 2, 3 and 4 in Fig. 5 with the shutter closing the window during the first and fourth quarters and exposing the image during the second and third quarters as the sine wave approaches and recedes from the crest of the half wave illustrated.

It is therefore a feature of this disclosure that the motor 28 be of the synchronous type; that it be set to turn relative to the shutter so that the sight window will be opened and closed in phase with the cyclic changes of the current impulses which energize the tubes. It is also a

feature of this disclosure that the motor be actuated by an alternating current of a reduced number of cycles from that supplied by the usual house or city source.

Reference is made to Fig. 6 for a description of one form of wiring for the apparatus. In such an arrangement a source of alternating electric current such as is supplied for house or city consumption and which in the United States is usually of sixty cycles per second is represented by the main leads 38 and 39 which lead to the blade of a two-position main switch 40.

Considering the arrangement of parts to the left hand side of the main switch and which are connected to the main leads when the switch is thrown to the left, there is disclosed a set of parts commonly found in X-ray machines to form a fluoroscopic circuit. This circuit is in turn formed of a main transformer circuit and a fine filament circuit arranged in parallel. The main transformer circuit includes a high tension step-up transformer 41 which comprises a single secondary 42 and two primaries 43 and 44. The secondary 42 is grounded at its central point 45. One terminal 46 of the secondary leads through "kenotron" 47 to anode element 14 of tube 11. The other terminal of the secondary leads by means of a conductor 48 through "kenotron" 49 to the anode element 14 of tube 12. Opposite ends of the associated primary 43 are connected by leads 50 and 51 to a voltage regulator 52 of the auto-transformer type. Conductors 54 and 55 lead to a reversible switch 56 by means of which the primary 43, together with the regulator 52 may be connected directly to the main leads 38 and 39 through conductors 57 and 58 when the switch 40 is in its left hand circuit closing position to effect such connection.

It is suggested that the parts of the circuit thus described be energized by an alternating current of less frequency than that supplied by the main leads 38, 39 and for this purpose a frequency changer 59 is contained in the circuit formed by the conductors 57, 58. The shutter driving motor 28 is shunted off the portion of the conductors 57, 58 between the reducer 59 and switch 56 so that the motor is driven by the alternating current of reduced frequency passing out of the reducer and which motor will be active irrespective of the position of the switch 56. Conductors 60 and 61 contained in a cable extend to the motor on the frame 17 from the frequency changer 59 which is usually located in juxtaposition to the parts shown in Fig. 6 and mounted on the support 10. The frequency changer is so set as to supply to the motor an alternating current which will cause the openings in the shutter to pass the window at a rate greater than sixteen, less than sixty, and of the order of about twenty-five views of the images per second. As the tubes are connected through the switch 56 with the same current frequency which is supplied to the motor the tubes will have a periodic functioning in synchronous relation to the motor and with a periodicity materially less than that of the main current supplied by the leads 38, 39.

The parts which form the fine filament circuit are connected in parallel with the primary circuit just described. This fine filament circuit in turn comprises two branches both supplied from the conductors 57, 58 and thus supplied with the current frequency of the main leads. One branch includes a small transformer 62, the secondary 63 of which is connected by leads 64 and 65 with the fine filament 15 of tube 11 which also receives the high tension from conductor 48 through bridge 106. The primary 66 of this transformer includes a variable resistance 67 and a local control switch 68. Similarly the other branch includes a small transformer 69, the secondary 70 of which is connected by leads 71 and 72 with the fine filament 15 of the tube 12 and which also receives high tension from conductor 46 through the bridge 107. The primary 73 of transformer 69 also includes variable resistance 74 and a local control switch 75. By the manipulation of these switches either or both of these small transformers 62 and 69 may be connected directly to the source of the main electric supply of alternating electric current supplied by the leads 38, 39 when the main switch 40 is in position shifted to the left to connect the fluoroscopic circuit with the main line.

Referring to the structure shown mainly on the right hand side of Fig. 6 there is disclosed a radiography circuit which is formed of a main transformer primary circuit and a broad filament circuit disposed in parallel. Referring to the primary circuit, it includes the other primary 44 of the main transformer 41 and which primary is connected by leads 76 and 77 through a timer 78 which regulates the duration of the current flow to the primary 44. From the timer conductors 79, 80, lead to a voltage regulator 81 of the auto-transformer type and hence by leads 82 and 83 to the right hand side of the main switch 40.

The broad filament circuit comprises two branches connected selectively through a two-way switch 84 and leads 85 and 86 with the leads 82 and 83. One of the branches includes a broad foci-transformer 87, the secondary 88 of which is connected by leads 89 and 90 with the broad filament 16 of tube 11 and which also receives the high tension of terminal 48 of the high tension through bridge 108. The primary 91 of transformer 87 includes a variable resistance 92. The other broad foci-branch includes a transformer 93, the secondary 94 of which is connected by leads 95 and 96 to the broad filament 16 of tube 12 which likewise receives the high tension from conductor 46 through bridge 107. The primary 97 of transformer 93 includes a variable resistance 98. It is understood that all of the transformers are of conventional design commonly used in devices of this character and include voltameters marked V in parallel with the associated primary in each case.

Positioned opposite the space between the screen 21 and the device 17 as shown in Fig. 1 and thus out of line with the rays which form the image and out of the optic field of the operator is a recording device designated 100 as a whole and which includes a pantograph 101 with its usual arrangement of crossed arms and a drawing board or other paper support 102 over which moves the pencil as is usual with such devices. It is a feature of this pantograph that one or more of its pivots 103 connecting the arms is of the adjustable type designed to be shifted to modify the movement of the pencil at 104 relative to the index pointer at 105 in such way as will compensate for the distortion in the image hereinafter described. The pantograph includes a control arm 108 preferably painted black and provided at its free end with its index 105 of some fluorescent material. At 109 is shown the pantographically produced record of the orthoscopic image 20 and which is at least approximately of the same dimensions as the cross section of the part of the object under examination and repre-

sented by the approximate square or quadrilateral figure 110 in Fig. 1.

In operation and assuming, for instance, that the main switch 40 is thrown to the left from the neutral position shown in Fig. 6, the apparatus is thus set to function with fluoroscopic stereoscopy. In this case it will be understood that each tube 11 and 12 will alternately become active with a frequency dependent upon the frequency of the alternating current supplied by the means 38, 39, or in the event that the cycle reducer 59 is used then by a suitable adjustment of the frequency changer the tubes will become active with a frequency governed by the setting of the frequency changer. It may be assumed by referring to the sine curve shown in Fig. 5 that tube 11 is active by virtue of the half wave above the neutral line *c—d* and the tube 12 is active by virtue of the half wave below the line. Reversing the switch 56 will reverse this condition of tube activity and under this arrangement tube 12 is active by virtue of the half waves above the neutral line and the tube 11 is active by virtue of the half waves below the line *c—d*.

As previously noted the shutter speed as controlled by the synchronous motor and the sequence of image exposures visible to the operator through the window is such that they can be seen only during the period of maximum illuminosity of the tubes, that is, in the space as represented in Fig. 5 between the lines 111 and 112 for tube 11, and between lines 113 and 114 for the tube 12. It is thus understood that in the period, for instance, between the point 112 and 113 an opaque portion of the shutter intercepts the view of the operator through the window. Tracing out some of the representative light lines shown in Fig. 1 as by reference to the corners A, B, C, D, of the object section in Fig. 1, it will be seen that the image 20 of the object is apparently formed in space between the observer's eyes and the screen 21. It will be noted that the image corresponds in general to the object, except that it is distorted either in one or both axis at right angles to each other or in both of these dimensions, that is, the points A^1, B^1 of the image are longer than the corresponding points A, B, of the object. As previously noted, the pantograph arms may be adjusted to compensate for this elongation in the longitudinal dimension of the image compared with the object or the arms may be set conventionally to copy in multiplied or divided relation the exact conformation of the image as seen by the operator.

In order to reproduce and make a permanent record of the image as seen by the operator, the pantograph is first adjusted to give the requisite correction necessary. The operator then looks through the window with the apparatus in operation as above described, and by manually guiding the phosphorescent index about the image as he views it in space, he can outline the entire image or whatever portion he may desire. The pencil on the drawing board reproduces the traced part and thus is formed the pencil record with its outline indicated by the traced lines designated A'', D'', B'', C'', in Fig. 1. By comparing this record with the object, it will be found to have at least approximately the same shape and dimensions and there is thus reproduced more or less exactly a cross section record of the concealed object in the plane set by the location of the tubes 11 and 12.

It is understood that device 17 may be swung into an out-of-the-way position thus permitting the operator to effect the ordinary fluoroscopic examination. Should it be desired to take ordinary X-ray pictures the device 17 is removed to its out-of-the-way position, the main switch 40 swung to the right from its neutral position shown in Fig. 6 to energize the radiographic circuit above described. In such cases only one of the broad filament transforming circuits is utilized and the secondary switch 84 is thrown into the position to energize whichever tube may be desired to be used for the time being. Should it be desired to take stereoscopic radiography, the operation proceeds as with known devices of this character using first one tube and then the other by means of the controlling secondary switch 84.

By means of a device of the character described, it is possible to provide a single, compact assembly which can be easily handled and which in addition to simple fluoroscopy and simple radiography may be additionally used for fluoroscopic stereoscopy and for the purpose of making records of any desired sectional parts of the subject under examination.

The strobo-stereoscopic device permits the forming of clean-cut images in stereoscopic relation with an elimination of the lag or after fluorescence of the screen. This elimination of after effects is further enhanced by the utilization of the synchronous motor which can be excited by setting the frequency changer to discharge a current having a number of cycles just sufficient to maintain the stereoscopic effect and thus tend further to eliminate lag or after fluorescence of the screen.

By introducing the frequency changer into the circuit leading to the motor controlling the shutter it is possible to cause the shutter to have a speed just sufficient to maintain a clearly defined image and to retain the desired persistency of vision of the operator as he views the images produced and at the same time by reducing the cycles of the current acting on the tubes from that usually employed, the otherwise brilliant showing of the images may be dimmed sufficiently to minimize the duration of the lag or after fluorescence of the images on the screen and thus cause an entire elimination of a preceding image before the shutter exposes to view the next succeeding image.

It is also possible with the arrangement of the reversible switch in the main primary of the fluorescent circuit to change the half cycles which act upon any particular one of the two tubes. For instance, with the right tube producing the image when the right eye is viewing the same the orthoscopic image 20 is produced and when the left tube is producing the image when the right eye is viewing the same a pseudoscopic image is produced. In this way and with the switch in one position, the orthoscopic image is produced visually as if in advance of the screen and with the switch in its other circuit closing position the pseudoscopic image is produced visually as if in rear of the screen and about where the object is located. As the orthoscopic image is produced in the open space, free of the object and other interference, in advance of the screen, this particular image is utilized in the pantographic recording or tracing of the part of the object under examination.

While there have been shown, described and pointed out in the annexed claims, certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the form and details of the apparatus illustrated and in its operation may be made by those

skilled in the art without departing from the spirit of the invention.

I claim:

1. In an X-ray apparatus, the combination of two Roentgen tubes of the double focus type, a main transformer having a single secondary and two primaries, means for connecting one terminal of the secondary of the transformer with a cathode of one tube and to the anode of the other tube and the other terminal with the anode of one tube and to the cathode of the other, means forming a fluoroscopic circuit comprising a primary circuit and a fine filament circuit connected in parallel, the primary circuit including one of the primaries of the main transformer and means for regulating the current flow through the same, the fine filament circuit including two branches, one for each tube and each branch including a transformer, the secondary of each of which is connected to the fine filament of its associated tube and the primary of each of which includes means for regulating the current flow through the same, means forming a radiography circuit including a primary circuit and a broad filament circuit connected in parallel, the primary circuit including the other primary of the main transformer, a timer and means for regulating the current flow therethrough, the broad filament circuit comprising two branches, one for each tube and each including a transformer, the secondary of each of which is connected to the broad filament of its associated tube and the primary of which includes means for regulating the current flow therethrough, a two-way switch for selectively connecting either one of the branches to the radiography circuit and a main two-way switch for selectively connecting either the fluoroscopic circuit or the radiography circuit at will to a source of alternating electric current.

2. In an X-ray apparatus, the combination of a source of alternating current, two Roentgen tubes of the double focus type, a step-up high tension transformer provided with a single secondary and two primaries, one end of the secondary connected to the anode of one of the tubes and to the cathode of the other, the other end of the secondary connected to the anode of the other tube and to the cathode of the first tube, means forming a fluoroscopic circuit including a primary circuit and a fine focus filament circuit, a cycle reducer between said primary and filament circuit to reduce the frequency of the current in the primary circuit below that in the source, said primary circuit including one of the two primaries of the transformer, an auto-transformer and a synchronous shutter rotating motor and a reversing switch between the reducer and the auto-transformer, said fine focus filament circuit including two branches, one for each tube each branch including a transformer, the secondary of each of which is connected to the fine focus filament of its associated tube and the primary of each of which includes a variable resistance, means forming a radiography circuit including a primary circuit and a broad focus filament circuit, said primary circuit including the other of the two primaries of the high tension transformer, a timer and an auto-transformer, said broad filament circuit including two branches, one for each tube, each branch including a transformer, the secondary of each of which is connected to the broad filament of its associated tube and the primary of each of which includes a variable resistance and a two-way switch for selectively connecting either branch with the radiography circuit, and a main two-way switch having one side connected to both the cycle reducer and to the fluoroscopic circuit and the other side connected to the radiography circuit for selectively connecting either the fluoroscopic or the radiography circuit at will with said source of alternating electric current.

3. In an X-ray apparatus, the combination of a source of alternating electric current, two self-rectifying Roentgen tubes, each including an anode and a broad focus cathode, a step-up high tension main transformer having one terminal of its secondary connected to an anode of one of the tubes and to the broad focus cathode of the other and its other terminal connected to the anode of the other tube and to the broad focus cathode of the first tube, means supplied from said source forming a primary circuit including the primary of said transformer, a timer and a current regulator of the auto-transformer type disposed in parallel, means forming two filament circuits, one for each tube and both supplied from said source of alternating current, each filament circuit including a secondary transformer each having its secondary connected to the broad focus cathode of its associated tube and each having its primary connected through a variable resistance with the source and a two-way switch for selectively connecting the primary of either secondary transformer and its associated resistance with said source.

4. In a device of the class described, the combination of a source of alternating electric current, a pair of Roentgen ray tubes of the double focus type, a fluorescent screen, a strobo-stereoscopic device operatively connected to operate in synchronism with said alternating circuit including the primary of said transformer, means connecting the primary with said source of alternating current, means in the primary circuit to modify a characteristic of the alternating electric current, said means including a reversible switch to make changes in the half wave energizing the tubes, said combination with the switch in one of its circuit closing positions acting to produce an orthoscopic image in front of the screen as viewed by the operator looking through the strobo-stereoscopic device and said combination with the switch in its other circuit closing position acting to produce a pseudoscopic image in rear of the screen as viewed by the operator looking through the strobo-stereoscopic device.

5. In a device of the class described, the combination with a source of alternating current, a pair of double foci Roentgen ray tubes, each including an anode, a fine focus cathode and a broad focus cathode, means forming a main transformer circuit and a fine filament circuit disposed in parallel, the main transformer circuit including a main transformer having a single secondary and two primaries, the secondary connected to the anodes of both tubes and to the broad focus cathode of both tubes, the fine filament circuit comprising two branches, one for each tube and each including a small transformer with its secondary connected to the fine filament of its associated tube, a main switch, means including a reversible switch connecting one of the primaries to one side of the main switch, both branches of the fine filament circuit connected to said side of the main switch,

a strobo-steroscopic device including a motor for driving the same, said motor being also connected to said side of the main switch, the other primary of the main transformer connected through a voltage regulator to the other side of the main switch, a broad foci transformer having its primary also connected to said other side of the main switch and having its secondary connected to the broad focus cathode of one of the tubes.

6. In a device of the class described, the combination of a pair of Roentgen tubes each including an anode, a fine focus cathode and a broad focus cathode, a main transformer including a secondary and two primaries, one terminal of the secondary connected to the anode of one tube and the broad focus cathode of the second tube and its other terminal connected to the broad focus cathode of the first tube and to the anode of the second tube, a pair of small transformers, one for each tube and each having its secondary connected to the fine focus cathode of its associated tube, means for selectively connecting the primaries of either or both of said small transformers to a source of alternating current of relatively high frequency, means forming a circuit of relatively low frequency, a motor of a strobo-stereoscopic device, a reversible switch, a voltage regulator and one of the primaries of the main transformer included in said circuit forming means, two broad foci transformers, one for each tube for energizing the broad focus cathode of its associated tube connected to the other primary of the main transformer and a switch for connecting said last named means with the source of high frequency current.

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