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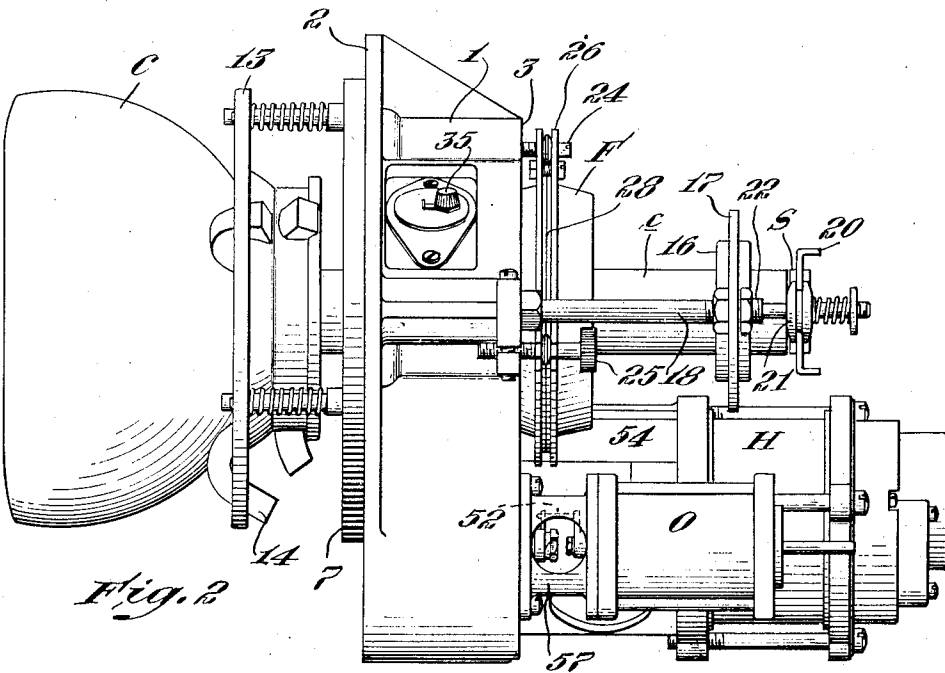
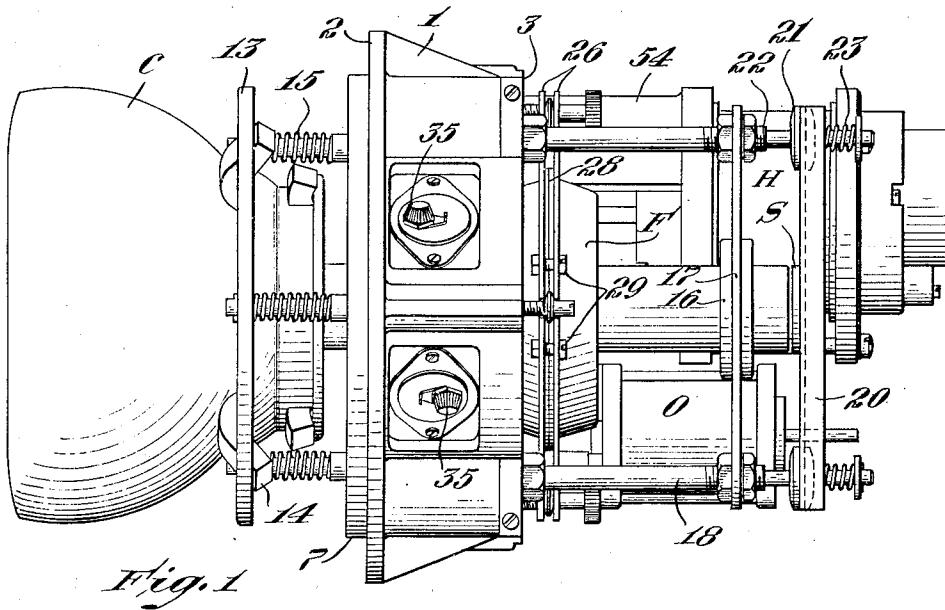
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2,389,995

POLAR COORDINATE OSCILLOSCOPE

Filed Jan. 21, 1944

3 Sheets-Sheet 1



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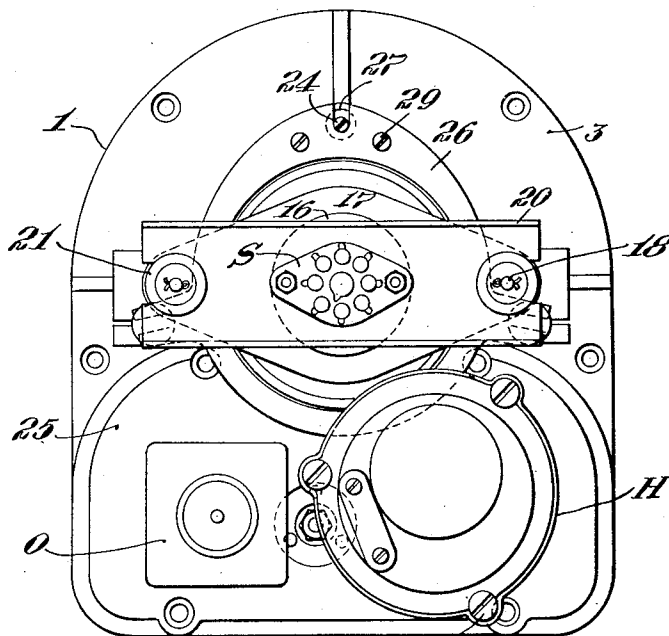
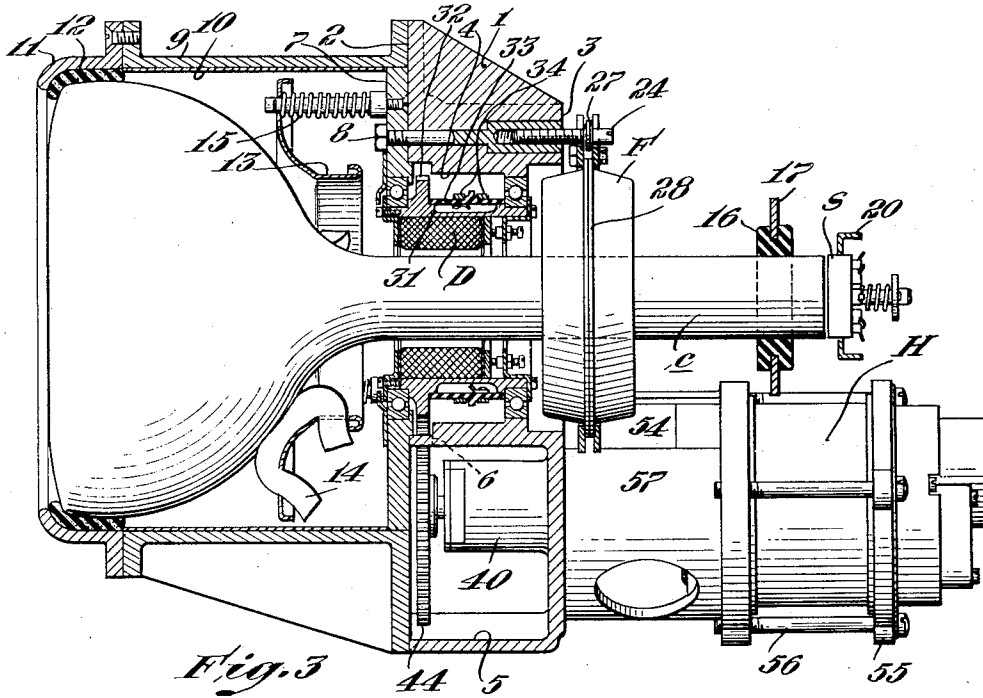
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POLAR COORDINATE OSCILLOSCOPE

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3 Sheets-Sheet 2



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POLAR COORDINATE OSCILLOSCOPE

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Fig. 5

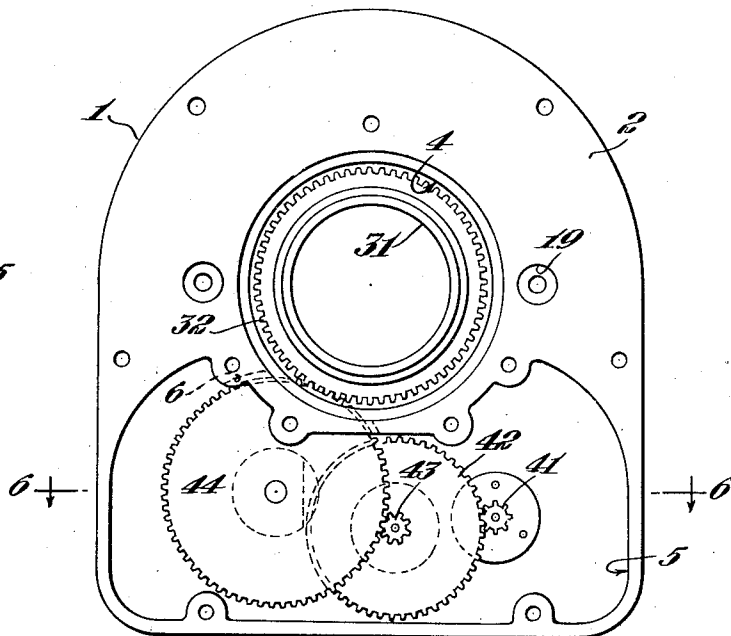
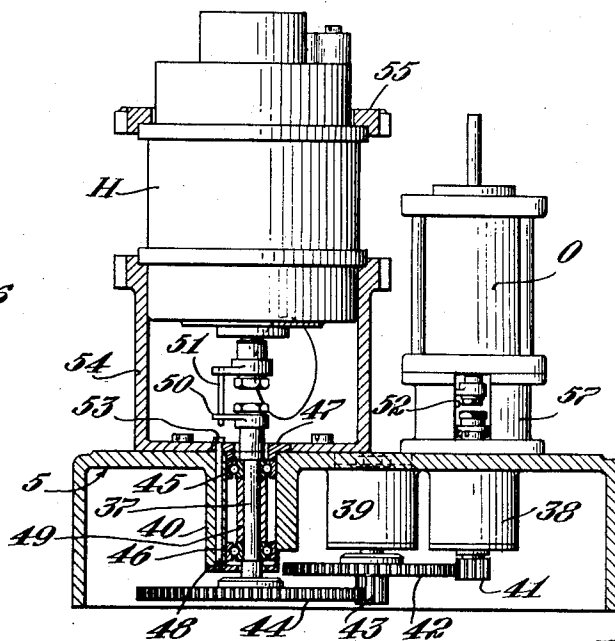


Fig. 6



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UNITED STATES PATENT OFFICE

2,389,995

POLAR COORDINATE OSCILLOSCOPE

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10 Claims. (Cl. 250—157)

This invention relates to polar coordinate oscilloscopes of the type which employs a cathode ray tube with a stationary coil for focusing a stream of cathode rays on a viewing screen; a deflection coil mounted to rotate about the axis of the tube, the deflection coil being energized by an appropriate sweep circuit; a so-called servomotor for driving the deflection coil; and a so-called Selsyn generator geared to both the motor and deflection coil for cooperation with a suitable servo amplifier system which, in turn, is associated with another Selsyn generator coupled to the rotating mechanism with which the deflection coil is to be synchronized. Inasmuch as the general arrangement and electrical connections of such devices are well known they need not be described herein, this invention relating solely to the mechanical correlation of the parts of the oscilloscope.

Objects of the invention are to provide apparatus which is simple and economical to construct, which can be assembled and disassembled easily and quickly, which is accurate and reliable in use and which is generally superior to prior apparatus of the aforesaid type.

According to the present invention the apparatus comprises a single integral hollow casting having two plane parallel faces, together with means engageable with one of the faces for detachably mounting the deflection coil on the casting, means engageable with the other of the faces for detachably mounting the motor on the casting, and drive means kinematically interconnecting the motor and deflection coil, the drive means including gearing mounted on the casting independently of the motor supports and flexible couplings between the gearing and motor. The aforesaid focusing coil is preferably mounted on the side of the casting which carries the motor. In the preferred embodiment the deflection-coil mounting means comprises a cylindrical support disposed in an opening in the casting, together with a ring mounted on one of the faces as aforesaid, a ball bearing between one end of the cylindrical support and the periphery of the aforesaid opening and another ball bearing between the aforesaid ring and the other end of the cylindrical support.

In a more specific aspect the aforesaid Selsyn generator is mounted on the rear face of the hollow casting alongside the motor, and is coupled to the motor through the minimum number of gears which will provide the necessary speed reduction between motor and generator, thereby to minimize the backlash between motor and

generator for the purpose of improving the aforesaid synchronization. The deflection coil gear is directly coupled to the generator gears.

In a still more specific aspect the aforesaid hollow casting has interior gearing and deflection-coil spaces, the gearing space being open on the forward side and the other space extending through the casting from face to face, together with means engageable with the forward face of the casting for rotatably mounting the deflection coil, means engageable with the rearward face for detachably mounting the motor and generator on the casting, a boss on the casting in the gearing space, a motor shaft journaled in the boss, the shaft extending out of the rearward side of the casting for connection with the motor, and drive means within the casting interconnecting the shaft with said mounting and generator.

For the purpose of illustration a typical embodiment is shown in the accompanying drawings, in which

Fig. 1 is a top plan;

Fig. 2 is a side elevation;

Fig. 3 is a vertical axial section;

Fig. 4 is a rear view;

Fig. 5 is a front view with parts removed; and

Fig. 6 is a horizontal section on line 6—6 of Fig. 5 showing parts in elevation.

The particular embodiment of the invention chosen for the purpose of illustration comprises a cathode-ray tube C having a long shank c, a focusing coil F, a deflection coil D, a servomotor O and a Selsyn generator H. The cathode-ray tube has the usual viewing screen at the forward end (left-hand end of Fig. 1) and at its rear end it is plugged into the usual socket S.

The support for the aforesaid parts comprises a casting 1, preferably formed of aluminum, having forward and rearward plane parallel faces 2 and 3 and having interior deflection-coil and gearing spaces 4 and 5 (Fig. 3) the coil space 4 extending all the way through the casting coaxially with the tube C and the gear space 5 being closed at the rear side and open in front, the two spaces intercommunicating through a small opening 6 (Fig. 3). Mounted on the front face 2 concentrically with the space 4 is a ring 7 which is held in place by screws 8. Fitting around the ring 7 is a cylindrical casing 9 having a lining 10 to serve as a shield for the cathode-ray tube. The front end of the tube is supported by a ring 11 detachably mounted on the forward end of the casing 9, with pads 12 of sponge rubber or the like between the ring and the tube. The intermediate portion of the tube is supported by

a ring 13 provided with pads 14, the ring being yieldingly mounted on posts secured to the ring 7 with compression springs 15 surrounding the posts. The rear end of the tube is supported in a rubber ring 16 mounted on a plate 17 which in turn is mounted on two posts 18 which extend through the casting boss with nuts on their forward ends which seat in recesses 19 in the forward face of the casting (Fig. 5). The aforesaid tube socket S is also mounted on the posts 18 through the medium of a bar 20 which has rubber or neoprene bushings 21 sliding on the posts, the bushings being pressed toward stops 22 by means of springs 23 (Fig. 1).

The focusing coil unit F is adjustably mounted on the rear face of the casting 1 by means of an upper post 24 and two lower posts 25 and two rings 26, the outer ring having radial slots to receive the posts as shown in Fig. 4. Each post has an integral collar 27 which tapers outwardly and the rings are pinched against the collars and against the flanges 28 of the two-part housing for the focusing coil by means of screws 29 (Figs. 1 and 4). By threading the screws 24 and 25 forwardly or rearwardly in the casing the focusing coil can be tipped in any direction, the rings 26 being sufficiently flexible to permit this tipping.

The deflection coil D is mounted inside a cylindrical support 31, being held in place by rings mounted on the support as shown in Fig. 3. The opposite ends of the support 31 are mounted on the casting 1 and the ring 7 by means of ball bearings. Intermediate the bearings the cylindrical support has an integral gear 32 and an insulation ring 33. Mounted on the ring 33 are two slip rings 34 which contact the brushes 35 (Fig. 1) for conducting current to the deflection coil.

Extending forwardly from the rear wall of the casting 1 into the gearing space 5 are three integral bosses 38, 39 and 40 (Figs. 3 and 6). Journaled in these bosses are shafts 37 which carry gears 41, 42, 43 and 44, the gears 41 and 42 meshing together and the gear 44 meshing with the gear 43 and also with the aforesaid gear 32 on the deflection coil rotor, the gear projecting from the gear space through the opening 6 (Fig. 3) into the deflection coil space. Each of the shafts 37 is mounted on two sets of ball bearings 45 and 46 which are held in place by rings 47 and 48 and an intermediate spacer 49. The ring 47 has a forward portion fitting into the bore in the boss to center the ring in the opening in the boss and a larger rearward portion which projects beyond the rear face of the casting to center the generator casing as hereinafter described. The rear ring around the shaft in boss 38 also projects beyond the rear face of the casting to center the motor casing as hereinafter described. However the rear ring around the intermediate shaft is disposed in a recess in the rear face of the casting so as not to interfere with the motor and generator casings. The forward and rearward rings around each of the three shafts are held in place by three screw bolts 53.

The generator H is mounted on the rear face of the casting through the medium of a cylindrical casing 54 which has an axial opening in its forward end fitting over the ring 47 and an open rearward end with a recess which is in axial alignment with the forward opening and into which the locating ring on the generator frame is fitted. The generator is held in place by means of a ring 55 and bolts 56. The motor S is likewise mounted through the medium of a cylindrical casing 57 which has an axial opening fitting over the afore-

said ring to center the motor in respect to the shaft in boss 38. Shaft 37 is connected with the generator shaft through a flexible coupling comprising a radial fork 50 on shaft 37 straddling a pin 51 on the generator shaft; and the motor shaft is similarly connected with the shaft in boss 38 by a similar coupling 52.

From the foregoing it will be evident that any one of the parts, the deflection coil, the focusing coil, the cathode-ray tube, the motor or the generator can be readily removed independently of the other parts. It will also be evident that all the parts may be readily aligned because they are all positioned with respect to the two parallel faces of the casting 1, the casting 1 is a simple and economical design, the two plane parallel faces may be accurately machined without difficulty and the openings through the casing may be easily and accurately formed because they are all perpendicular to the plane parallel faces 1 and 2. Thus the invention affords the utmost accuracy and convenience with a minimum number of parts each of which is of simple and inexpensive construction.

Referring to Figs. 5 and 6 it will also be evident that, instead of the motor driving the generator gear through the medium of the deflection-coil gear as usual, the generator gear 44 is interposed between the deflection-coil gear 32 and the motor gear 41. Thus there is less back-lash between the motor and generator gears and therefore better synchronization.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, and a motor for rotating the deflection coil, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other of said faces for detachably mounting the motor on the casting, and drive means kinematically interconnecting the motor and deflection coil, the drive means including gearing mounted on the casting independently of the motor support and a flexible coupling between the gearing and motor.

2. In a polar coordinate oscilloscope of the type having a cathode-ray tube, focusing and deflection coils surrounding the tube, and a motor for rotating the deflection coil, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other of said faces for detachably mounting the motor on the casting, drive means kinematically interconnecting the motor and deflection coil, and means for adjustably mounting the focusing coil on the side of the casting opposite to the side upon which the deflection coil is mounted.

3. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, and a motor for rotating the deflection coil, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other

of said faces for detachably mounting the motor on the casting, and drive means kinematically interconnecting the motor and deflection coil, the deflection coil mounting means comprising a cylindrical support disposed in an opening extending through the casting from face to face, a ring mounted on said first face, a ball bearing between one end of the cylindrical support and the periphery of said opening and another ball bearing between said ring and the other end of the cylindrical support.

4. In a polar coordinate oscilloscope of the type having a cathode-ray tube, focusing and deflection coils surrounding the tube, and a motor for rotating the deflection coil, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other of said faces for detachably mounting the motor on the casting, drive means kinematically interconnecting the motor and deflection coil, the drive means including gearing mounted on the casting independently of the motor support and a flexible coupling between the gearing and motor, and means for adjustably mounting the focusing coil on the side of the casting opposite to the side upon which the deflection coil is mounted, the deflection coil mounting means comprising a cylindrical support disposed in an opening extending through the casting from face to face, a ring mounted on said first face, a ball bearing between one end of the cylindrical support and the periphery of said opening and another ball bearing between said ring and the other end of the cylindrical support.

5. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, a motor for rotating the deflection coil, and a generator for synchronizing the motor, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other of said faces for detachably mounting the motor and generator on the casting, and drive means kinematically interconnecting the motor and generator and deflection coil, the drive means including gearing mounted on the casting independently of the motor and generator and flexible couplings between the gearing and motor.

6. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, a motor for rotating the deflection coil, and a generator for synchronizing the motor, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection coil on the casting, means engageable with the other of said faces for detachably mounting the motor and generator on the casting, and drive means kinematically interconnecting the motor and generator and deflection coil, the drive means including gearing mounted on the casting independently of the motor and generator, the gearing including motor generator and coil gears associated with the motor generator and deflection coil respectively, the generator gear being intermediate the motor and coil gears.

7. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, and a motor for rotating the deflection coil, the combination of a single

integral hollow casting having forward and rearward plane parallel faces and interior gearing and deflection-coil spaces, the gearing space being open on the forward side and the other space extending through the casting, means engageable with said forward face for rotatably mounting the deflection coil on the casting, means engageable with said rearward face for detachably mounting the motor on the casting, a boss on the casting in the gearing space, a motor shaft journaled in the boss, and drive means interconnecting said shaft and deflection coil mounting means inside said casting, said shaft extending out of the rearward side of the casting for connection with the motor.

8. In a polar coordinate oscilloscope of the type having a cathode-ray tube, focusing and deflection coils surrounding the tube, and a motor for rotating the deflection coil, the combination of a single integral hollow casting having forward and rearward plane parallel faces and interior gearing and deflection-coil spaces, the gearing space being open on the forward side and the other space extending through the casting, means engageable with said forward face for rotatably mounting the deflection coil on the casting, means engageable with said rearward face for detachably mounting the motor on the casting, a boss on the casting in the gearing space, a motor shaft journaled in the boss, drive means interconnecting said shaft and deflection coil mounting means inside said casting, said shaft extending out of the rearward side of the casting for connection with the motor, and means for adjustably mounting said focusing coil on the rearward side of the casting.

9. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, a motor for rotating the deflection coil, and a generator for synchronizing the motor, the combination of a single integral hollow casting having forward and rearward plane parallel faces and interior gearing and deflection-coil spaces, the gearing spaces being open on the forward side and the other space extending through the casting, means engageable with said forward face for rotatably mounting the deflection coil on the casting, means engageable with said rearward face for detachably mounting the motor and generator on the casting, bosses on the casting in the gearing space, motor and generator shafts journaled in the bosses respectively, and drive means interconnecting said shafts and deflection coil mounting means inside said casting, said shafts extending out of the rearward side of the casting for connection with the motor and generator respectively.

10. In a polar coordinate oscilloscope of the type having a cathode-ray tube, a deflection coil surrounding the tube, a motor for rotating the deflection coil, and a generator for synchronizing the motor, the combination of a single integral hollow casting having two plane parallel faces, means engageable with one of said faces for detachably mounting the deflection-coil on the casting, means engageable with the other of said faces for detachably mounting the motor and generator on the casting, and drive means kinematically interconnecting the motor and generator and deflection coil, the drive means including gearing mounted on the casting independently of the motor and generator supports, and flexible couplings between the gearing and the motor and generator respectively.

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