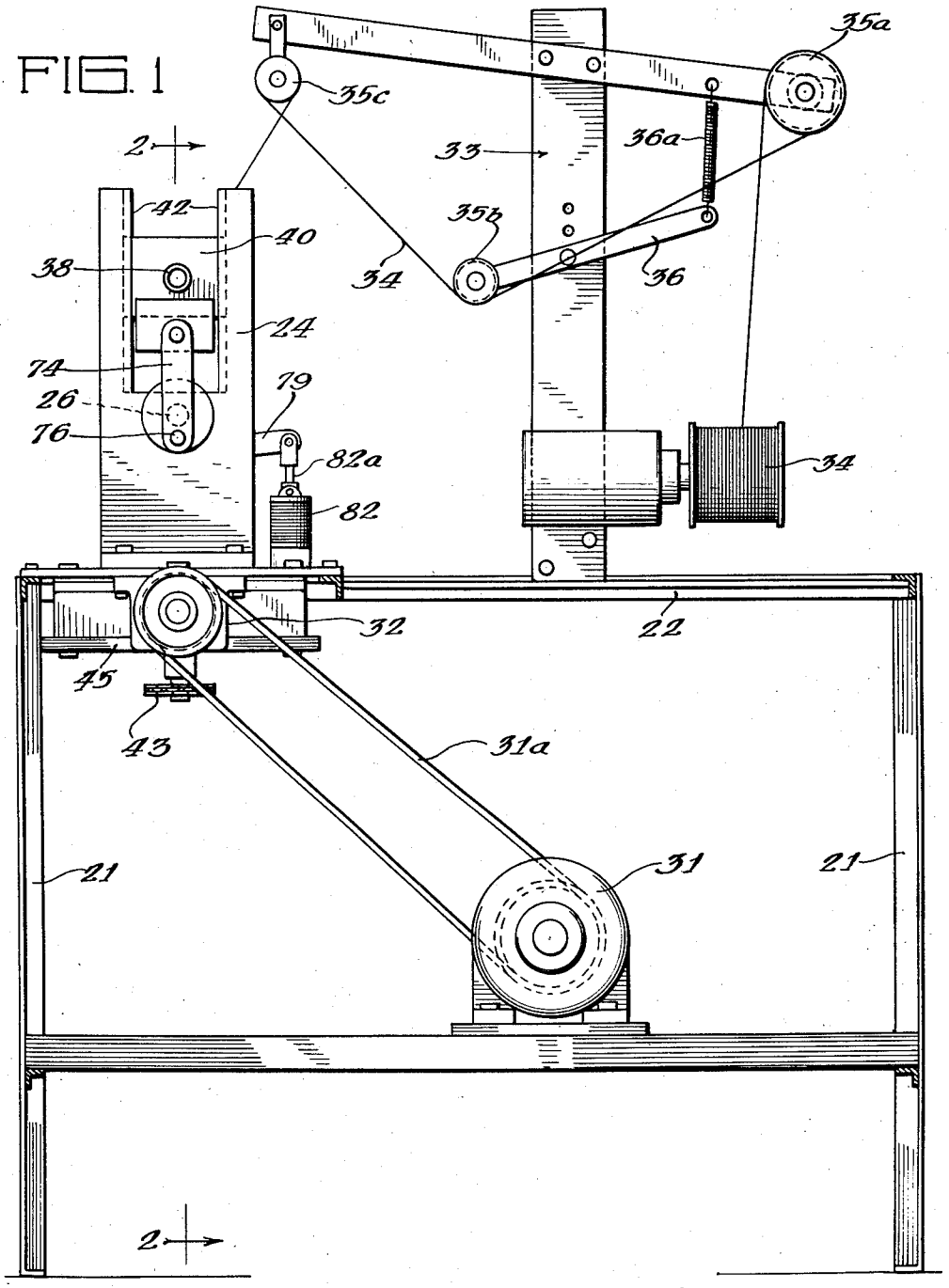
Feb. 5, 1957 W. H. STEGER 2,780,246

COIL WINDING MACHINE

Filed Dec. 14, 1955 5 Sheets-Sheet 1

FIG. 1



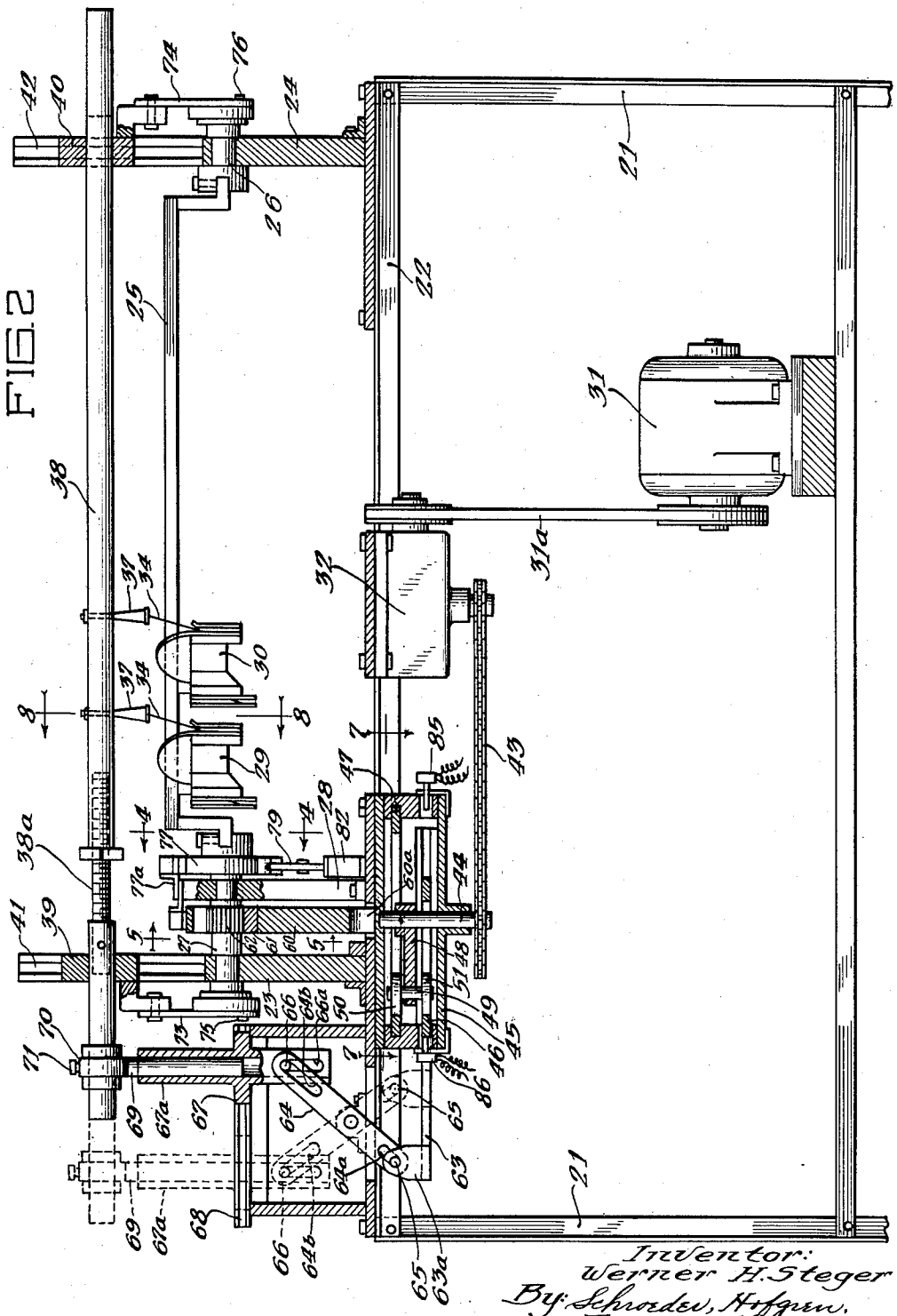

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Feb. 5, 1957 W. H. STEGER 2,780,246

COIL WINDING MACHINE

Filed Dec. 14, 1955 5 Sheets-Sheet 2

FIG. 2



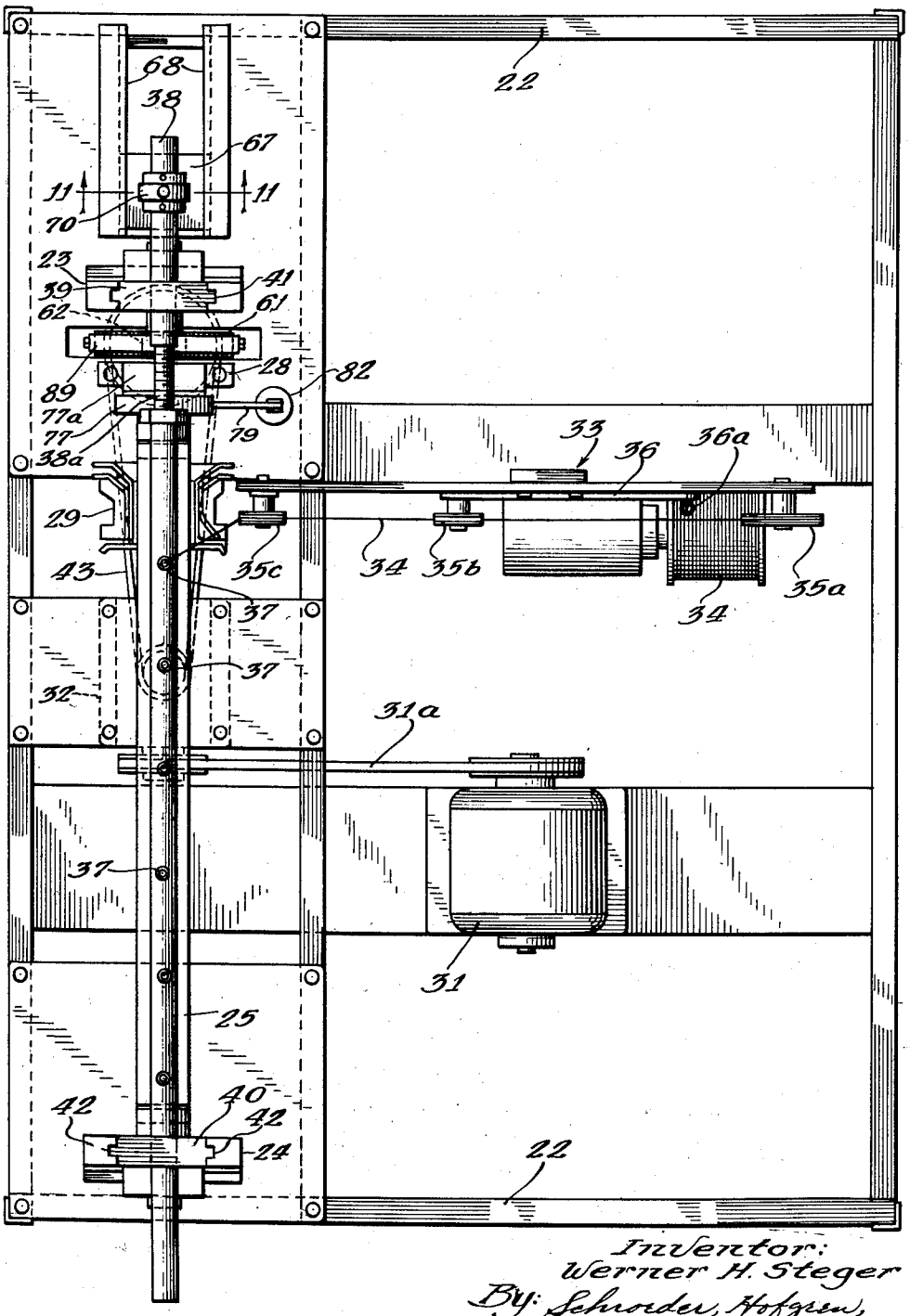
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COIL WINDING MACHINE

Filed Dec. 14, 1955 5 Sheets-Sheet 3

FIG. 3




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Feb. 5, 1957 W. H. STEGER 2,780,246

COIL WINDING MACHINE

Filed Dec. 14, 1955 5 Sheets-Sheet 4

FIG. 4

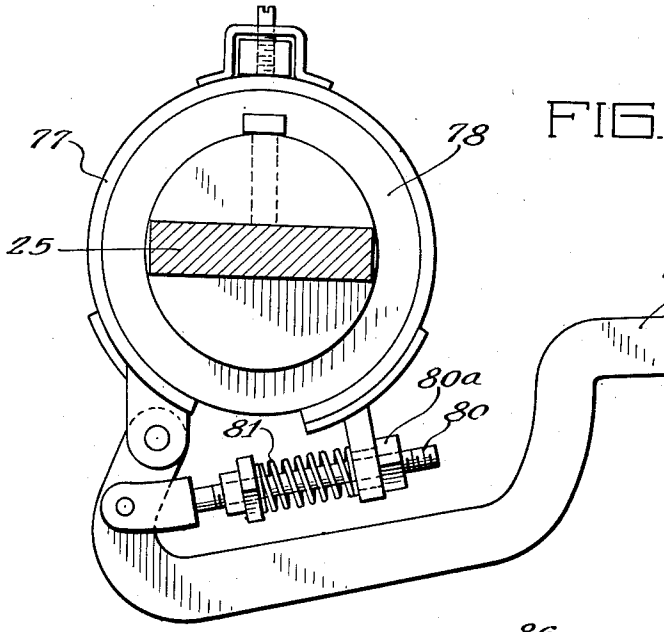



FIG. 6

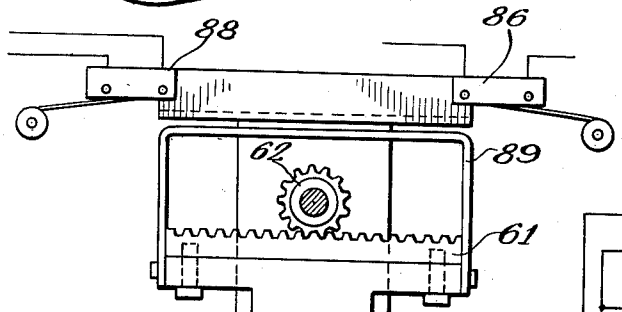
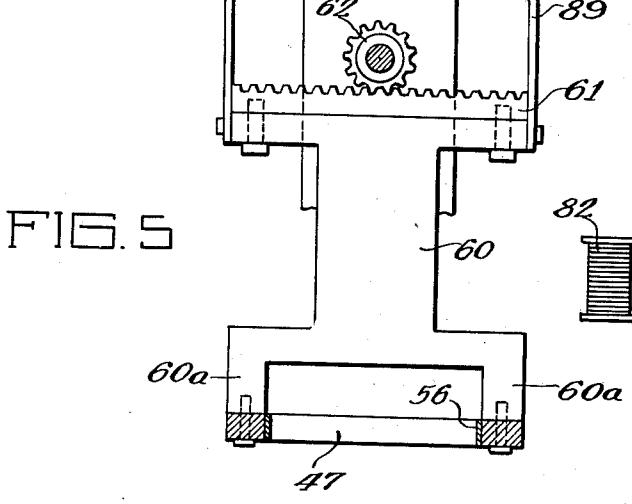
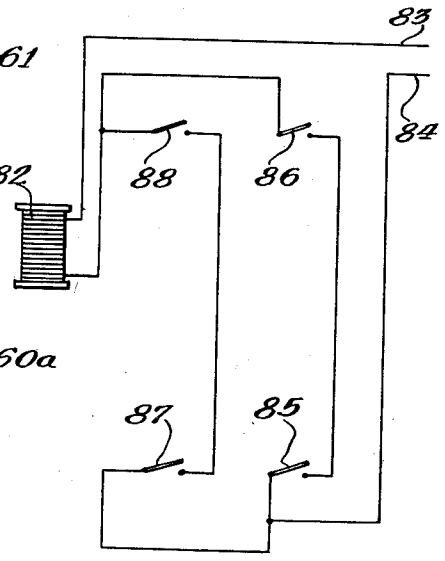



FIG. 5




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Feb. 5, 1957 W. H. STEGER 2,780,246

COIL WINDING MACHINE

Filed Dec. 14, 1955 5 Sheets-Sheet 5

FIG. 7

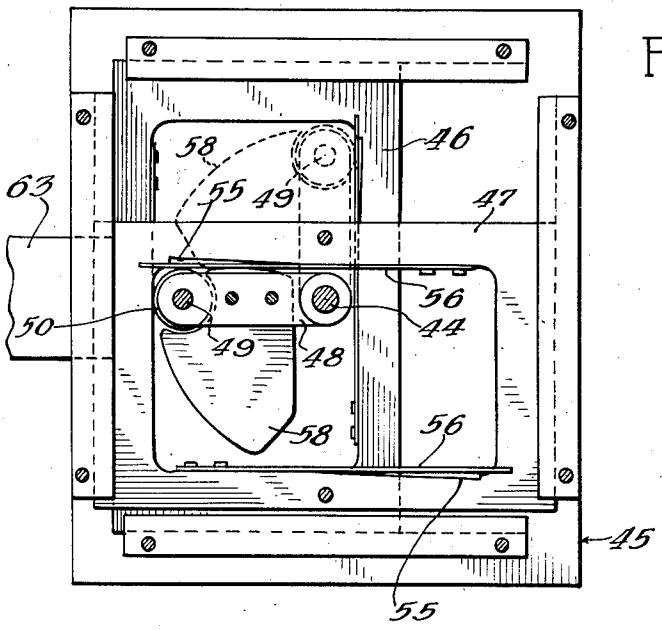



FIG. 8

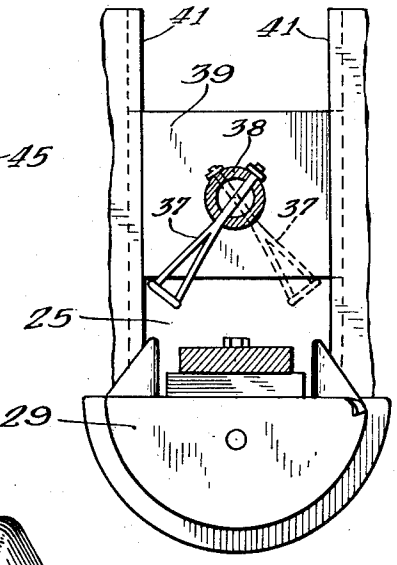



FIG. 9

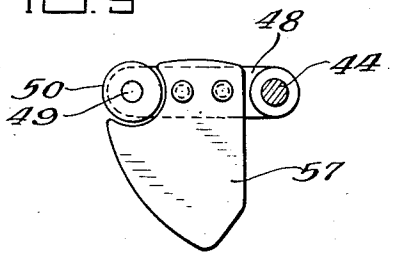
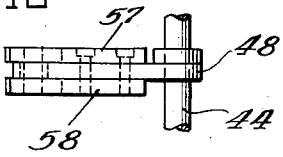



FIG. 10



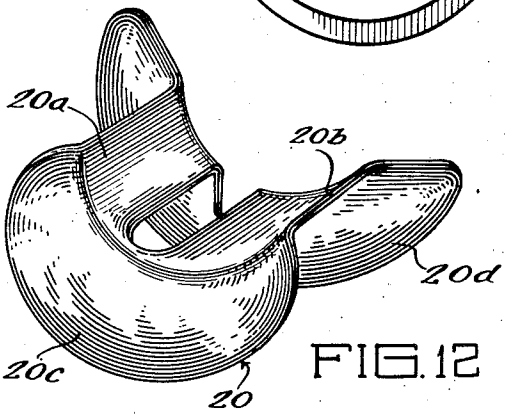
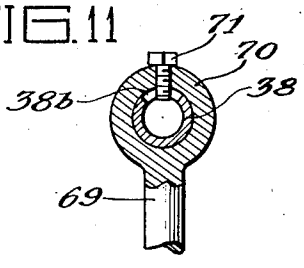




FIG. 12

FIG. 11




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2,780,246

# COIL WINDING MACHINE

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Application December 14, 1955, Serial No. 553,067

16 Claims. (Cl. 140—92.2)

This invention is concerned with a machine for winding beam deflection coils, particularly for use in television receivers.

One object of the invention is to provide a machine comprising a rotatable support adapted to have an elongated coil form mounted thereon, a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto, a first drive means for effecting intermittent rotational reciprocation of the coil form support, and a second drive means for effecting intermittent longitudinal reciprocation between the wire guide and the coil form support. Another object is to provide such a machine in which the coil form is mounted eccentrically with respect to the axis of rotation of the support. A further object is to provide first drive means which also effect movement of the wire guide away from and toward the axis of the coil form support during rotation of the support.

Still another object is to provide a first drive means which causes rotation of the support of less than 360°. Yet a further object is to provide a brake for stopping rotation of the coil form support and which is operated in accordance with the operation of the drive means.

The apparatus of the invention is illustrated in a preferred embodiment in the accompanying drawings, in which:

Figure 1 is an end elevational view of the coil winding machine;

Figure 2 is a vertical sectional view taken longitudinally through the machine substantially along line 2—2 of Figure 1;

Figure 3 is a top plan view thereof;

Figure 4 is an enlarged sectional view taken substantially along line 4—4 of Figure 2;

Figure 5 is an enlarged sectional view taken along line 5—5 of Figure 2;

Figure 6 is a schematic diagram of the brake control circuit;

Figure 7 is an enlarged sectional view taken substantially along line 7—7 of Figure 2;

Figure 8 is an enlarged sectional view taken substantially along line 8—8 of Figure 2;

Figure 9 is a top plan view of the drive cam;

Figure 10 is a side view thereof;

Figure 11 is a fragmentary sectional view of the wire guide support rod drive connection; and

Figure 12 is a perspective view of a coil wound on the machine.

The advent of television has created an ever increasing demand for the deflection coils which are placed around the neck of a cathode-ray picture tube of television receivers and have currents supplied thereto which in turn control the deflection of the electron beam to sweep the face of the tube. In Figure 12, a representative coil segment **20** of a deflection coil assembly is shown. It will be understood that the deflection coil assembly is made up of a plurality, usually four, such coil segments spaced around the neck of the tube. The coil segment **20** has



elongated portions **20***a* and **20***b* which extend longitudinally of the cathode-ray tube neck and are joined at either end of the coil by arcuate or fan-shaped portions **20***c* and **20***d*. The portion **20***d* in the coil shown is formed so that it will fit snugly about the enlarged body of the cathode-ray picture tube forwardly of the neck portion thereof.

Turning now to Figures 1, 2 and 3 of the drawings, the coil winding machine is shown mounted on a stand including legs **21** and cross members **22**. A pair of spaced upright members **23** and **24** are mounted at either end of the stand. A coil form support member or arbor **25** is rotatably carried on aligned shaft segments **26** and **27** which are journalled in bearings provided in upright members **23** and **24**, respectively. A third upright member **28** provides an auxiliary bearing for shaft segment **27**. The arbor **25** has secured thereto a plurality of coil forms, as **29** and **30**, which are suitably constructed to form the wire wound thereon into the configuration desired, as for example that shown in Figure 12. It will be noted that arbor **25** is eccentrically mounted with respect to the axis of shaft segments **26** and **27**. This compensates for the irregular shape of the coil form and places the center of gravity approximately on the axis of rotation.

A wire feeding mechanism indicated generally as **33** is mounted on the stand alongside coil form **29**. Only one mechanism is shown in the drawings in the interest of simplicity, it being understood that in practice there will be a similar feeding mechanism provided for each of the coil forms carried on the coil form support **25**. The wire feeding mechanism includes a coil of wire **34** and a plurality of sheaves **35***a*, **35***b* and **35***c* around which the wire is strung. Sheave **35***b* is carried at one end of a pivotally mounted arm **36** and is urged against the wire **34** by a spring **36***a* to maintain the necessary tension. The wire leaving sheave **35***c* passes through a wire guide loop **37** to the coil form **29**. Wire guide **37** is carried on a rod **38** slidingly carried in a pair of blocks **39** and **40**, for reciprocation longitudinally of the machine. The blocks **39** and **40** are slidably mounted in vertical guides **41** and **42**, respectively, provided on the end members **23** and **24**. The wire feed sheave **35***c*, wire guide **37** and coil guide **29** are so positioned that the wire **34** is not excessively bent as it passes through the guide and to the coil form **29**.

The machine is driven by an electric motor **31** connected by a belt drive **31***a*, transmission **32** and chain drive **43** to a rotating drive shaft **44** which extends upwardly into a housing **45**. Carried within the housing **45** are two yoke members **46** and **47** each of which comprises an open centered rectangular frame slidably carried in suitable guides within the housing. As best seen in Figure 7, the lower yoke **46** is mounted for sliding movement longitudinally of the machine while the upper yoke **47** is mounted for movement transversely thereof. The rotating drive shaft **44** extends through the openings formed by the rectangular yoke frames **46** and **47** and has mounted thereon cam means including an arm **48** which extends radially of the shaft between the yokes **46** and **47**. A pin **49** extends vertically through outer end of arm **48** and has mounted thereon rollers **50** and **51**, one being above the arm and the other below. As the drive shaft **44** rotates, the rollers **50** and **51** successively engage opposite interior surfaces of the rectangular yokes **46** and **47**, moving them alternately back and forth in their respective guides.

The inner wall of each frame is relieved adjacent the point at which the roller strikes it, as indicated at **55** on yoke **47**. A strip of spring steel **56** is bolted to the interior of the yoke frame opening opposite the point of roller impact and has its free end inserted in a slot pro-

vided in the yoke. The spring steel strip thus cushions the impact of the roller on the yoke frame. Mounted on either side of the arm 48 are cam members 57 and 58 which trail behind the arm as it rotates in a clockwise direction as viewed from above, preventing each of the yokes from moving away from its limiting position for slightly less than a quarter turn of the shaft.

A rack support 60 is provided with depending legs 60*a* which extend through openings in top of housing 45 and are secured to the upper yoke 47. A rack 61 is carried by the rack support and engages a pinion 62 affixed to shaft segment 27. Thus, as yoke 47 is caused to move back and forth under the action of the cam means carried on drive shaft 44, rotary reciprocation of the coil form support 25 is effected. Coil form support is rotated slightly less than a full turn, and preferably about 330°.

Secured to the lower yoke 46 is arm 63 which has an upturned ear 63*a* at the end thereof. A lever arm 64 is pivotally mounted, at a point intermediate its ends, and is provided at its lower end with a slot 64*a* which engages a pin 65 affixed to the ear 63*a*. The opposite end of lever arm 64 is provided with a similar elongated slot 64*b* which engages a pin 66 carried by a plate 67 slidably mounted in guideways 68 for movement longitudinally of the machine. Extending upwardly from plate 67 is a bushing 67*a* which slidably receives a rod 69 that has formed at its upper end a collar portion 70 through which the end of wire guide support rod 38 passes. A bolt 71 is threaded through collar 70 and engages rod 38 locking the two together for longitudinal movement. As yoke 46 is caused to move back and forth under the action of the cam means carried on the drive shaft 44, longitudinal reciprocation of the wire guide support rod 38 is effected; and this longitudinal reciprocation and the rotary reciprocation of the coil form support 25 occur alternately. Pin 66 is mounted in an elongated slot 66*a* permitting adjustment of the longitudinal movement of rod 38.

It is desirable that the wire guide 37 be mounted as close to the coil form 29 as possible so that wire breakage is minimized. However, the coil form is not symmetrical with the axis of rotation of the coil form support and, in order to keep the wire guide as close as possible to the form at all times, the wire guide support rod 38 is mounted in sliding blocks 39 and 40, as previously described. A pair of cranks 73 and 74 are connected between eccentric pins 75 and 76, carried on the shaft segments 27 and 26, and the sliding blocks 39 and 40. Thus, as the coil form 29 is rotated the wire guide 37 is raised and lowered in synchronism therewith. The longitudinal position of the wire guides 37 may be varied simultaneously by adjusting the threaded section 38*a* in rod 38.

A brake is provided to stop the rotational movement of the coil form support and reduce the mechanical pounding of the upper yoke 47 which would otherwise occur, due in part to the rather great weight of the rotating coil forms. The brake includes a split band 77 carried by a bracket 77*a* mounted on upright member 28 and encircling brake disc 78 carried on the shaft segment 27. A lever arm 79 is pivotally connected to one end of the band 77 and is connected through a link 80 to the other end. A spring 81 mounted on the link urges the ends of the band apart, out of contact with disc 78. The free end of lever arm 79 is connected to the armature 82*a* of a solenoid 82 which when energized draws the armature downwardly causing the brake band to engage disc 78. When the energization circuit of the solenoid 82 is broken, arm 79 is released and spring 81 insures release of the brake. The tension applied by the brake may be adjusted by a nut 80*a* on link 80.

The energization circuit for the solenoid 82 is shown in Figure 6 and includes a pair of leads 83 and 84 which may be connected to a suitable source of power (not shown). Two parallel energization circuits are provided,



the first including series connected switches 85 and 86, and the second including series connected switches 87 and 88. Switches 85 and 86 are mounted on either side of housing 45 (Figure 2) to be engaged by lower yoke 46 at either end of its travel. Switches 86 and 88 are mounted on bearing support 28 for engagement with a switch operating extension 89 carried above the rack 61, and are closed when the rack is at either end of its path of travel. Assuming that switch 85 has just closed, i. e., that yoke 46 is in its right-hand position as viewed in Figure 2, the next movement of the drive mechanism moves the rack 61 to the right as viewed in Figure 5. As the rack nears the end of its path of travel, switch 86 is closed energizing brake solenoid 82 and applying the brake to the rotating coil support. Before the rack is again moved in the opposite direction, however, lower yoke 46 has been moved to the left position (Figure 2), switch 85 opened and switch 87 closed. Thus when the coil form support starts to turn, the brake has been released.

The over-all operation of the machine will now be considered briefly. The desired number of coil forms are secured to support member 25 and the end of wire 34 from the individual wire feed mechanisms secured to each. The machine then may be placed in operation. The coil forms are first rotated to form the wire into end portion 20*c* of the coil segment; then the wire guide rod 38 is traversed longitudinally to the dotted line position shown in Figure 2 forming the wire into the longitudinally extending portion 20*a* of the coil segment. The coil forms are then rotated forming the next portion of wire into a conductor in the coil segment 20*d* and the wire guide rod 38 traversed in the opposite direction to form a conductor in coil segment 20*b*. The operation is then repeated until the desired number of turns are placed on the coil form.

Referring to Figures 8 and 11, it will be seen that wire guide 37 is permitted to oscillate through a limited arc as the coil form support 25 rotates, permitting the wire 34 to align itself between sheave 35*c* and the coil form. This is accomplished by providing a circumferential slot 38*b* in wire guide support rod 38 into which the drive bolt 71 extends.

The foregoing detailed description is given for clearness of understanding only and no unnecessary limitations are to be understood therefrom, as some modifications will be obvious to those skilled in the art.

I claim:

1. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a first drive means for effecting intermittent rotational reciprocation of said coil form support; and a second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support.

2. A coil winding machine of the character described in claim 1, wherein said first and second drive means are interconnected to operate alternately.

3. A coil winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon, the coil form being mounted eccentrically with respect to the axis of rotation of the support; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a first drive means for effecting intermittent rotational reciprocation of said coil form support; and a second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support.

4. A coil winding machine of the character described in claim 3, wherein the first drive means effects movement of the wire guide away from and toward the axis of

rotation of the coil form support during rotation of the coil form support.

5. A coil winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a first drive means for effecting intermittent rotational reciprocation of said coil form support, the rotation of said support being less than 360°; and second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support.

6. A coil winding machine of the character described in claim 5, wherein said first drive means effects rotation of the coil form support of the order of 330°.

7. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a first drive means for effecting intermittent rotational reciprocation of said coil form support; a second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support; and a brake for stopping rotation of said coil form support.

8. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a first drive means for effecting intermittent rotational reciprocation of said coil form support; a second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support; an electric brake for stopping rotation of said coil form support; and a circuit for operating said brake and including switches operated in accordance with the operation of said first and second drive means.

9. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto, the wire guide being movably mounted to align itself with the wire during feeding thereof; a first drive means for effecting intermittent rotational reciprocation of said coil form support; and a second drive means for effecting intermittent longitudinal reciprocation between said wire guide and coil form support.

10. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide adjacent said coil form support and adapted for relative longitudinal movement with respect thereto; a rotating drive shaft; a first yoke connected to said rotatable support; a second yoke connected to said wire guide; and a cam on said drive shaft for alternately reciprocating said yokes to cause alternate rotational reciprocation of the coil form support and longitudinal reciprocation of the wire guide.

11. A coil winding machine of the character described in claim 10, wherein said yokes have a resilient buffer portion against which said cam strikes.



12. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide mounted adjacent said coil support on a rod movable longitudinally thereof; a rotating drive shaft; a first yoke; a rack and pinion connected between said first yoke and said rotatable coil form support; a second yoke; a lever connected between said second yoke and said rod; and a cam on said drive shaft for alternately reciprocating said yokes to effect alternate rotational reciprocation of the coil form support and longitudinal reciprocation of the wire guide support rod.

13. A machine of the character described in claim 12, wherein said wire guide support rod has limited rotational freedom whereby the wire guide may align itself with the wire.

14. A coil winding machine of the character described in claim 12, wherein said wire feed support rod is adjustable longitudinally.

15. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon, the coil form being mounted eccentrically with respect to the axis of rotation of the support; a wire feed including a wire guide mounted adjacent said coil form support on a longitudinally movable rod, the rod being carried in supports movable away from and toward the coil form support; a rotating drive shaft; a first yoke connected to said rotatable coil support; a second yoke connected to said wire guide rod; a cam on said drive shaft for alternately reciprocating said control yokes to cause alternate rotational reciprocation of the coil form support and longitudinal reciprocation of the wire guide rod; and a crank connected between said coil form support and wire guide rod for effecting movement of said rod away from and toward the coil form support during rotation of the coil form support.

16. A winding machine for beam deflection coils, comprising: a rotatable support adapted to have an elongated coil form mounted thereon; a wire feed including a wire guide mounted adjacent said support on a rod movable longitudinally thereof; a rotating drive shaft; first drive means including a first yoke connected with said coil form support by a rack and pinion; second drive means including a second yoke connected with said wire guide rod by a lever; a cam on said drive shaft for alternately reciprocating said yokes for effecting alternate rotational reciprocation of said coil form support and longitudinal reciprocation of said wire guide support rod; an electrically operated brake associated with said coil form support; a circuit, including a plurality of switches associated with said drive means, for energizing said brake at the end of each period of rotation of the coil form support.

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