July 31, 1962 J. T. McNANEY 3,047,759

CATHODE-RAY TUBE STRUCTURE

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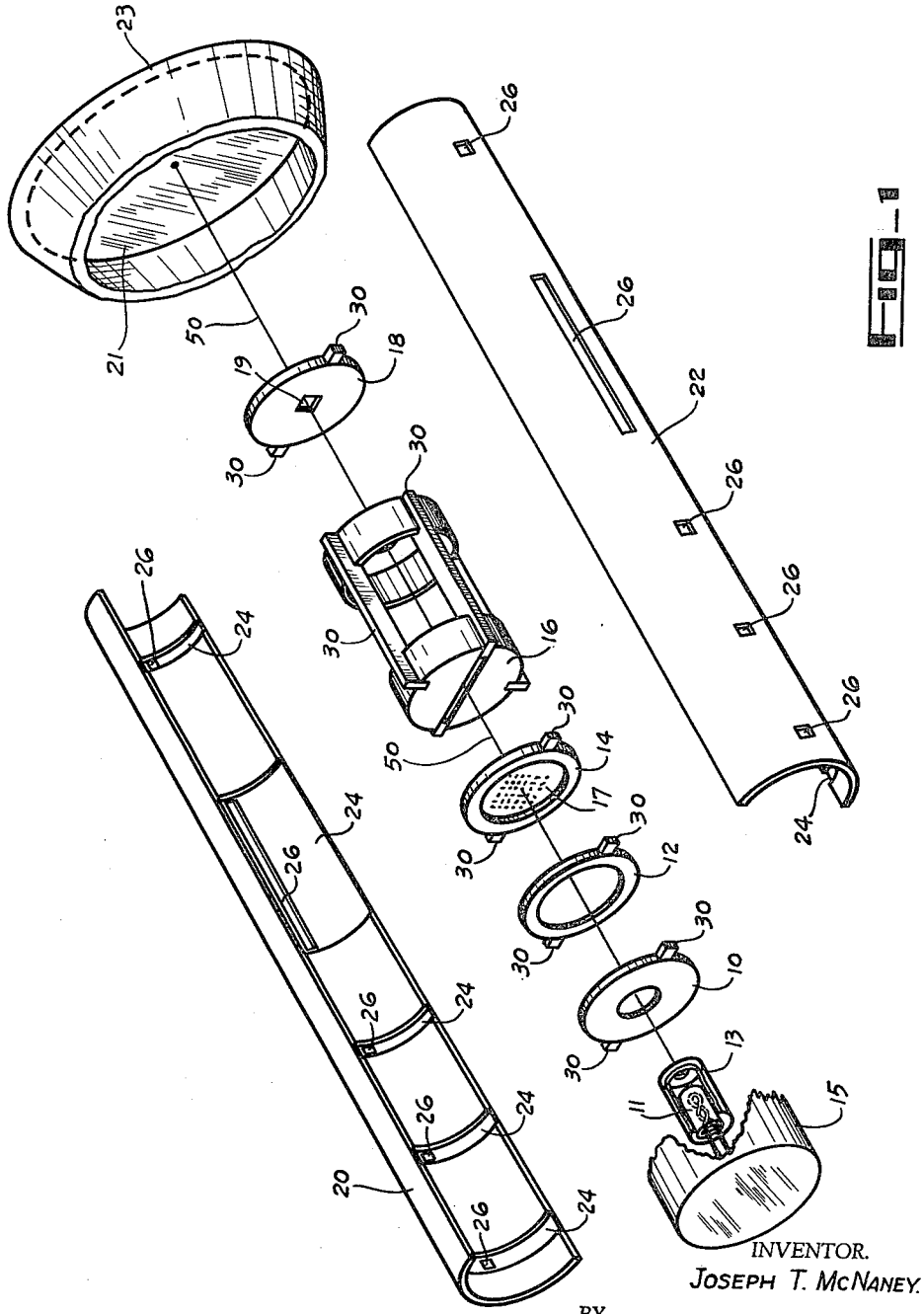


FIG. 1

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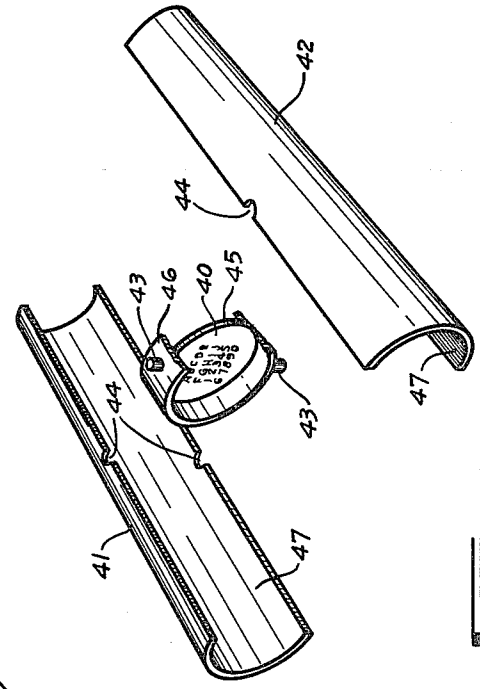


FIG. 3

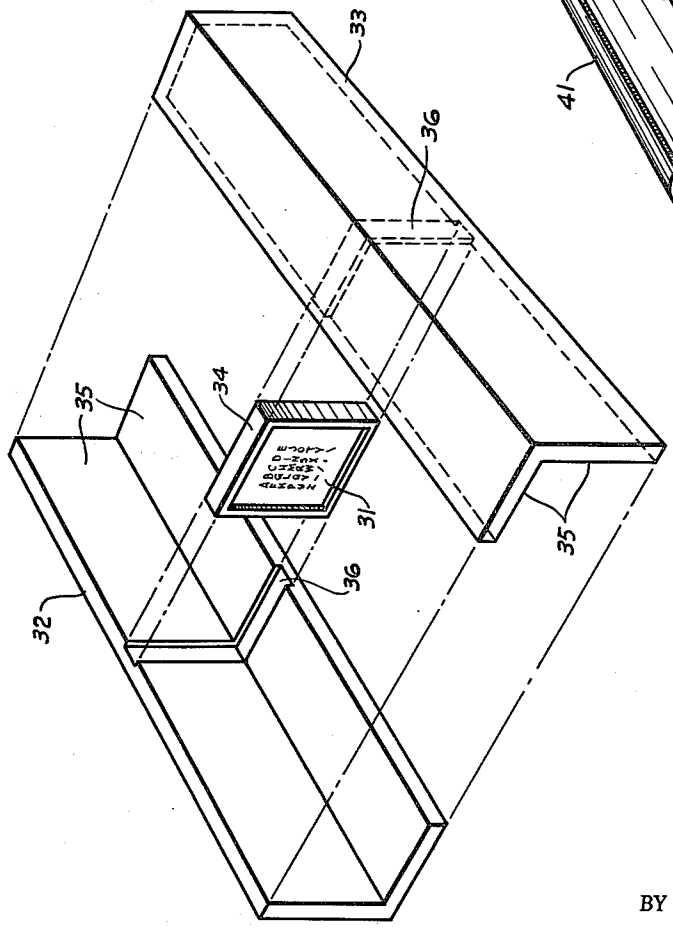


FIG. 2

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CATHODE-RAY TUBE STRUCTURE

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5 Claims. (Cl. 313—82)

This invention relates generally to cathode-ray tube structure and more particularly to cathode-ray tube electron gun construction and assembly techniques.

The invention has general utility in cathode-ray devices containing complex beam generating, forming, or deflection systems, but is of particular advantage in the improvement of the internal structure of cathode-ray tubes known as shaped beam tubes.

The shaped beam tube comprises an evacuated envelope having at one end a beam generating means, at the other end a screen coated on the inside with an electron sensitive phosphor. Intermediate the two ends is a character forming matrix which subdivides the electron beam into a plurality of character shaped streams. Intermediate the matrix and the screen is a means for selecting specific streams for projecting onto the screen in response to an input code. The selection means itself may comprise one or more electrostatic lenses, a series of deflection coils or plates, and an aperture plate, as described fully in U.S. Patent No. 2,761,988, issued to Joseph T. McNaney and assigned to the common assignee hereof. In order that successive indicia may be precisely registered or located on the screen, the structural elements within the shaped beam tube must be assembled and maintained in rigid and precise alignment.

It is accordingly an object of this invention to provide a cathode-ray tube structure having improved alignment accuracy.

Another objective is to provide a complex cathode-ray tube electron gun structure which can easily be assembled in proper alignment.

Still another objective is to provide a relatively inexpensive cathode-ray tube structure.

Further objectives and an appreciation of the invention are obtainable on examination of the following description in conjunction with the drawings in which:

FIGURE 1 is an exploded view, showing a typical assemblage of shaped beam tube elements fabricated according to the invention;

FIGURE 2 is an exploded fractional view of another embodiment; and

FIGURE 3 is an exploded fractional view of still a third embodiment.

Briefly, the invention comprises a cathode-ray tube structure in which each of a series of electron optical elements within a cathode-ray tube is fabricated so as to have a periphery which cooperates with two appropriately shaped longitudinal members for the purpose of accurately positioning the electrical elements in rigid alignment. The assembled longitudinal members form a tubulation which may be an integral part of the envelope of a cathode-ray tube or which may be mounted within the cathode-ray tube envelope.

Referring now to the drawing for a more detailed description, FIGURE 1 is an exploded view of one embodiment showing the various elements of a shaped beam tube fabricated according to the invention into an electron gun structure.

The electrode members to which direct current and/or control potentials are applied, hereinafter designated as electron optical elements, are shown aligned along the longitudinal axis **50** of a cathode-ray tube (shown in part). The various optical elements function in a shaped beam

cathode ray tube in the manner substantially as shown in U.S. Patent No. 2,761,988 and as described hereinafter. A cathode **11** and control grid **13** are separately mounted adjacent one end of the cathode-ray tube envelope **15**. The optical elements shown are a first anode **10** for accelerating and effecting a first crossover of the electron beam, a convergence lens **12** for reconverging the electron beam at a second crossover point, a character matrix **14** containing a plurality of character shaped openings **17** and located intermediate the cathode and the second crossover point for forming the electron beam into a pluraltiy of streams, a selection unit **16** located at the second crossover point for redirecting the plurality of electron streams, and an aperture plate **18** having a central aperture **19** which is large enough to permit only one shaped electron stream to pass therethrough. The selected electron stream impinges on a target **21** such as an electron sensitive phosphor on the inside surface of the cathode-ray tube faceplate **23**. Although the selection unit **16** as shown herein functions in the manner of the normal type of electrostatic deflection plates, any suitable type of deflection system may be used such as a coplanar type of deflection system.

Two tubular or semitubular members **20** and **22**, made of glass, metal, or any other rigid material suitable for inclusion in a cathode-ray tube, serve as structural supports and longitudinal spacers for the optical elements **10**, **12**, **14**, **16** and **18**. The two tubular members **20** and **22** cooperate to form a long tube in which the optical elements are mounted. Annular grooves **24** are cast or machined on the inside of each tubular member **20** and **22** to accept the peripheral portions of the respective optical elements. The grooves **24** are oriented transversely to the axis of the tubulation and their location along the axis is precisely calculated for optimal display of the projected indicia.

Assembly consists of inserting the optical elements into the grooves in one of the two tubular members and then fitting the other tubular member into place. The edges of the two tubular members **20** and **22** are spot welded or otherwise connected, after assembly.

It is especially important in shaped beam tubes to align the various optical elements with extreme angular accuracy. The effect of angular misalignment of the selection system relative to the character matrix would be at best poor registration of the visual output on the screen and at worst incorrect translation of the input code. To establish and maintain correct angular orientation of the optical elements, there is provided keying elements **30** protruding from the periphery of each optical element. The keying elements **30** cooperate with a pair of corresponding keyways **26** in the tubular members **20** and **22**. The keying elements **30** may also serve as electrical conductors for energizing the optical elements. While two keying elements **30** are shown, it is within the scope of the invention to use only one keying element to provide circumferential stability within the tubular members **20** and **22**. However, the use of two keying elements **30** presents advantages over the use of a single keying element in that greater circumferential stability is obtainable and also the two elements provide easier orientation of the optical elements with the tubular members aiding in the alignment and joint assembly of the tubular members **20** and **22**.

FIGURE 2 is an exploded fractional view of an embodiment in which rotation of the electron optical element **31** within the tubular members **32** and **33** is prevented by another means. Both the periphery **34** of the optical elements **31** and the inside surface **35** of the tubular members **32** and **33** have a cooperating out-of-round configuration, shown in the figure as a square, but not limited thereto. Grooves **36** on the inside surface of the tubular members

cooperate with the periphery 34 of the optical members 31 to establish accurate longitudinal spacing, as before.

FIGURE 3 is an exploded fractional view of an embodiment in which rotation of each optical element 40 within the tubulation 41 and 42 is prevented as in FIGURE 1 by keying members or pins 43 protruding radially from each optical element 40 so as to cooperate with corresponding keyways or holes 44 in the tubular members 41 and 42. The keyways 44 in this embodiment serve also to locate the optical elements 40 precisely along the longitudinal axis of the tubulation formed by the mating of the two tubular members 41 and 42. Lateral instability or twisting of the optical elements in this embodiment is prevented by providing the periphery 45 of each optical element 40 with a secured to thickness or flange 46 which cooperates with the inner surfaces 47 of the tubular members 41 and 42. As stated in regard to the embodiment shown in FIGURE 1, one of the pins 43 may also be eliminated in this embodiment with the aforesaid attendant loss of advantages.

Although the invention has been described with a degree of particularity, it should be understood that the present disclosure has been made only by way of example and that numerous changes may be made in the configuration and arrangement of the structural components without departing from the spirit and scope of the invention, as hereinafter claimed.

I claim:

1. An electron gun construction capable of use in a cathode-ray tube comprising a plurality of electron optical elements, said elements having functions that require that they bear a proper angular orientation with respect to each other in order to properly coact, a pair of semitubular members having corresponding recesses displaced along their lengths, said members being capable of being joined together into a tubular member, each of said optical elements having means capable of coacting with at least one of said corresponding recesses for securing said elements at predetermined positions along said length of said members and means for angularly positioning said elements within said recesses in a fixed angular position which provides said proper angular orientation with respect to the other of said elements and prevent rotational movement of said elements in said tubular member when said members are joined together into said tubular member.

2. An electron gun construction capable of use in a cathode-ray tube comprising a plurality of electron optical elements, a plurality of rigid partially tubular elements joined to form a tubular member capable of securing said elements into an electron beam forming gun, said tubular member having displaced along its length a plurality of keyway arrays equal in number to said plurality of electron optical elements, each of said optical elements having at least one keying element capable of coacting with one of said keyways for securing said optical elements at predetermined positions along the length of said tubular member.

3. An electron gun construction capable of use in a cathode-ray tube comprising a plurality of electron optical elements, a cylindrical member capable of securing said elements into an electron beam forming gun, said cylindrical member having displaced along its length a like plurality of pairs of keyways, each of said optical elements having a pair of keying elements capable of coacting with one of said pairs of keyways for securing said optical elements at predetermined positions along the length of said cylindrical member, each of said optical elements having an outer configuration corresponding to the inner configuration of said cylindrical member and means causing said optical elements to coact with the inner surface of said cylindrical member to provide lateral stability.

4. An electron gun construction capable of use in a cathode-ray tube comprising a plurality of electron optical elements, a pair of semi-cylindrical members, at least one of said members having keyways in their edge portions at displaced points along its length and having circumferential grooves in its inner surface at the point of each of said keyways, said members being capable of being joined together into a cylindrical member, said optical elements having a circular outer surface with a predetermined thickness corresponding to the width of said grooves and with at least one keying element projecting radially from said surface, said optical elements being adapted to be positioned in said grooves in a manner that said keying elements coact with said keyways and said optical members are secured along the length of said members when said semi-cylindrical members are joined together.

5. An electron gun construction capable of use in a cathode-ray tube comprising a plurality of electron optical elements of an electron beam forming gun, each of said elements having a circular outer surface with a predetermined thickness and with at least one keying element projecting radially from said surface, a pair of semi-cylindrical members adapted to be formed into a cylinder for securing said optical elements into said gun, each said semi-cylindrical member having a like plurality of keyways displaced along its inner length for receiving said keying elements of said optical elements, each said semi-cylindrical member also having a like plurality of circumferential grooves in its inner periphery, each aligned with one of said keyways and having a width corresponding to said thickness of respective ones of said optical elements for receiving said optical elements keyed to said respective keyways.

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