Oct. 6, 1959 K. C. CORMIA 2,907,367

ELECTRON DISCHARGE DEVICE ASSEMBLY APPARATUS

Filed Dec. 31, 1957 4 Sheets-Sheet 1

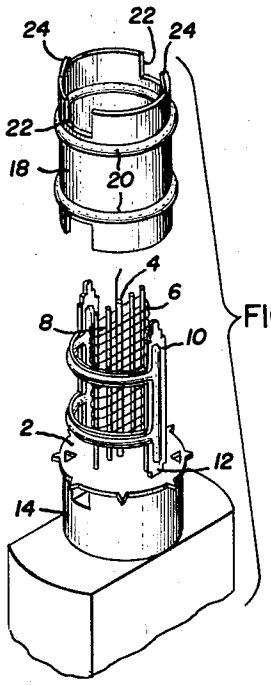


FIG. 1.

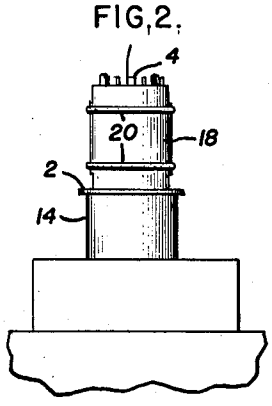
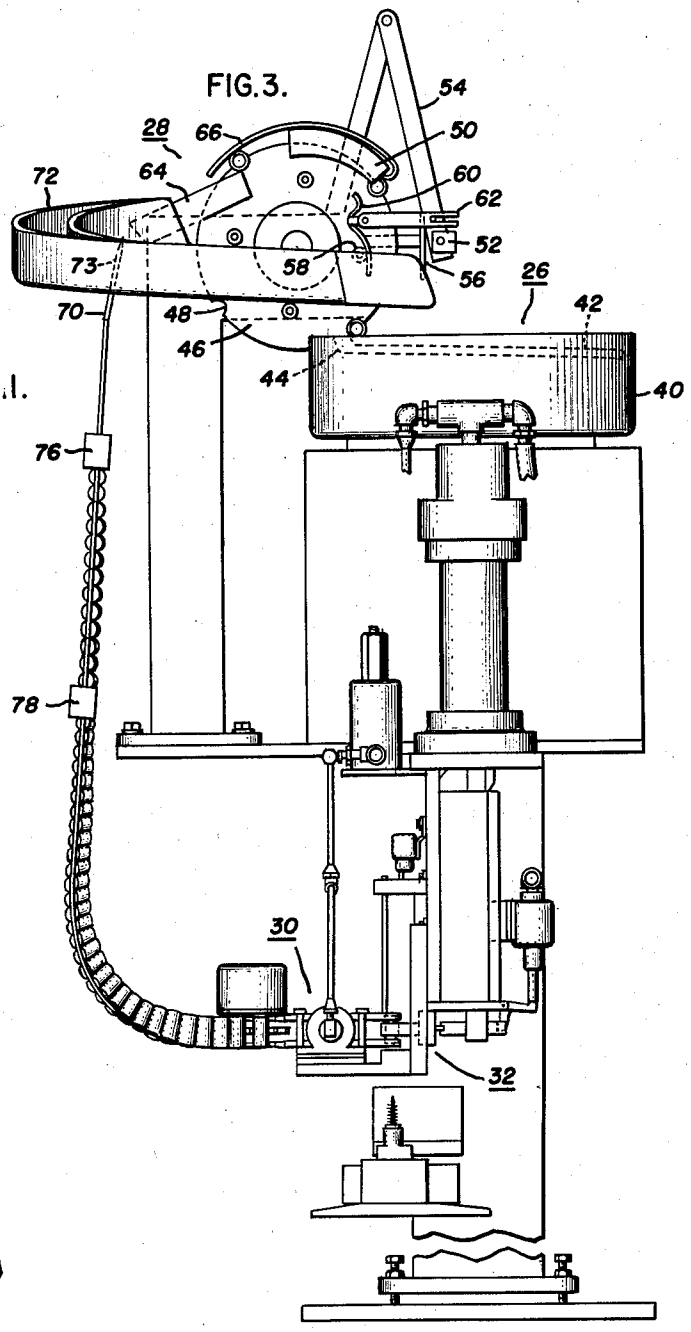


FIG. 2.

FIG. 3.



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ELECTRON DISCHARGE DEVICE ASSEMBLY APPARATUS

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FIG.4.

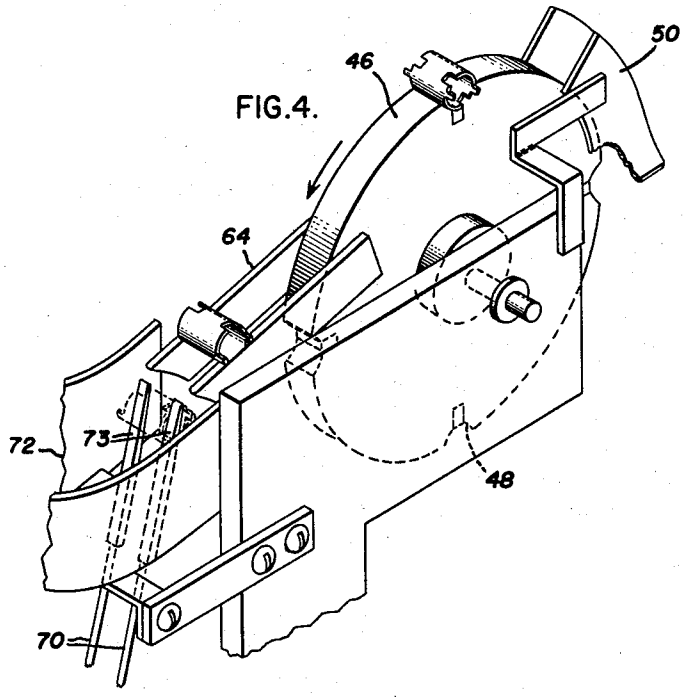
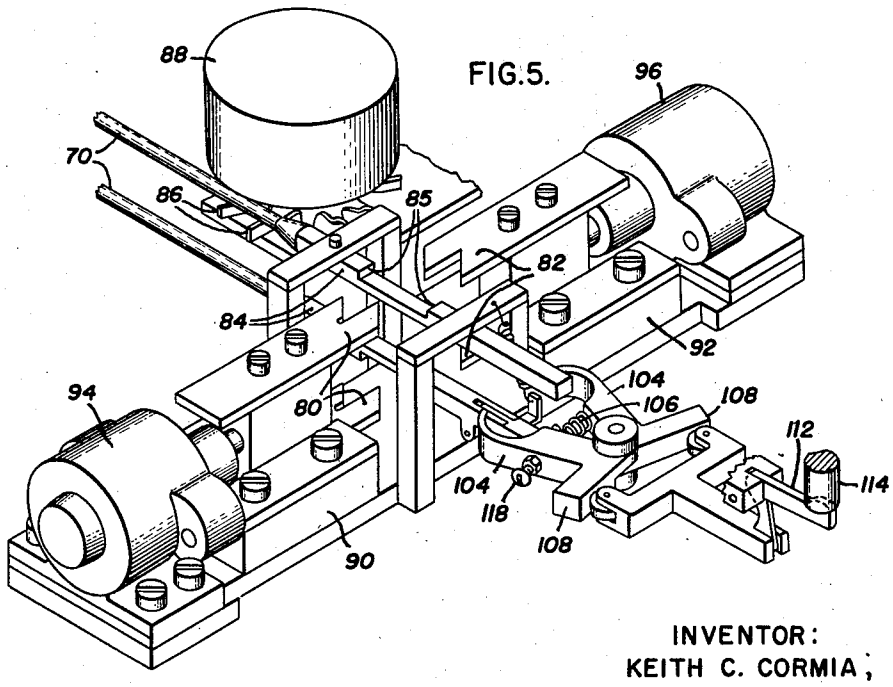


FIG.5.



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FIG.6.

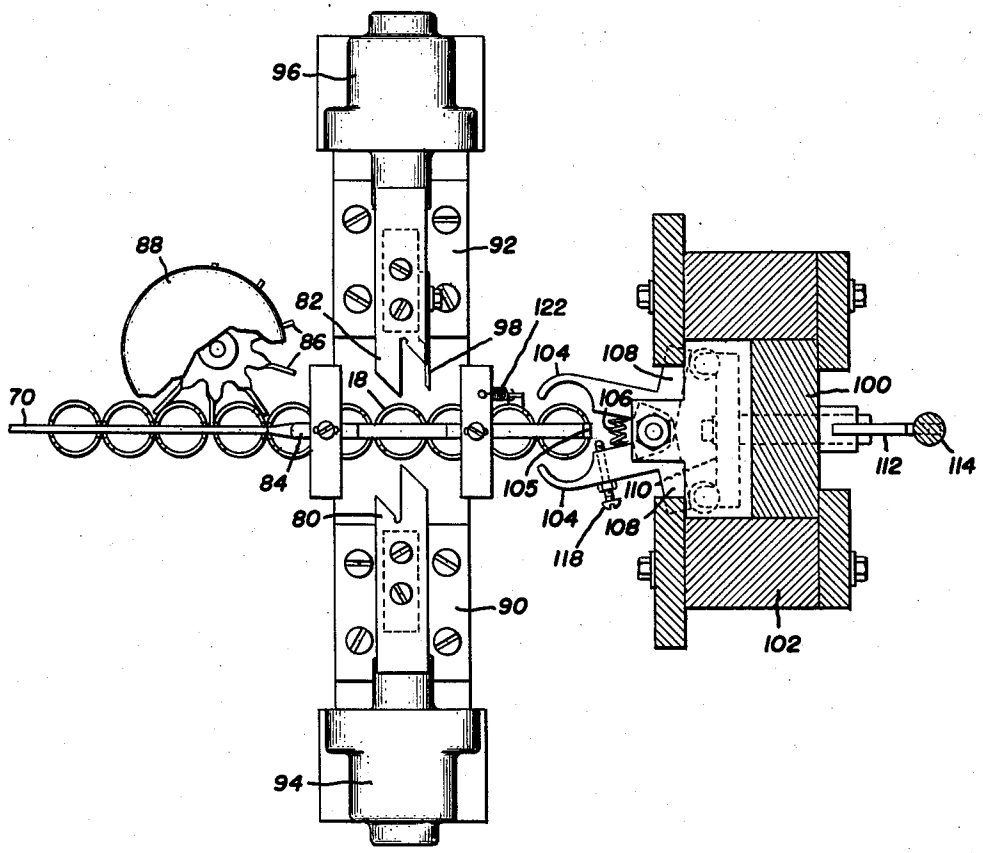
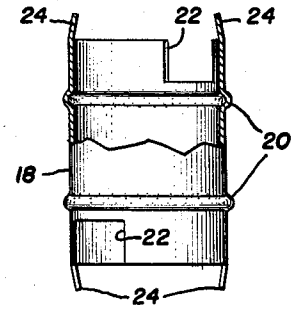


FIG.7.



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ELECTRON DISCHARGE DEVICE ASSEMBLY APPARATUS

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FIG.8.

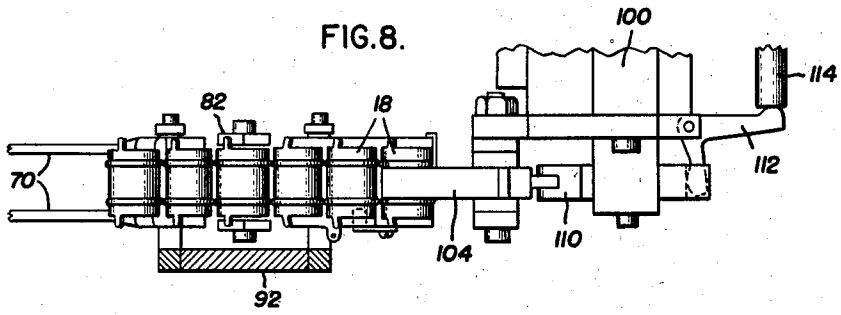
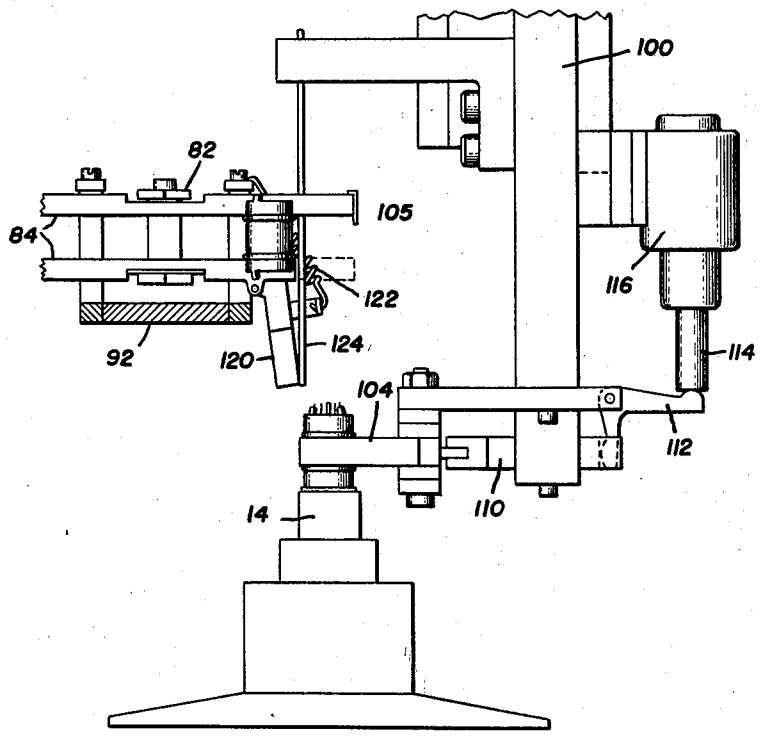


FIG.9.



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United States Patent Office 2,907,367 Patented Oct. 6, 1959

2,907,367

ELECTRON DISCHARGE DEVICE ASSEMBLY APPARATUS

Keith C. Cormia, Scotia, N.Y., assignor to General Electric Company, a corporation of New York

Application December 31, 1957, Serial No. 706,514

15 Claims. (Cl. 153—21)

This invention relates to the manufacture of electron discharge devices and more particularly to apparatus for automatically assembling electrodes and associated parts of such devices of the type, such as receiving tubes, wherein such parts are of small size and delicate nature. The invention has particular utility in connection with automatically assembling an outer electrode shield with a pre-assembled group of electrodes of an electron discharge device.

Electrodes and other associated parts of electron discharge devices such as receiving tubes are often of longitudinal hollow cylinder-like form, such as for example grids comprising helically coiled wire of cylindrical or cylinder-like outline, anodes of cylinder-like or particylinder-like form, and shields of cylinder-like form. Generally such parts are assembled and supported, usually in coaxial spaced relation, between transverse insulative plates such as thin plates of mica. The mica plates are formed with precisely located apertures through which the ends of the parts extend, and thus the micas afford firm support to the parts as well as permanently securing the parts in precisely spaced relationship for proper electrical operation of the discharge device with its intended electrical characteristics.

The desirability of eliminating costly hand operations in the assembly of such parts on a mass production scale has been recognized for sometime. However, although such an assemblage of parts has desirable electrical and mechanical properties, the small size and fragile nature of the parts involved, the need for adherence to relatively close tolerances in positioning and spacing of parts during assembly, and the resulting undesirability of using apparatus involving violent motion or large forces inherently makes many conventional types of apparatus unsuitable.

A principal object of the present invention is to provide apparatus for automatically installing electrodes and associated parts of electron discharge devices, such as receiving tubes, which apparatus will handle the parts at a rapid rate, suitable for automated production, yet reliably and with minimum risk of damage to the parts, and which will insure proper location of the assembled parts with the desired precision.

Another object is to provide apparatus for assembling parts of electron discharge devices which is of small size suitable for convenient installation in an assembly line and which will operate reliably for long periods as required in continuous automated production without requiring repair or adjustment.

Another object is to provide such apparatus which is capable of being supplied with parts of cylinder-like shape in bulk unoriented form, and can place the parts in assembled position with precise desired orientation.

These and other objects will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of electron discharge device parts to the assembly of which the apparatus of the present invention is particularly suited.

Fig. 2 is another view of the structure of Fig. 1, after completion of the assembly operation performed by the apparatus of the present invention.

Fig. 3 is an elevation view of apparatus constructed according to the present invention.

Fig. 4 is an enlarged perspective view of a portion of the structure of Fig. 3.

Fig. 5 is an enlarged perspective view of another portion of the structure of Fig. 3.

Fig. 6 is a plan view of structure shown in Fig. 5.

Fig. 7 is a detail sectional view of an electron discharge device part after processing by the apparatus of Figs. 5 and 6.

Fig. 8 is an elevation view of part of the structure shown in Fig. 5.

Fig. 9 is an enlarged elevation view of a portion of the structure shown in Fig. 3.

Referring to the drawings, the present invention is illustrated in connection with the assembly of an outer electrode shield of an electron discharge device of the receiving tube type, onto a support plate of mica or other insulative material, in coaxial surrounding relation with a plurality of electrodes also secured to the insulative support plate.

Fig. 1 shows a mica support plate **2** with a cathode **4**, grids **6**, **8** and anode **10** already mounted thereon. One end of the cathode extends with a snug fit through a central aperture in the mica, thereby supporting the cathode with its axis substantially normal to the mica. The grids **6**, **8** are disposed in concentric surrounding relation with the cathode and are supported by the mica by means of depending feet on one end which extend through apertures in the mica. The anode **10** is likewise disposed in concentric surrounding relation with the grids and cathode and is supported by depending tabs **12** which extend through corresponding apertures in the mica.

As shown in Fig. 1 the electrode assembly and supporting mica with which the shield is to be assembled may conveniently be supported on a fixture or mount block **14** with the mica laying flat on a horizontal shelf on block **14** and the electrodes supported in an upright position by the mica. Further support for the electrodes may be provided by an upstanding pin (not shown) carried by the mount block and extending through the hollow tubular portion of the cathode. The shield shown in Fig. 1 consists of a hollow sheet metal cylinder **18** which may have one or more circumferential stiffening ribs **20**. At each end of the shield are a pair of diametrically spaced notches **22** which serve as inspection windows for viewing electrodes enclosed within the shield after assembly. Also extending longitudinally from each end of the shield is a pair of diametrically spaced tabs **24** which are adapted to be received in corresponding apertures in a mica **2** for the purpose of securing the shield thereto. The diametrical plane of the shield on which all the tabs **24** are disposed forms an acute angle with the diametrical plane on which all the notches **22** are centered.

Fig. 2 shows the mica **2** and electrode assembly thereon after installation of the shield **18** by the apparatus of the present invention. The shield is disposed in coaxial surrounding relation with the electrodes, and supported by the insertion of its tabs **24** through apertures in the mica **2**.

Turning now to Fig. 3 the apparatus of the present invention includes generally a dispensing portion **26** to which shields are supplied in bulk and from which they are dispensed one at a time, an orienting portion **28** which receives shields from the dispensing portion and arranges them in correct orientation for installation in a mica, a

tab-forming portion 30 to which the oriented shields are supplied from the orienting portion 28, and a loading portion 32 which actually installs the shields on micas placed in a predetermined shield-receiving position either manually or by suitable placement apparatus.

Turning now to a detailed description of the various portions of the machine in the order mentioned above, the dispensing portion 26 includes a tray or pan 40 adapted to receive a relatively large number of shields in bulk unoriented condition. Then pan is suitably vibrated by a motor (not shown) and the shields are fed by the vibration up and inclined spiral ramp 42 on the inside vertical wall of the tray to a pickup station 44 adjacent the periphery of a rotating pickup wheel 46. The wheel 46 is equipped with a plurality of magnetized pockets 48 spaced along its periphery, each of which is adapted to receive a shield as it passes the pickup station 44 and magnetically retain the shield on the wheel with the longitudinal axis of the shield generally parallel to the axis of rotation of the wheel. Each of the shields picked up by the wheel is adapted to be carried through an aligning device consisting of a pair of plates 50 slightly inclined toward one another and between which the shield is carried as the wheel rotates. The plates serve to cam a shield in a direction parallel to the wheel axis, and thereby properly align each shield longitudinally.

Occasionally a shield may be picked up by the wheel with an improper orientation relative to the magnetic pocket carrying it. This might result in jamming the alignment device 50 or deforming or otherwise damaging the shield, and accordingly to prevent an improperly oriented shield from reaching the alignment device an automatic inspecting device is provided between the pickup station and plates 50. The automatic inspection device includes a magnet 52 of greater magnetic attractive force than the magnetic pockets 48 on wheel 46. The magnet 52 is carried by an arm 54 pivoted for movement toward and away from the periphery of the wheel, and between magnet 52 and the path of shields carried by the wheel is a stationary plate 56 of non-magnetic material. The plate is so spaced from the path of shields carried by the wheel that an improperly oriented shield is attracted to and retained against the plate by magnet 52 as the wheel turns, while a shield properly seated in a pocket 48 of the wheel will pass the plate 56 undisturbed. As the wheel rotates each pickup pocket past the plate a cam 58 on the wheel moves a follower 60 which through a link 62 pivots the arm 54 and moves the magnet away from the plate. This releases a shield held by the plate and the released shield falls into the pan 40.

After emerging from between the guides 50, each shield is carried by further rotation of the wheel 46 to the orienting portion 28 of the apparatus. As best shown in Figs. 3 and 4 the orienting portion includes a pair of parallel inclined upper rails 64 straddling the downwardly moving side of the wheel 46. The upper ends of the rails are disposed on opposite faces of the wheel and the spacing of the rails is such as to correspond to the longitudinal spacing of the tabs 24 on opposite ends of the shield. Thus a shield brought to the rails by the wheel is cammed out of its magnetic pocket 48 on the wheel, and when thereby separated from the wheel the shield slides down the rails 64 on its tabs 24. A resilient finger 66 secured to the guides as shown in Fig. 4 holds each shield firmly against the rails as it is cammed out of its pocket 48 so as to prevent improper engagement of the shield with the rails 64.

Adjacent the lower end of the upper rails 64 is the upper end of a pair of lower rails 70 down which the shields are adapted to slide to the tab forming and loading portions 30, 32 of the device. The lower rails are parallel, having a spacing corresponding to the longitudinal spacing of the notches 22 in the shield, and at their upper ends the lower rails are disposed at an angle with respect to the upper rails corresponding to the angle between the diametral plane of the shield tabs 24 and the plane bisecting the shield notches 22. Thus as a shield slides off the lower end of the upper rails 64, if it is oriented as shown in Fig. 4 the notches 22 will be engaged by the upper ends of the lower rails 70 as shown in Fig. 4 and the shield will slide freely down the lower rails. If, however, a shield is turned end-for-end on the upper rails 64 from the position shown in Fig. 4 its notches 22 will not be aligned with the upper ends of the lower rails 70 and it will therefore be rejected by the lower rails 70 and will fall into an inclined chute 72 and be returned thereby to the pan 40.

The upper ends of the lower rails are slightly tapered to form prongs 73 as best shown in Fig. 4 to facilitate receiving a shield, but the lower portions of the lower rails are so dimensioned as to engage the notches with relatively little play and hence the shields carried by the lower rails are oriented angularly relatively precisely as well as having a correct end-for-end orientation. The shields are adapted to be stacked up in the lower rails so as to provide an uninterrupted supply of shields to the tab forming and loading portion 30, 32 of the device. Accordingly, there is disposed opposite the lower rails at points spaced intermediate their vertical path a pair of switches 76, 78 arranged to sense the presence of shields in the lower rails. The switches 76, 78 are connected in circuit with the device for wheel 46 and pan 40 to cause the dispensing portion of the device to operate until the lower rails 70 are filled up to the level of the upper switch 76 at which point the dispensing portion of the device is de-energized until the shield level falls to the position of the lower switches 78.

From the lower rails 70 the oriented shields pass to the tab-forming portion 30 of the device, the purpose of which is insuring exact alignment of tabs 24 to facilitate damage-free loading of the shields onto a mica 2. As best shown in Figs. 5 and 6, the tab-forming portion includes a pair of opposed upper and lower jaws 80, 82 between which extends a pair of stationary guides 84 forming a horizontal extension of lower rails 70 and adapted to engage the notched portions 22 of the shields. Guides 84 are cut away as at 85 to accommodate closing of jaws 80, 82. Successive shields are urged onto guides 84 by paddles 86 driven by a continually energized stall-torque motor 88. The jaws 80, 82 are reciprocated in slides 90, 92 by air cylinders 94, 96 actuated by any suitable means such as solenoid valves (not shown). The shield-engaging surfaces of the jaws are so shaped that all four tabs 24 of a shield between the jaws are engaged thereby simultaneously. The guides 84 are dimensioned to engage the sides of the shield notches 22 with no play so the shield is precisely positioned by the guide while the tabs are precision formed by the jaws to correct any improper tab alignment and insure correct registry with the mica apertures intended to receive them. If desired, the tab-engaging surfaces of the jaws may be beveled slightly so as to bend the tabs at a slight angle such as to facilitate insertion of the tabs into the apertures in the mica. Such bent tabs are best shown in Fig. 7. One of the jaws 82 carries a finger 98 which serves as a gate camming a shield 18 between the jaws 80, 82 into exact alignment with the jaws and preventing movement of the shield along the guides 84 while the jaws are closing on it.

From the tab-forming portion 30 the shields pass along extensions of the guides 84 to the shield-loading portion 32 of the device. The loading portion includes a slide 100 vertically reciprocable in a track 102 between an upper or shield-receiving position, as shown in Figs. 6 and 8, and a lower or shield installing position at which a mounting fixture 14 is placed in Fig. 9, as shown.

The slide carries a pair of movable jaws 104 adapted to receive one at a time shields fed to a stop 105 on the adjacent end of the guides 84. The jaws 104 are pivotly mounted on slide 100 and are closed against a

compression spring 106 by the engagement of crank arms 108 by a link 110 actuated by a bell crank 112 driven by the vertically reciprocable piston 114 of an air cylinder 116. Closing of the jaws is regulated by an adjustable stop 118 so as to prevent damage to the shields.

Operation of the loading portion is such that when piston 114 moves down the jaws 104 are first closed and then the slide 100 is moved vertically down carrying with it the jaws 104 and a shield enclosed within them. Simultaneously with closing of the jaws 104, the tab-forming jaws 80, 82 close as to prevent further feeding of shields across guides 84. As best shown in Fig. 8 the portion 120 of the lower guide 84 adjacent jaws 104 is pivotly mounted and is cammed downward out of the way against the force of tension spring 122 to permit unobstructed movement of the jaws 104 and shield therewithin down to the mounting fixture 14. As the slide 100 begins to descend, a vertically extending finger 124 carried by the slide moves into obstructing relation with the shield adjacent that in the loading jaws, and thereby serves to prevent further forward movement of shields on the guides 84 until the loading jaws are restored to their upper or shield-receiving position. At the lower end of the vertical excursion of the slide 100 the loading jaws are so positioned with respect to the mounting fixture 14 as to insert the bottom tabs 24 of the shield into corresponding apertures in a mica 2 thereon.

The movement of the slide is then reversed, first opening the jaws 104 to release the installed shield and then moving the slide vertically upward so as to return the jaws to shield-receiving position. When the loading jaws reach their upper position, the tab-forming jaws open, and motor 88 indexes another shield into the loading jaws 104. With the shield thus assembled the fixture 14 may then be removed either manually or by suitable conveying apparatus, and after substitution of another fixture mounted mica and electrode assembly the apparatus is ready to recycle.

It may be seen that with the apparatus above-described the shields are handled delicately yet positioned exactly and with minimum possibility of damage. The apparatus is capable of operating reliably for long periods with a minimum of adjustment, yet its cycle time is desirably short as required for automated production, being less than 3 seconds in one embodiment which has been tested. Accordingly, it will be appreciated that apparatus constructed according to the invention is particularly suited for automated high speed low cost production.

It will be appreciated by those skilled in the art that the invention may be carried out in various ways and may take various forms and embodiments other than those illustrative embodiments heretofore described. It is to be understood that the scope of the invention is not limited by the details of the foregoing description, but will be defined in the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, the combination of orienting means including a first rail means engageable with said tabs and along which shields are adapted to slide, second rail means disposed adjacent said first rail means and cooperable with the notches of shields sliding along said first rail means with a desired end-to-end orientation to divert from said first rail means shields having a desired end-to-end orientation and reject shields having a different orientation, a pair of loading jaws movable between a shield receiving position opposite the other end of said second rail means and a shield assembling position, and means for feeding oriented shields from said second rail means to said loading jaws.

2. In apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, the combination of orienting means including a pair of parallel first rails engageable with said tabs and along which shields are adapted to slide, a pair of parallel second rails dimensioned and spaced to extend through notches at opposite ends of a shield, said second rails being disposed at said acute angle relative to said first rails and with one end of said second rails disposed in the path of the notches of shields sliding along said first rails with a desired end-to-end orientation, whereby said second rails will engage by the notches and divert from said first rails shields having a desired end-to-end orientation and will reject shields having a different orientation, a pair of loading jaws movable between a shield receiving position opposite the other end of said second rails and a shield assembling position, and means for feeding oriented shields from said second rails to said loading jaws.

3. Apparatus for assembling in an apertured support plate an article of tubular shape having at its ends longitudinally extending spaced tabs adapted to be received in the support plate apertures and longitudinally extending notches, said apparatus comprising means for orienting the article end-for-end, a pair of article supporting guides dimensioned and spaced to extend through said notches, means for feeding oriented articles to said guides, loading jaws movable between an article receiving position opposite an end of said guides and an article assembling position at which the apertured plate is adapted to be supported, and means for feeding oriented articles along said guides to said loading jaws.

4. Apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at its ends longitudinally extending spaced tabs adapted to be received in the support plate apertures and longitudinally extending notches, said apparatus comprising means for orienting the shields end-for-end, movable opposed jaws adapted to press therebetween the tabs of successive shields for precision forming of said tabs to correct any improper alignment thereof, a pair of guides extending between said jaws and dimensioned to extend through said notches and engage the sides of said notches to support shields between the jaws, means for conveying oriented shields to said guides, loading jaws movable between a shield receiving position opposite the end of said guides and a shield assembling position at which the apertured plate is adapted to be supported, means for urging oriented shields along said guides toward said loading jaws, whereby a shield is urged from the end of the guides into the loading jaws when the forming jaws are open, and means for operating the loading jaws and forming jaws in synchronism.

5. Apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at its ends coplanar diametrically spaced tabs adapted to be received in the support plate apertures and coplanar diametrically spaced notches, said apparatus comprising means for orienting the shields end-for-end, movable opposed jaws adapted to press therebetween the tabs of successive shields for precision forming of said tabs to correct any improper alignment thereof, a pair of guides extending between said jaws and dimensioned to extend through said notches and engage the sides of said notches to support shields between the jaws, a pair of rails dimensioned to extend through the shield notches and along which shields are adapted to slide to said guides, loading jaws movable between a shield

receiving position opposite the end of said guides and a shield assembling position at which the apertured plate is adapted to be supported, means for urging shields along said guides toward said loading jaws, whereby a shield is urged from the end of the guides into the loading jaws when the forming jaws are open, and means for closing and moving the loading jaws from shield-receiving to shield-loading position when the forming jaws are closed.

6. Apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said apparatus comprising means for orienting shields end-for-end, means for feeding shields to said orienting means, a pair of rails arranged to receive shields from the orienting means, said rails being dimensioned to extend in free-sliding relation through the notches at the respective ends of a shield and being inclined to permit stacking of a plurality of shields therein, a pair of loading jaws movable between a shield receiving position and a shield assembling position at which the apertured plate is adapted to be supported, a pair of guides forming an extension of the lower end of said rails and extending to the shield receiving position of said loading jaws, said guides being dimensioned to extend through said shield notches and engage the sides of said notches to support shields thereon with precision, means for urging shields along said guides toward said loading jaws, and a pair of tab-forming jaws disposed on opposite sides of said guides for engagement with the tabs of shields carried by said guides.

7. Apparatus for assembling in an apertured support plate an electron discharge device electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said apparatus comprising orienting means including a pair of parallel inclined upper rails between which a shield is adapted to be supported on its tabs and down which a shield thus supported is adapted to slide, a pair of lower rails disposed beneath the upper rails for sliding engagement with the notches of desirably oriented shields on said upper rails, a pair of loading jaws movable between a shield receiving position and a shield assembling position at which the apertured plate is adapted to be supported, a pair of guides forming an extension of said lower rails and extending to said loading jaws, said guides being dimensioned to extend through said shield notches and engage the sides of said notches to support shields thereon with precision, means for urging shields along said guides toward said loading jaws, and a pair of tab-forming jaws disposed on opposite sides of said guides for engagement with the tabs of shields carried by said guides.

8. Means for orienting end-for-end an electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said orienting means comprising a pair of parallel first rails engageable with said tabs and along which a shield is adapted to slide, a pair of second rails dimensioned and spaced to extend through notches at opposite ends of a shield, said second rails being disposed at said acute angle relative to said first rails and with one end of said second rails disposed in the path of the notches of shields sliding along said first rails with a desired end-to-end orientation, whereby said second rails will engage by the notches and divert from said first rails shields having a desired end-to-end orientation and will reject shields having a different orientation.

9. Means for orienting end-for-end an electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said orienting means comprising a pair of parallel rails having a spacing corresponding to the longitudinal spacing of said tabs and having an inclination such that a shield supported thereon on its tabs will slide to the lower end of said first rails, means for depositing a shield on said first rails with the tabs at each end of the shield supported by a respective one of said rails, whereby said notches are either disposed at or displaced from a desired angle with respect to said rails depending on the end-for-end disposition of said shield on said rails, and a pair of shield selecting prongs having a spacing corresponding to the longitudinal spacing of said notches and disposed opposite the lower end of said rails in the path of notches of a shield arriving at the lower end of said first rail with a desired end-for-end orientation.

10. Means for orienting end-for-end an electrode shield of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said orienting means comprising a pair of parallel first rails having a spacing corresponding to the longitudinal spacing of said tabs and having an inclination such that a shield supported thereon on its tabs will slide to the lower end of said first rails, means for depositing a shield on said first rails with the tabs at each end of the shield supported by a respective one of said rails, whereby said notches are either disposed at or displaced from a desired angle with respect to said rails depending on the end-for-end disposition of said shield on said rails, and a second pair of rails having a spacing corresponding to the longitudinal spacing of said notches and arranged opposite the lower end of said rails and at said desired angle to said first rails so as to extend through those notches of a shield at the lower end of said first rails which are disposed at said desired angle.

11. Apparatus for feeding and orienting end-for-end an article of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a second common longitudinal plane disposed at an acute angle to the plane of said tabs, said apparatus comprising a pair of parallel rails having a spacing corresponding to the longitudinal spacing of said tabs and supportingly engageable with said tabs, a rotatable wheel the periphery of which extends between one end of said rails, said wheel having on its periphery spaced magnetized pockets each dimensioned to receive an article with its longitudinal axis substantially perpendicular to the axis of said wheel, an article pick-up station adjacent the periphery of said wheel from which articles are magnetically attracted to said pockets as said wheel rotates, means for feeding articles to said pick-up station, a guide opposite the path of said pockets between the pick-up station and said rails for camming said articles in a direction parallel to said wheel axis to a position such that the tabs line up with the rails, and article selecting means disposed adjacent said rails for engagement with the notches of articles desirably oriented on said rails.

12. Apparatus for feeding and orienting end-for-end an article of tubular shape having at each end a pair of longitudinally extending tabs and a pair of longitudinally extending notches, said tabs being disposed in a common longitudinal plane and said notches being located in a

second common longitudinal plane disposed at an acute angle to the plane of said tabs, said apparatus comprising a pair of parallel rails having a spacing corresponding to the longitudinal spacing of said tabs and having an inclination such that an article supported thereon on its tabs will slide to the lower end of said rails, a rotatable wheel extending between the upper ends of said rails and having on its periphery spaced magnetized pockets each dimensioned to receive an article with its longitudinal axis substantially perpendicular to the axis of said wheel, an article pickup station adjacent the periphery of said wheel from whence articles are magnetically attracted to said pockets as said wheel rotates, means including an article-receiving pan and a vibrator for feeding articles to said pickup station, a guide opposite the path of said pockets between the pickup station and said rails for camming said articles in a direction parallel to said wheel axis to a position such that the tabs line up with the rails so that as said wheel rotates successive articles will be cammed by said rails out of said pockets and deposited on said rails with the tabs at each end of an article supported by a respective one of said rails, whereby said notches are disposed at or displaced from a desired angle with respect to said rails depending on the end-for-end disposition of said article on said rails, a pair of prongs having a spacing corresponding to the longitudinal spacing of said notches and arranged opposite the lower end of said rails for engagement with notches disposed at said desired angle of successive articles arriving at the lower end of said rails, and means for returning to said feeding means articles not engaged by said prongs.

13. Means for feeding magnetizable articles comprising a plurality of spaced magnetized pockets movable along a closed path and each dimensioned to accommodate an article with a desired orientation, a pickup station adjacent the path of said pockets to which articles are supplied and from which successive articles are magnetically attracted to the pockets, a non-magnetic plate adjacent the path of said pockets, a rejecting magnet of greater magnetic attractiveness than said pockets, means mounting said rejecting magnet for movement to and from a position close enough to said plate to attract to said plate articles in said pockets whose orientation is different from said desired orientation, and means associated with each pocket for camming said rejecting magnet away from said plate after the pocket passes said plate so as to release from said plate an article attracted thereto by said rejecting magnet.

14. Means for feeding tubular articles of ferromagnetic material comprising a plurality of spaced magnetized pockets movable along a closed path and each dimensioned to receive a tubular article with the longitudinal axis of the article having a desired direction, a pickup station adjacent the path of said pockets to which articles are supplied and from which successive articles are magnetically attracted to the pockets, a non-magnetic plate adjacent the path of said pockets, a rejecting magnet of greater magnetic attractiveness than said pockets mounted for movement to and from a position adjacent said plate such as to attract to said plate articles in said pockets whose longitudinal axes are not arranged in said desired direction, and means associated with each pocket for camming said rejecting magnet away from said plate after the pocket passes said plate so as to release from said plate an article attracted thereto by said rejecting magnet.

15. Means for feeding tubular articles of ferromagnetic material comprising a rotatable wheel having a plurality of peripherally spaced magnetized pockets each dimensioned to receive a tubular article with the longitudinal axis of the article having a desired direction, a pickup station adjacent the path of said pockets to which articles are supplied and from which successive articles are magnetically attracted to the pockets, a non-magnetic plate adjacent the path of said pockets, a rejecting magnet of greater magnetic attractiveness than said pockets, a movable support mounting said magnet for movement to and from a position adjacent said plate such as to attract to said plate articles in said pockets whose longitudinal axes are not arranged in said desired direction, and a cam on said wheel associated with each pocket and engageable with said support for moving said rejecting magnet away from said plate after the pocket passes said plate so as to release from said plate an article attracted thereto by said rejecting magnet.

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