Aug. 23, 1955 L. A. BEARD ET AL 2,715,796

APPARATUS FOR SMOOTHING AND POLISHING TELEVISION PANELS AND BULBS

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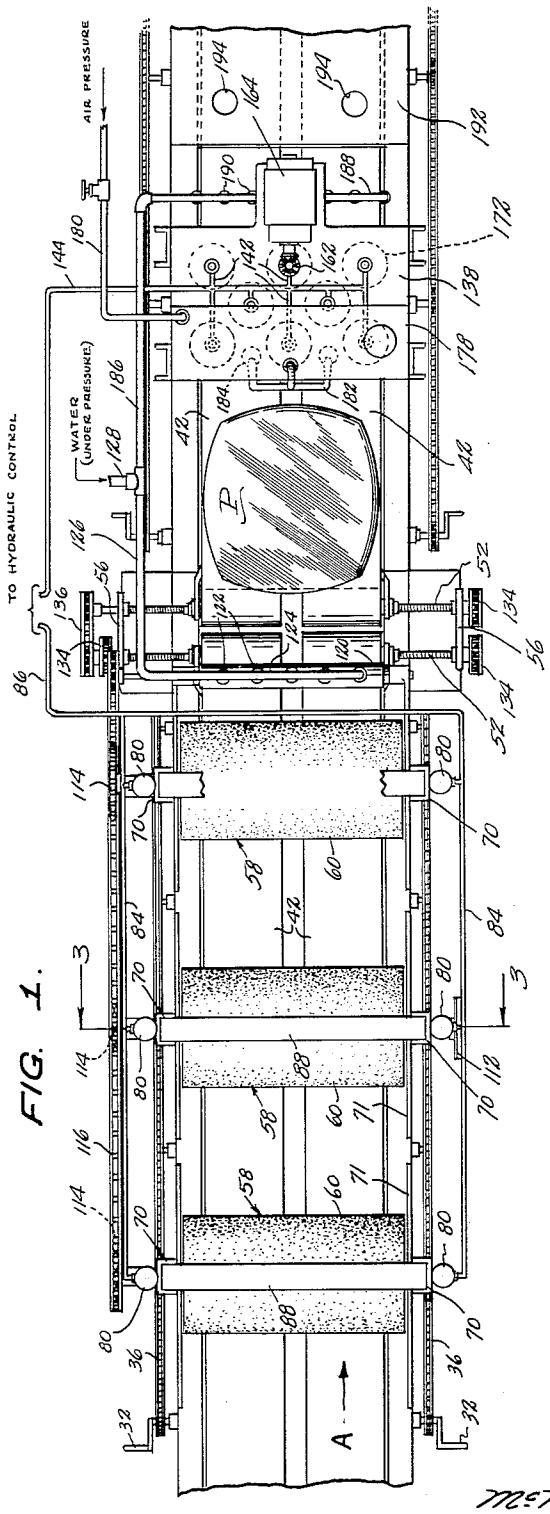


FIG. 1.

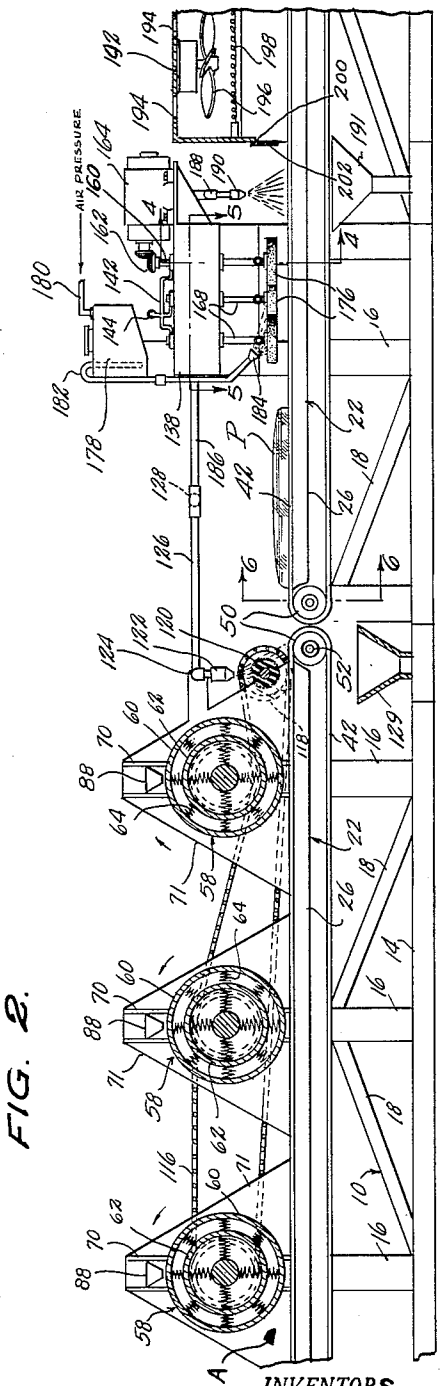


FIG. 2.

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FIG. 3.

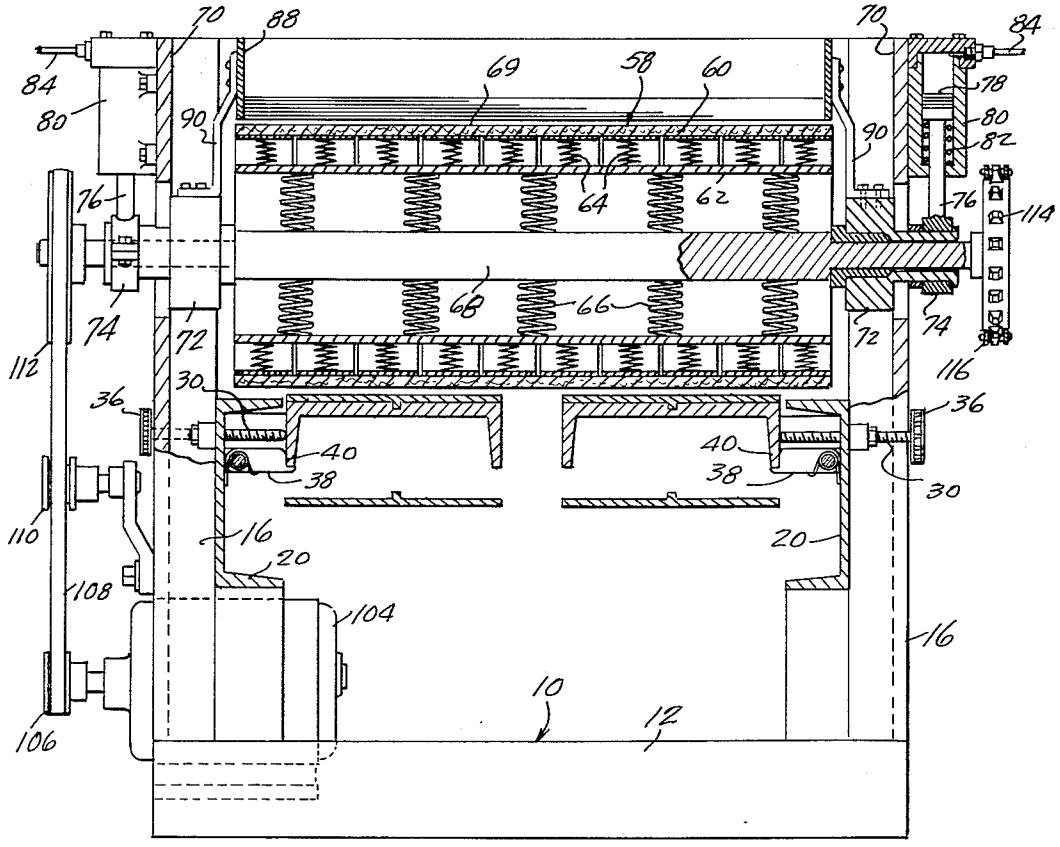
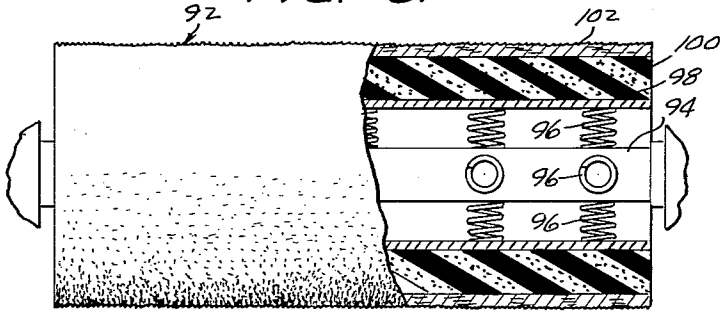


FIG. 8.



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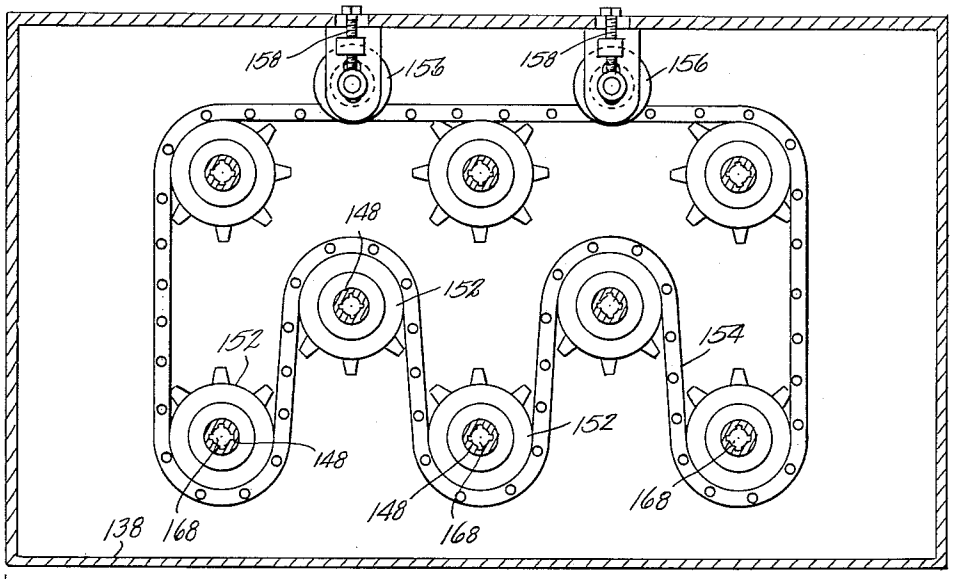


FIG. 5.

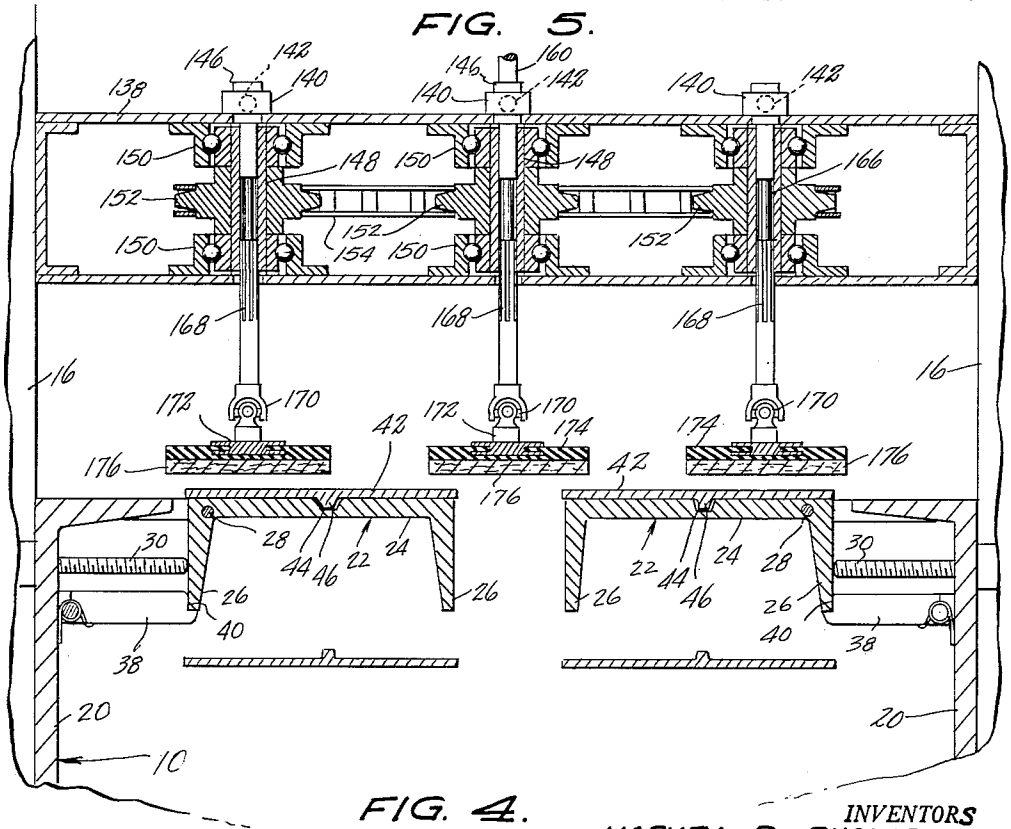


FIG. 4.

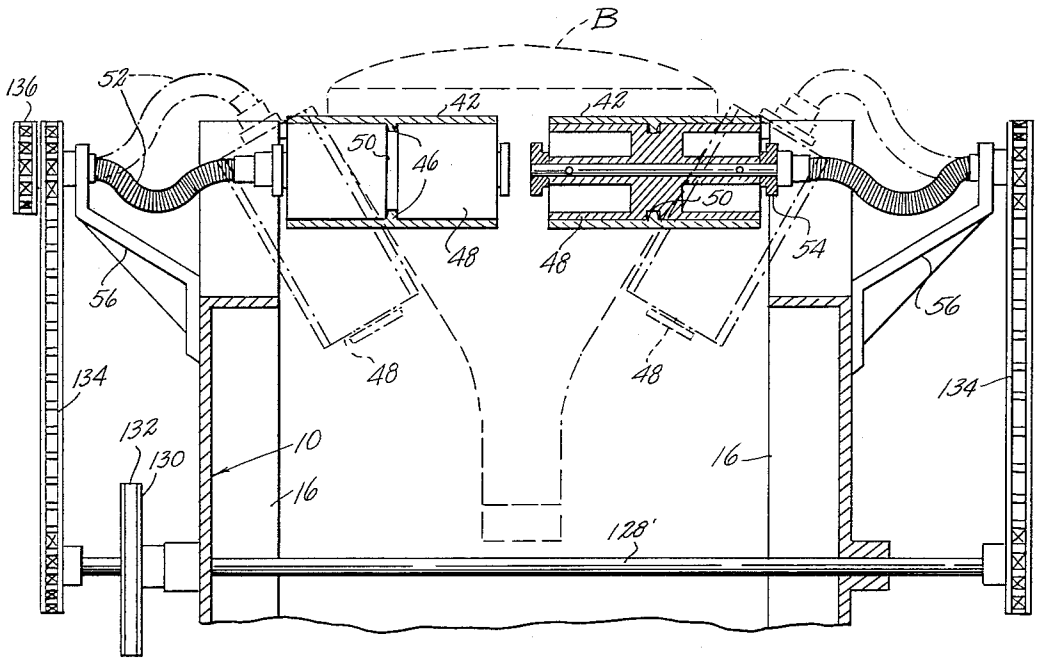
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FIG. 6.



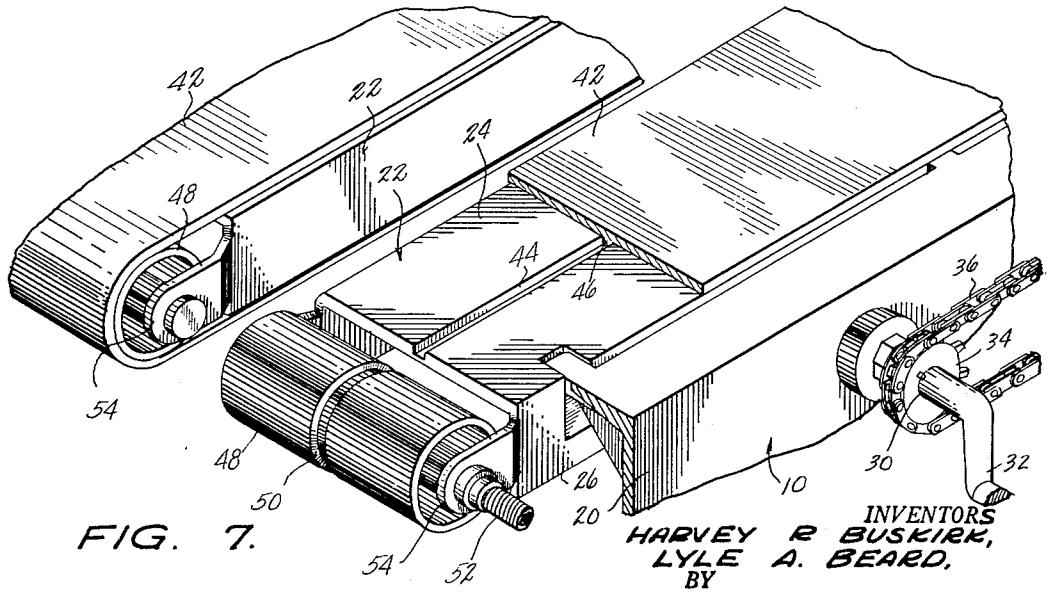


FIG. 7.

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Patented Aug. 23, 1955

2,715,796

APPARATUS FOR SMOOTHING AND POLISHING TELEVISION PANELS AND BULBS

Lyle A. Beard, Knoxville, and Harvey R. Buskirk, Ulster, Pa.

Application November 12, 1952, Serial No. 319,940

5 Claims. (Cl. 51—3)

This invention relates to an automatically operating apparatus designed particularly for polishing and smoothing the panels of television picture tubes.

In the art to which the invention relates, the manufacture of television picture tubes has reached large proportions, as a result of which the polishing and smoothing of the panels of said tubes has become an operation carried on on a large scale.

Despite the fact that the grinding and smoothing of said panels is a large scale operation, at present this particular step in the processing is carried out manually, with each panel being polished and smoothed by manual exertion on the part of a worker.

This is obviously an undesirable situation, and considerable time and effort has been devoted to the design of an apparatus which will eliminate these manually carried out steps in the manufacture of a picture tube. However, to our knowledge, no apparatus which will be completely efficient, within prescribed tolerances, has so far been designed.

The main object of the present invention is to provide an apparatus which will automatically polish and smooth the panels of television picture tubes, while said tubes are fed through the apparatus on a conveyor belt, in successively following order.

Another object of the invention is to provide an apparatus of the character referred to which, by reason of its automatic operation, will eliminate a substantial amount of the manual effort heretofore exerted in the polishing and smoothing of bulb panels, thus to permit said operations to be carried on with the expenditure of far less time and effort than is presently required.

Yet another object is to provide an apparatus of the character referred to which will be so designed as to permit the polishing and smoothing of picture tube panels both before said panels are assembled with "funnels" to form a completed bulb, and after they are so assembled with "funnels." This is of importance because, while the polishing and smoothing operations are normally carried out before the panels are fused with funnels to form the bulbs, said grinding and smoothing operations are also necessary, in many instances, after the panels and funnels have been formed into a bulb.

Another object of importance is to provide an apparatus in which the drums abrade or polish the tube panel with pumice over the entire area of the panel, despite the normal convexity of said panel.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawings, in which like references designate like parts throughout the several views, and wherein:

Figure 1 is a top plan view of an apparatus formed in accordance with the present invention, the end portions of said apparatus being broken away;

Figure 2 is a side elevational view;

Figure 3 is an enlarged transverse sectional view taken substantially on line 3—3 of Figure 1, showing the construction of one of the pumice application drums;

Figure 4 is a transverse sectional view, on an enlarged scale, taken substantially on line 4—4 of Figure 2, showing the construction of the rouging means;

Figure 5 is a sectional view through the rouging assembly, taken substantially on line 5—5 of Figure 2;

Figure 6 is an enlarged transverse sectional view taken substantially on line 6—6 of Figure 2, the full and dotted lines respectively showing alternate positions of a pair of conveyor belts, a supported television bulb being illustrated in dotted lines;

Figure 7 is a fragmentary perspective view of the conveyor belts; and

Figure 8 is a view partly in elevation and partly in longitudinal section of a modified form of pumice drum.

Referring to the drawings in detail, the reference numeral 10 has been applied generally to designate an elongated support frame, said frame being rigidly formed from suitable metal material, such as channels, I-beams, etc. welded or otherwise rigidly connected to provide a support for the moving parts of the apparatus.

In the illustrated example of the invention, the elongated support frame 10 is provided, at intervals spaced longitudinally thereof, with transversely extending cross members 12, said cross members 12 being supported upon a floor or other supporting surface, to which the cross members can be bolted if desired.

Rigidly secured to the opposite ends of the several cross members 12 are lower longitudinal members 14, said longitudinal members 14 extending through the full length of the apparatus. Standards 16 are welded or otherwise rigidly joined at their lower ends to the members 14, at intervals spaced longitudinally of said members 14, the standards 16 being formed from channel iron material or the like.

To rigidify and strengthen the structure, angular braces 18 can be provided, said braces being welded at their opposite ends to the standards and members 14.

We believe that quite possibly, the particular formation of the supporting frame can be varied, it being mainly important that an elongated, raised structure be provided.

Extending the length of the apparatus is a conveyor, said conveyor including a pair of parallel belts adapted to support the work to be polished and smoothed. Each belt is carried by a conveyor belt support member 22, the member 22 being of channeled formation, and having a web 24 formed, at opposite longitudinal edges thereof, with depending side walls 26.

Each support member 22 is pivotally mounted upon the supporting frame 10, for movement from the horizontal position shown in Figure 4 to a tilted position. To this end, a pivot rod 28 is carried by upper longitudinal frame members 20, the pivot rod 28 associated with each support 22 extending in parallelism with the longitudinal ecnter line of said support, adjacent one side edge of the support.

Normally, the supports 22 are swung to a horizontal position shown in Figure 4, in which positions they support a plurality of television bulb panels P. In effecting adjustments of the supports 22, any suitable means can be used, and the illustrated means comprises a plurality of adjusting screws 30 threadedly engaged in the upper longitudinal members 20. The members 30, at each side of the support frame 10, are linked for joint rotation, thus to assure their uniform inward and outward movement.

To operate the several adjusting screws 30, a crank 32 can be provided upon one of said screws, said screw having a sprocket about which a chain is trained. Each of the several screws 30 has a sprocket 34 (see Figure 7), a single chain 36 extending about the several sprockets 34 at each side of the supporting frame 10.

By reason of this arrangement, it will be seen that rotation of the crank handle **32** in one direction will be effective to simultaneously adjust the several screws **30** inwardly, against the adjacent side wall **26** of the conveyor belt support member **22**. This will hold the support member in a selected position of tiltable adjustment, with position can be any tilted or inclined position with respect to the horizontal position of the support member **22** shown in Figure 4.

It is also desired that a positive means be provided for locking the supports **22** in their horizontal positions. To this end, a plurality of detents **38** can be mounted upon the respective longitudinal members **20**, said detents being swingable upwardly and downwardly, and being spring urged to their up positions. The detents **38** have notches **40** at their outer ends, receiving the adjacent side wall **26**. The detents **38** when swung downwardly and out of engagement with the adjacent side walls **26** of the support member **22** permit the conveyor support members **22** to be swung to the tilted positions to their maximum extent, assuming, of course, that the screws **30** have been backed off to an extent sufficient as to prevent said screws from interfering with the free tilting movement of the conveyor belt support members.

Supported upon each member **22** is belt **42**, the belt **42** being of the endless web type. The web **24** of each support member **22**, in this connection, is preferably provided with a groove **44** extending longitudinally and centrally thereof, the groove **44** being adapted to receive a depending longitudinal rib **46** provided upon the belt **42**. In this way, the belt **42** is held against lateral deviation, during operation of the apparatus.

At opposite ends of the conveyor belt support member **22**, each belt **42** is trained about rollers **48** (Figures 6 and 7), having circumferential grooves **50** disposed medially between their ends, to accommodate the ribs **46** of the belts.

At each end, the conveyor belt support member **22** is, in the illustrated embodiment of the invention, provided with projecting ears **54** having openings receiving the opposite ends of the roller **48** associated therewith.

In view of the fact that the entire conveyor belt assembly is tiltably adjustable, it is necessary that the rollers **48** be tiltably swingable therewith, between the full and dotted line positions of the rollers shown in Figure 6. Accordingly, to drive the rollers, flexible shafting **52** is used. The shafting **52** is journaled, at its outer end, in bearing plates **56** rigidly mounted upon opposite sides of the supporting frame **10**.

A means for driving the rollers **48** will be described hereinafter.

The purpose of the adjustable positioning of the conveyor belts is to allow the apparatus to polish and smooth not only panels P, but completed bulbs B. In other words, during the manufacture of a bulb B, the panel P is processed through the grinding and smoothing operations, before it is fused to a funnel. Subsequently, the panel is bonded to a funnel, to form a completed bulb B. During the assembly of the panel and funnel, the panel may become disfigured, as a result of which selected bulbs B are reprocessed through the apparatus illustrated and described herein. When the bulbs are reprocessed in this manner, the conveyor belts are adjusted to their tilted positions so as to engage diametrically opposite portions of the funnel portion of the bulb, while still feeding the bulb longitudinally of the apparatus. The screws **30**, of course, hold the conveyor belts in their selected positions of tiltable adjustment, so as to support the bulbs B at a desired elevation during the polishing and smoothing thereof.

In Figures 1, 2, and 3 we have illustrated a means for applying pumice to the panels or bulbs, said means including a plurality of pumice drums designated generally by the reference numeral **58** and each carried by a horizontally disposed shaft **68** rotating above the conveyor.

The drums **58** are spaced longitudinally of the apparatus, at the entrance end thereof and indicated by the letter A in Figures 1 and 2. As shown in Figure 2, the last drum **58**, that is, that drum **58** most remote from the entrance end, rotates oppositely to the direction of rotation of the other drums **58**, it being found that this acts to clean the pumice from the panels or bulbs.

It is important that the several drums **58** apply a constant pressure against the panels or bulbs passing thereunder. It being equally important, however, that the drums yield as necessary to conform the surfaces of the drums to the convexity of the panels P. Said convexity is, of course, quite slight, but it nevertheless exists, and it is important that all areas of the panel P be treated uniformly, with equal amounts of pumice being applied thereto and with equal pressure being imparted to the panel surface for the purpose of creating a uniform abrasive action thereon.

In view of the above, the drums **58** are specially formed, and reference should now be had to Figures 2 and 3, wherein it is seen that each drum includes an outer cylinder **60** which, in one embodiment of the invention, can be of metal formation, said cylinder being of substantially greater diameter than and being normally concentric with an inner cylinder **62**.

A circumferential series of springs **62** is provided, the springs of said series being interposed between the cylinders **60**, **62** respectively, thus to normally hold the cylinders in concentric relation, while still permitting temporary shifting of one cylinder relative to the other into an eccentric relationship or into a position in which the cylinders have their axes in oblique relation to one another, rather than in their normal coaxial alignment.

Also provided in each drum **58** are springs **66**, said springs **66** being disposed in circumferential series spaced longitudinally of the drum, with the springs of said series fixedly secured to the inner cylinder **62** and the drum shaft **68** respectively.

The springs **66** permit yielding movement of the inner cylinder **62** relative to the drum shaft **68**, as necessary, but serve to normally hold the cylinder **62** in concentric relationship to the shaft **68**.

Extending about the outer cylinder is a wool covering **69**, which is relatively thick and soft, so as to permit the same to conform itself to the slight convexity of the panel P.

The opposite ends of each drum shaft **68** are supported in upstanding extensions **70**, said extensions **70** being extended vertically from the upper ends of and being rigid with selected standards **16**. The extensions **70** are of channeled formation, and slidably mounted thereon are bearings **72** in which the ends of the shafts **68** are journaled. The bearings **72** are thus utilized as floating bearings, so as to permit the drums **58** to be shifted bodily upwardly and downwardly.

Each bearing **72** is provided, at its outer end, with a cylindrical extension, about which is circumposed the annular clamp portion **74** provided at the lower end of a piston rod **76** having a piston **78** working upwardly and downwardly within a hydraulic cylinder **80**. A spring **82** may be interposed between the lower end of the cylinder **80** and the piston **78**, so as to normally urge the piston **78** upwardly within the cylinder.

The several cylinders **80** are supplied with fluid under pressure, through hydraulic fluid supply lines **84**. The lines **84** are extended from a common main hydraulic fluid supply line **86**, which extends from a suitable hydraulic control mechanism, not shown.

When fluid is supplied under pressure to the several cylinders **80**, it will be effective to force the several pumice drums **58** downwardly, against the panels P. As a result, a substantial pressure is exerted downwardly against the panels, so as to cause said panels to be effectively polished when the drums are rotated.

It will be understood, of course, that although a

substantial amount of pressure is exerted downwardly by the drums against the panels P, the drums are still so formed as to yield to a necessary extent, thus to prevent breakage of the panels while still assuring uniform coverage of all portions of the panel surface.

Disposed above each drum **58**, and arranged longitudinally of the drum, is a pumice trough **88**, each trough being supported, as shown in Figure 3, by trough support brackets **90** mounted upon the bearings **72**. Since the troughs are supported by the bearings **72**, they move upwardly and downwardly with their associated drums **58** as a unit, thus to keep the troughs in a particular, selected, spaced relationship to the drums.

The troughs **88**, along their bottom edges, have a continuous longitudinal opening, through which pumice will gravitate, thus to cause the several drums **58** to be coated uniformly with pumice.

It is important, after the panels or bulbs have been processed through the series of drums **58**, that they be properly polished by the drums, and to insure that the desired polishing action is obtained, we may desire, in certain instances, to vary the construction of the drums.

A possible alternative drum construction is illustrated in Figure 8, the drum of Figure 8 being designated generally by the reference numeral **92**. In this form of the drum, the shaft **94** thereof is surrounded by a plurality of springs **96**. The springs are arranged in a plurality of series, spaced longitudinally of the shaft **94**, the springs of each series projecting radially from the shaft and being spaced circumferentially thereabout.

At their outer ends, the springs **96** are engaged against the inner surface of a metal cylinder **98**, and adhesively or otherwise secured to the outer surface of said cylinder is a thick sponge rubber covering **100**, about which is circumposed a wool cover **102**.

The means for driving the several drums **58** will now be described, and reference should now be had to Figure 3, wherein it is shown that a drive motor **104** is mounted upon the support frame **10**. Secured to the shaft of the motor **104** is a small drive pulley **106** about which is trained a drive belt **108**, said belt **108** being tensioned by an idler **110**, and being trained about a large driven pulley **112**. The driven pulley **112** is secured to one end of the shaft of one of the rollers **58**, this being the middle roller when said rollers are viewed as in Figures 1 and 2.

Secured to the other end of the shaft of the middle roller or drum is a sprocket **114**, about which is trained a chain **116**.

As will be noted from Figure 2, the chain **116** extends longitudinally of the entire series of rollers **58**, each roller being provided with a sprocket **114** engaged by said chain. However, the sprocket **114** of the innermost roller **58**, that is, that roller shown at the right in Figure 1, is disposed exteriorly of the endless chain **116**, rather than interiorly thereof. As a result, the roller **58** shown at the right in Figures 1 and 2 will rotate clockwise, while the other rollers **58** will rotate counter-clockwise.

It is necessary, after the panels or bulbs have passed beyond the last roller **58**, that all pumice on the panels be cleaned therefrom, since any pumice that is allowed to remain upon the panel will be ground thereinto during a later step in the polishing and smoothing operation.

To accomplish the cleaning of the panel surfaces, we provide a sprocket **118** rotated by the chain **116**. The sprocket **118** (see Figure 2) is secured to one end of the shaft of a wiping roller **120**, said roller **120** being substantially smaller in diameter than the diameter of the rollers **58**. The wiper roller **120** is formed of a soft material such as a soft, fine sponge, and is disposed directly in the path of jets of water discharged under substantial pressure from nozzles **122** spaced longitudinally of the wiping roller **120** (see Figure 1). The nozzles **122** depend from a pipe **124** disposed transversely of and above the conveyor belts, the pipe **124** extending from one end of a water supply pipe **126**, to which water is fed under pressure through a connection **128**.

It will thus be seen that simultaneously with the application of a substantial quantity of water under pressure to the face of each panel P, after the panel has passed through the series of drums **58**, the panel will be wiped clean. This, as will be apparent, will effectively remove all the pumice, so as to prepare the panels for the next step in the operation.

Below the nozzles **122**, we provide a drain trough **129**, which will receive the water discharged from the nozzles.

Means is provided for driving the conveyor belt rollers, and to this end, a conveyor drive shaft **128'** is journalled transversely of the support frame (see Figure 6). The shaft **128'** is driven by a pulley **130**, about which is trained a belt **132**, it being understood that the belt **132** would be driven by a suitable motor, not shown.

Secured to the shaft **128'** is a sprocket, about which is trained a chain **134**, said chain **134** being trained about a sprocket secured to the outer end of one of the flexible shafts **52**. A similar chain is secured to the other end of the shaft **128'**, so as to drive the corresponding conveyor roller at the other side of the apparatus.

So as to link adjacent conveyor rollers for joint operation, endless chains **136** are provided, said chains being meshed with sprockets carried by adjacent shafts **52**.

As a next step in the polishing and smoothing operation, the panels P or bulbs B, as the case may be, are passed under a series of rotating, horizontally disposed rouging wheels.

The rouging wheels constitute part of a smoothing assembly, said assembly including a hollow casing **138** (Figures 4 and 5).

Mounted rotatably upon the upper end wall of the casing **138** are collars **140**, said collars being of hollow formation. Hydraulic fluid supply lines **142** extend in communication with the several collars **140**, fluid being forced into said lines under pressure, from a main line **144**. The main hydraulic fluid supply line **144** is controlled remotely by a suitable means, not shown.

The collars **140** are secured to hollow shafts **146** rotatably mounted in the top wall of the casing **138**, said hollow shafts extending downwardly into the casing and communicating with hollow spline shafts **148**, rotatably mounted in bearings **150**.

Secured to the several shafts **148**, for rotation therewith, are sprockets **152**, about which is trained a single endless chain **154** (Figure 5). Idlers **156** engage said chain, and are adjustable toward and away from the chain by means **158**, thus to hold the chain under a selected tension.

A single drive shaft **160** is used to power the chain, said shaft **160** being provided with a bevel gear **162** (Figure 2) in mesh with a bevel gear carried by the shaft of a rouge wheel drive motor **164**.

It will be seen that on operation of the motor **164**, the several hollow shafts **148** will be driven simultaneously, in a common direction.

Carried by the shafts **148** are solid spline shafts, the shafts **148** having spline grooves receiving spline ribs of the shafts **168**.

The spline shafts **168** are forced downwardly by the fluid supplied under pressure to the portions of the several shafts **148** above the top ends of the spline shafts **168**, thus to cause a uniform but substantial pressure to be applied to the surface of the panels P, during operation of the apparatus.

At the lower ends of the shafts **168**, we provide universal connections **170**, whereby there are movably connected to the shafts rouging discs **172**. Thus, the discs **172** rotate conjointly with the several spline shafts **168**, while being permitted, at the same time, swingable movement to selected positions, whereby said rouging discs will conform to the particular shape of the panel surface.

Each disc **172** is circumferentially grooved, to receive

a rubber backing disc **174**, said disc **174** having a felt pad **176** cemented thereto.

Agitated rouge is sprayed between the several rouging wheels, and to accomplish this action, we provide a rouge tank **178** (Figures 1 and 2). The tank **178** is of sealed formation, with air being supplied under pressure thereto through an air supply line **180**.

The rouge is forced from the tank by the compressed air, through outlet lines **182**, said lines **182** terminating in nozzles **184**.

As will be noted from Figure 1, a second water supply line **186** extends from the fitting **128**, the line **186** terminating in a header **188** carrying a series of depending nozzles **190**. Thus, after the panels or bulbs pass below and are polished by the wheels **176**, water jets under pressure will be sprayed thereagainst, to clean the rouge therefrom.

Thereafter, the panels or bulbs pass to a drying means shown at the right in Figures 1 and 2. Said means includes a housing **192** formed with a plurality of air inlet openings **194**. Mounted within the housing is a blower including a series of blades **196**, said blower being arranged to direct air past a resistance element **198**, for heating of said air prior to impingement thereof against the panel or bulb.

The panels or bulbs enter the housing **192** through an opening **200**, over which may be hung a flexible flap **202**.

It will thus be seen that the work, when passing through the housing **192**, will be dried by warm air currents blown thereagainst.

The construction illustrated and described can, it is believed, be varied in certain respects, within the scope of the appended claims. For example, the particular number of pumice rollers and rouging wheels illustrated in the drawings is not critical, and can be increased or decreased, as necessary.

Additionally, it may be desired to use hair pads on the rouging wheels, rather than felt pads. Other changes, of course, may be found desirable.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles of operation and the means presently devised to carry out said principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. Apparatus for polishing and smoothing television picture tube panels and bulbs, comprising: a supporting frame; a conveyor supported thereon and including a pair of side by side, endless belts tiltably adjustable about axes extending longitudinally thereof, between one position in which said belts are aligned transversely of the frame in a common horizontal plane for supporting panels, and a second position in which the belts converge downwardly when viewed in cross section for supporting bulbs; means for holding the belts in selected positions to which they are tiltably adjusted; a series of drums spaced longitudinally of the conveyor and each carried by a horizontally disposed shaft rotatably mounted above the conveyor; means for cleaning said articles of pumice after passage thereof under said drums; a series of vertically disposed shafts rotatably mounted above the conveyor and carrying at their lower ends discs arranged to polish said articles after movement thereof past said means; and means for, in succession, cleaning and drying the articles after passage thereof beyond the discs.

2. Apparatus for polishing and smoothing television picture tube panels and bulbs, comprising: a supporting frame; a conveyor supported thereon and including a pair of side by side, elongated, conveyor support members tiltably mounted on the frame for adjustment about axes extending longitudinally of said members between one position in which said members are aligned transversely of the frame in a common horizontal plane for supporting panels, and a second position in which the members converge downwardly when viewed in cross section for supporting bulbs, endless belts mounted on said members, and means for holding the members in selected position to which they are tiltably adjusted; a series of drums spaced longitudinally of the conveyor and each carried by a horizontally disposed shaft rotating above the conveyor; means for cleaning said articles of pumice after passage thereof under said drums; a series of vertically disposed shafts rotatably mounted above the conveyor and carrying at their lower ends discs arranged to polish said articles after movement thereof past said means; and means for, in succession, cleaning and drying the articles after passage thereof beyond the discs.

3. Apparatus for polishing and smoothing television picture tube panels and bulbs, comprising: a supporting frame; a conveyor supported thereon and including a pair of side by side, elongated, support member of inverted U shape in cross section, said members being tiltably mounted on the frame for adjustment about axes extending longitudinally of said members between one position in which said members are aligned transversely of the frame in a common horizontal plane for supporting panels, and a second position in which the members converge downwardly when viewed in cross section for supporting bulbs, belt rollers rotatably mounted at opposite ends of the members, endless belts mounted on said members and driven by the rollers, said rollers having flexible shafts extending therefrom, means for driving the shafts, and means for holding the members in selected positions to which they are tiltably adjusted; a series of drums spaced longitudinally of the conveyor and each carried by a horizontally disposed shaft rotatably mounted above the conveyor; means for cleaning said panels and bulbs of pumice after passage thereof under said drums; a series of vertically disposed shafts rotatably mounted above the conveyor and carrying at their lower ends discs arranged to polish said panels and bulbs after movement thereof past said cleaning means; and means for, in succession, cleaning and drying the panels and bulbs after passage thereof beyond the discs.

4. Apparatus for polishing and smoothing convexed picture tube panels and bulbs, comprising: a supporting frame; a conveyor supported thereon; a series of drums spaced longitudinally of the conveyor and each carried by a horizontally disposed shaft rotatably mounted above the conveyor and adapted to exert pressure against panels and bulbs passing thereunder while conforming to the convexity of the panels and bulbs, the shafts of said drums extending transversely of the conveyor with the shaft disposed innermost of said series of drums rotating in the direction opposite to the direction of rotation of the other shafts of the drums in such series; a pumice feed trough extending longitudinally of each drum immediately thereabove; means for cleaning said panels and bulbs of pumice after passage thereof under said drums; a series of vertically disposed shafts rotatably mounted above the conveyor and carrying at their lower ends discs arranged to polish said panels and bulbs after movement thereof past said cleaning means; and means for, in succession, cleaning and drying the panels and bulbs after passage thereof beyond the discs.

5. Apparatus for polishing and smoothing convexed picture tube panels and bulbs, comprising: a supporting frame; a conveyor supported thereon; a series of drums spaced longitudinally of the conveyor and each carried by a horizontally disposed shaft rotating above the conveyor and adapted to exert pressure against panels and bulbs passing thereunder while conforming to the convexity of the panels and bulbs, the shafts of the drums of said series extending transversely of the conveyor and each drum

including a cylinder circumposed about its shaft, and a plurality of springs interposed between the shaft and cylinder; a pumice feed trough extending longitudinally of each drum immediately thereabove; means for cleaning said panels and bulbs of pumice after passage thereof under said drums; cleaning means including a wiping drum disposed transversely of the conveyor and a plurality of spray nozzles disposed for directing spray jets against the wiping drum and at the opposite sides of said drum; a series of vertically disposed shafts rotatably mounted above the conveyor and carrying at their lower ends discs arranged to polish said panels and bulbs after movement thereof past said cleaning means; and means

for, in succession, cleaning and drying the panels and bulbs after passage thereof beyond the discs.

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