Nov. 24, 1959 C. D. RUETSCH 2,914,258

CATHODE RAY TUBE SCREENING APPARATUS

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FIG.1.

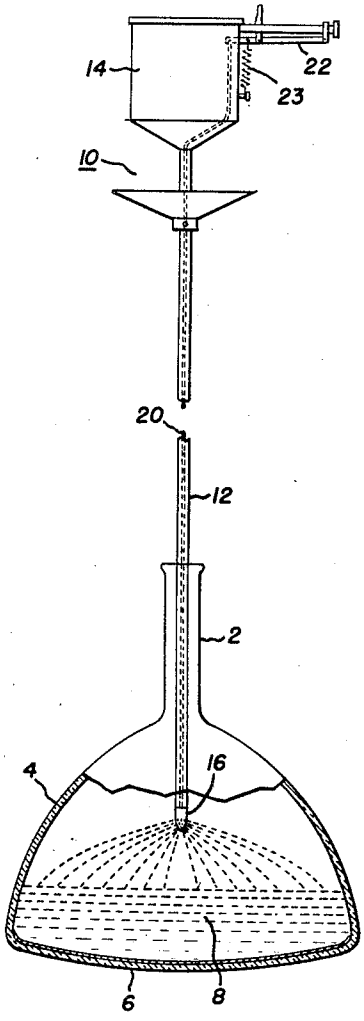


FIG.2.

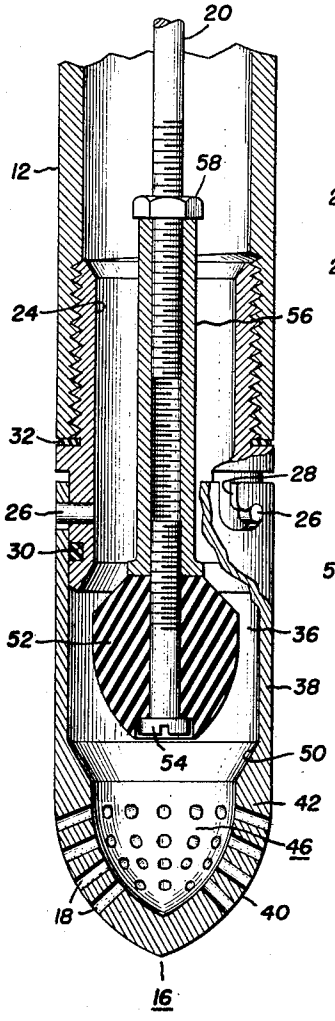
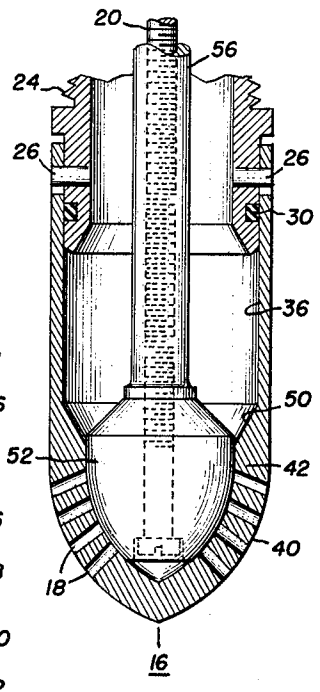


FIG.3.



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CATHODE RAY TUBE SCREENING APPARATUS

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4 Claims. (Cl. 239—562)

This invention relates to improvements in apparatus for screening cathode ray tubes and the like by a liquid settling process.

According to one type of liquid settling process with which the apparatus of the present invention may be employed with particular advantage, a charge of a suitable cushioning liquid such as an aqueous solution of an ionizable salt is introduced into the envelope of a tube to be screened so as to cover the interior surface of the face plate onto which the screen is to be deposited. Then a charge of a suitable screening solution, for example a slurry of powdered phosphor mixed with a suitable binder such as an aqueous solution of potassium silicate, is dispensed onto or into the cushioning liquid, and allowed to settle through the cushioning liquid onto the face plate surface. For optimum uniformity of distribution of the screen material across the face plate surface the screening solution is preferably dispensed onto the surface of the cushioning liquid in the form of a uniformly distributed spray from a spray nozzle positioned a short distance, e.g. a few inches in a cathode ray tube of 21" face plate diagonal dimension, above the surface of the cushioning liquid.

In semi-automatic screening of tubes the envelopes of tubes to be screened are transported past the screening station in a neck-up position on a slowly but continuously moving conveyor. At the screening station a charge of cushioning liquid is introduced into the tube envelope so as to cover the interior surface of the face plate to the desired depth. An operator then lowers into the neck of each envelope in turn a dispenser pipe, connected at its upper end to a container for screening solution and having at its lower end a spray tip. The pipe is inserted into the tube sufficiently to situate the spray tip with the desired spacing above the surface of the cushioning liquid, a charge of screening solution is introduced into the funnel, and then the screening solution is valved from the spray tip onto the cushioning liquid. The pipe is then lifted out of the neck of the envelope, rinsed, inserted into the neck of the next envelope to be screened, and the process of dispensing another charge of screening solution is repeated.

The conveyor-mounted tube envelopes are usually relatively closely spaced, and the conveyor is continually moving both when the dispenser pipe is in and when it is out of a tube. Consesquently, as the dispenser is lifted out of each tube envelope in turn, rinsed, and inserted into the next tube envelope it is inevitable that the spray tip end of the pipe passes back and forth over each tube in succession several times.

One of the difficulties heretofore encountered in semi-automatic tube screening of the type above described has arisen from the fact that the spray tip end of the dispenser pipe has a tendency to drip after the screening solution charge has been dispensed from it, so that droplets of phosphor-binder slurry may fall from the spray tip onto various parts of the tubes over which the spray tip passes during handling. Such droplets may land on the

surface of the cushioning liquid within a tube through which previous dispensed phosphor is settling, causing undesirable ripples in the cushioning liquid and resultant uneven distribution of the settling phosphor. The droplets may also land on the internal surface of a tube neck, or they may land on the external surface of a tube, from which they may drip down around the large end of the cone portion of the tube envelope and flow onto the exterior surface of the face plate. It may be appreciated that the falling of such droplets onto any portion of the tube envelope is highly objectionable because if the droplets are allowed to dry where they land they may produce objectionable discolorations in a tube or blemishes in the contour of its face plate, or if the droplets land within the tube neck the material thus deposited may objectionably affect the electrical characteristics of the tube.

Consequently, it has heretofore been necessary to carefully inspect each tube envelope after a screening operation and to remove any extraneous droplets of phosphor-binder material, particularly from the interior surface of the neck or the exterior surface of the cone or face plate. Removal of such extraneous material has heretofore required the use of mechanical buffing equipment, or a very careful rinsing of the affected area with an appropriate solvent such as hydrofluoric acid. Such additional process steps, however, are time consuming as well as hazardous to the tube, and hence costly. Moreover in some instances the blemishes caused by such droplets are impossible to remove or the removal process may so damage the phosphor screen as to require complete reprocessing of the tube, which is of course extremely expensive in terms of time, materials and excess equipment-capacity required for a given volume of production.

Accordingly it is a principal object of the present invention to eliminate the formation of blemishes in or on the walls of tube envelopes caused by the dripping of phosphor-binder mixtures thereon.

Another object is to provide improved screening solution dispensing apparatus which eliminates dribbling and dripping of residue screening solution from the spray tip thereof at any time during the course of screening either a single tube or a plurality of tubes in succession.

Another object is to provide an improved screening solution spray tip and valve therefor which positively prevents dripping or dribbling of residue from the spray tip after shut-off, and which is inexpensive, easy to clean and convenient to operate.

These and other objects of the present invention will be apparent from the following description considered in conjunction with the accompanying drawing.

In the drawing:

Fig. 1 shows a cathode ray tube in which is inserted screening solution dispensing apparatus of a type to which the present invention is particularly suited;

Fig. 2 is an enlarged view, partly broken away in axial section, of a portion of a dispensing apparatus such as shown in Fig. 1, constructed according to the present invention; and

Fig. 3 is a view similar to Fig. 2, showing the parts in the valve-closed position.

Turning now to Fig. 1 there is shown a cathode ray tube envelope including a neck 2, a cone portion 4 and a face plate 6 on the interior surface of which a screen is to be deposited by the liquid settling process. The tube is arranged in a position suitable for such screening, i.e. with the face plate 6 down and the neck 2 extending upwardly in a generally vertical direction. Within the tube envelope and covering the interior surface of the face plate is a charge of cushioning liquid 8 which may be, for example, water containing a small quantity of an electrolyte such as barium acetate.

Arranged above the envelope is a screening solution

dispensing apparatus 10. The dispensing apparatus includes a pipe 12 which extends into the tube envelope through the neck. Through the pipe 12 may be introduced a charge of screening solution, for example a slurry of phosphor and a suitable binder such as an aqueous solution of potassium silicate, for settling through the cushioning liquid 8 onto the face plate 6. The upper end of the pipe is connected to and supplied from a funnel or other container 14 of sufficient size to hold a desired charge of screening solution for one or more tubes. Attached to the lower end of the pipe 12 is a spray tip 16 consisting of a thimble-shaped metal member, preferably made of stainless steel, having a plurality of spray orifices 18 adjacent its lower end. Within the spray tip 16 is a valve, shown in Fig. 2 and to be more fully described hereafter, for controlling flow of screening solution from the tip. Operation of the valve is manual in the apparatus shown, by means of a rod 20 extending through the pipe 12 from the valve at its lower end to a control lever 22 mounted on the container 14. Control lever 22 is biased by spring 23 to urge the rod 20 downwardly to the valve-closed position.

As best shown in Fig. 2 the spray tip is secured to an adapter sleeve 24 threaded to the lower end of the pipe 12 by a bayonet-type connection including a pair of radially extending pins 26, on the adapter and slots 28 in the wall of the spray tip. Thus the spray tip may be conveniently removed for cleaning, inspection, or the like. Annular seals 30, 32 are provided between tip 16 and adapter 24 and between adapter and pipe 12 to insure a leakproof connection. The spray tip is hollow and its internal cavity includes an upper portion 36 of relatively large internal diameter surrounded by a relatively thin wall 38 and a somewhat ogive-shaped lower portion 40 which diminishes in internal diameter toward its lower end. The wall portion 42 of the spray tip surrounding the cavity portion 46 is substantially thicker than wall 38, and is separated from the thinner upper wall 38 by an upwardly facing internal shoulder 50. In the relatively thick portion 42 of the spray tip wall is located the plurality of small orifices or passageways 18 through which the screening solution may discharge from the spray tip in a desired distribution onto the surface of the cushioning liquid. The thickness of the wall portion 42 containing the orifices affords good directionality to the streams of liquid discharged therefrom, and the number, size, and arrangement of the passages, in relation to the preferred height of positioning of the spray tip above the cushioning liquid surface at the time of screening solution discharge, is such as to create a desired discharge of screening solution over the surface of the cushioning liquid.

Flow of screening solution from the spray tip is controlled by the valve 52. Valve consists of a plug of material which is resilient, abrasion resistant, and suitably impervious to chemical attack by the various ingredients of the screening solution. One preferred material for the valve is neoprene. The exterior surface of the valve is generally complementary in shape to the interior surface of the thick walled portion 42 of the spray tip, which serves as a valve seat. The valve is mounted within the spray tip for axial reciprocating motion between its seated and unseated positions, and for this purpose the valve is threadably secured to the actuating rod by a shoulder screw 54 and a threaded coupling 56. The threaded coupling permits axial adjustment of the valve relative to rod 20 to insure firm seating of the valve in the closed position with a tight seal of orifices 18. Proper adjustment of the valve is retained by lock nut 58. The diameters of the rod 20, coupling 56, and valve 52 are such, in relation to the inside diameters of the pipe 12, adapter 24 and spray tip cavity portions 36, 40, respectively, as to provide a flow passage of ample cross sectional area for free flow of screening solution from the container to the spray tip orifices when the valve is open.

In the operation of the apparatus described, the pipe 12 is inserted into the neck of an envelope to be screened and positioned so that the spray tip 16 is spaced the preferred distance above the surface of the cushioning solution in the envelope. With a suitable charge of screening solution in the container 14, the valve 52 is opened to permit spraying of the screening solution onto the surface of the cushioning liquid 8. After the desired charge of screening solution has been dispensed from the spray tip, the valve is closed by spring 23 when the hand lever 22 is released.

The resilient material of the valve seats firmly against the interior surface of the thick-walled portion 42 of the tip, tightly sealing the orifices 18 while at the same time expelling the last of the screening solution from within the spray tip with a squeegee-like action. The flexible or resilient character of the valve plug effects a positive closure even in the presence of foreign particles and without requiring critical adjustment. Thus the dispensing apparatus may be freely removed from the tube without dripping or dribbling on or in the tube or its neighbors.

It may thus be seen that the present invention provides an improved screening solution dispensing apparatus which completely eliminates dripping and dribbling of screening solution, and accordingly eliminates the need for inspection for droplets of screening solution on or in the tubes, as well as the time and expense of eliminating blemishes caused thereby.

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. Apparatus of the character described for use in screening cathode ray tubes and the like comprising a solution dispenser pipe for insertion into a cathode ray tube envelope or the like, a spray tip on the discharge end of said dispenser pipe, said spray tip having a downwardly and inwardly sloping interior surface provided with a plurality of spray orifices, a valve within the spray tip including a plug of resilient material, means mounting said valve for movement between an open position spaced from said orifices and a closed position wherein said plug engages said sloping interior surface in sealing relation with said orifices, resilient means associated with said valve for urging said valve toward said closed position, and control means operatively associated with said valve for moving said valve to said open position.

2. Apparatus for use in screening cathode ray tubes and the like comprising a screening solution dispenser pipe for insertion into a cathode ray tube envelope through the neck thereof, a spray tip on the discharge end of said dispenser pipe, said spray tip having a cylindrical relatively thin walled portion connected at one end to said dispenser pipe and connected at its other end to an ogive shaped relatively thick walled portion, the thick walled portion of said spray tip having a downwardly and inwardly sloping interior surface provided with a plurality of spray orifices, a valve within the spray tip including a plug of resilient material engageable with said sloping interior surface in sealing relation with said orifices in the closed position, and control means including a rod connected to said valve for moving said valve to an open position within the thin walled portion of said spray tip.

3. Apparatus for use in screening cathode ray tubes comprising a screening solution dispenser pipe for insertion into the neck of a cathode ray tube envolpe, a

thimble-shaped spray tip on the discharge end of said dispenser pipe, said spray tip having a wall including a relatively thin upper portion and a relatively thick lower portion separated from said relatively thin portion by an internal upwardly facing shoulder, the thick wall of said tip having a downwardly and inwardly sloping interior surface provided with a plurality of spray orifices, a valve within the spray tip including a plug of resilient material, an axially movable valve actuator rod connected to said valve and extending through said pipe, control means connected to said rod for moving said valve axially between a closed position in engagement with said sloping surface and in sealing relation with said orifices and an open position opposite said thin wall portion, and a spring associated with said valve for urging said valve toward said closed position.

4. Apparatus for use in making cathode ray tube screens by the liquid settling process comprising a container for holding a charge of screening solution including a silicate binder, a discharge pipe depending from the container for insertion into the neck of a cathode ray tube envelope, a removable thimble-shaped spray tip on the end of the discharge pipe, said tip having an interior

cavity including an enlarged diameter portion at its upper end and a diminished diameter portion defined by a downwardly and inwardly sloping interior surface at its lower end, said tip having a plurality of spray orifices communicating with said downward and inwardly interior surface, a valve within the spray tip including a plug of resilient material having an exterior surface generally complementary in shape to said downwardly and inwardly sloping surface, valve actuating means for moving the valve between a closed position in engagement with said sloping surface and an open position spaced from said sloping surface, and resilient means associated with said actuating means for urging said valve into said closed position.

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