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METHOD OF PRODUCING TELEVISION TUBE FACE

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Our invention is concerned with a new and improved process for treating glass surfaces to destroy substantially the normal reflective qualities thereof while maintaining a relatively smooth surface.

More particularly our invention is directed to the application of our new process to the production and treatment of television tube face plates whereby we may successfully produce an improved, permanent, non-reflective surface thereon without impairing the ability of the tube face to transmit a televised image to the observer.

The need for a television tube face plate with substantially non-reflective qualities is in extreme demand in the television industry. Surface glare and resulting eye strain to the observer are a popular objection to present day television and although some progress has been made from the early days of television along this line, complete public acceptance of the products presented so far is still forthcoming. Consequently, we have devised a new and improved process for treating both surfaces of a television tube face plate which not only substantially eliminates reflection and glare, but also eliminates weak spots in the glass surfaces and improves the adhesion of the glass for the fluorescent screen coating which is applied to the inner surface of the tube face plate.

Briefly, we have devised a new and improved etching dip treatment of the glass tube face plate which brings about a most satisfactory result, not only as to improved optical characteristics, but as to improved physical properties, uniformity of product and similar considerations as well. The process in brief is one of subjecting the glass to a succession of dipping baths wherein both surfaces of the glass are etched to destroy the normal surface reflective qualities of the glass without substantially impairing the transmission therethrough of an image in juxtaposition of the inner surface of the tube face, for example, a televised image.

It is therefore the main object of our invention to disclose a new and improved process for treating the surfaces of a glass television tube face plate, or the like, by which there is substantially an elimination of all surface reflective characteristics thereof while maintaining its ability to transmit satisfactorily and in sharp definition televised images.

Another important object of our invention is to disclose a process for treating glass television tube face plates or the like whereby the surface of the glass is uniformly strengthened by the

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elimination of marring marks, scratches and like weak spots normally found in the surfaces of commercial glass plate.

Still another important object of our invention is to treat the inner surface of a television tube face plate, or the like, in such a manner as to permit greater adhesion of the fluorescent screening powders for the inner surface of the face plate.

A still further object of our invention is to disclose a method of producing a new and improved television tube face plate or the like which, because of the permanent treatment of its surface to eliminate weak spots therein, is adverse to injury by high temperatures and impacts such as are encountered during the sealing of the tube or during various other operations practised by the manufacturers of television tubes.

These and further objects and advantages of our new and improved product and process will appear from the following detailed description. Now in order to acquaint those familiar with this art as to the mode of producing our product and practising our invention we shall set forth in detail the various features and steps of our process by which our improved product is gained.

In practising our process, and as particularly applied to a television tube face plate of the type to be utilized in the fabrication of metal television tubes, it is first essential that the glass be free of all surface grease and dirt. We have found that the use of a clean, lint-free rag dipped in clear water is entirely satisfactory to clean initially the surface of the glass preparatory to the first dipping bath. Additionally, we have found that commercial grey crystal glass is to be preferred to gain the desired optical qualities for a tube face plate such as we are about to set forth.

First bath

The first bath or dip, after the water cleaning step above, is largely for the purpose of conditioning the glass for the later etching processes. For this purpose we employ a water solution having approximately 8% of hydrofluoric acid by weight although we have found that a 2% variation of this acid content is entirely satisfactory. However, the 8% solution is preferable and a dipping period of from 20 seconds to 3 minutes is satisfactory in most instances, although the preferred time is one minute. The results of the first dip are twofold: first, the glass surfaces are cleaned of all grease and dirt, and second,

a primary etching of the surface takes place at this stage.

Upon removal of the tube face plate from the first dip, the glass should be allowed to drain in the open air for approximately 10 to 15 seconds. It is very important that the surfaces of the glass do not become dry at this stage and care must be taken to see that a wet film is present on the surfaces of the glass upon introduction of the face plate to the second dipping bath.

Second bath

After the cleaning and preparatory etching step of the tube face plate, as set forth above, we next subject the glass to a second etching bath. First, a supersaturated solution of ammonium bifluoride, hydrofluoric acid and water must be prepared. The preferred proportions for this initial solution have been determined to be approximately six pounds of technical grade ammonium bifluoride, one pound of chemical grade 52% hydrofluoric acid and four pounds of water. It is, of course, understood that if chemically pure ammonium bifluoride is used then less than six pounds would be necessary for an equivalent concentration and likewise if a greater concentration percent of hydrofluoric acid is used then corresponding reduction in the weight necessary for that item is indicated. It has also been found that by first combining a mixture in the proportion of six pounds of ammonium bifluoride to one pound of 52% hydrofluoric acid and one pound of water, heating this solution to a temperature of from 130° to 140° F. and then adding the remaining three pounds of water to the final bath solution, that the supersaturated effect is most easily obtained.

After arriving at the supersaturated solution as outlined above, seven ounces of 99.7% chemically pure sodium chloride and 88 ounces of diethelene glycol are added to the mixture to make up the final bath for the second dipping process. The bath is maintained at room temperature and preferably within the range of from 75° to 80° F.

Into this heated bath then, the glass face plate is dipped for approximately one-half to two minutes. Two minutes is the preferred bath time although there appears to be no critical upper limit; the increase of bath time having no marked effect on the surface characteristics of the glass, but serving to vary the thickness of the glass only.

After the preferred bath time of two minutes has expired the tube face plate should be removed from the bath and submerged in a rinsing solution of water, removed therefrom and then sprayed or hosed with clean, clear water to remove all surface residue preparatory to introducing the tube face to the third bath solution.

Third bath

The third bath is preferably a more mild acidic bath than the second bath and is composed of approximately 15% to 35% by weight of 52% concentration, commercial grade, hydrofluoric acid, 26% being the preferred amount of acid, with the remainder of the bath being water. The dipping time in the third bath is within the range of from four to six minutes although as the bath is continuously used and the acid concentration becomes weaker, a longer time may be necessary. Upon completion of the third dip the tube face is removed from the bath and again rinsed with water and dried to complete our surface treating process.

We have found that a television tube face treated by the above successive dipping steps has a marked tendency toward uniform strength in that the surface scratches normally present in commercial grade glass have been wiped out as well as the substantial elimination of areas of high stress in the glass surface. Such a property of uniform strength is advantageous in that it results in less breakage during assembly of the tube face plate with the tube proper and especially so during the evacuation of the television tube to cause a partial vacuum therein, as is the practise with television tube manufacturers.

The greatest effect of our dipping process, however, is the substantial reduction and elimination of the normal reflective quality of the glass surface combined with a marked reduction of halations within the tube face plate itself. This feature makes the television face plate adaptable for both day and night observation without permitting interfering reflection of lights, furniture, etc., on the television screen. At the same time the transmission characteristics of the glass of an image in juxtaposition of a surface thereof is not impaired and a sharper image or picture is obtainable when observing a televised image therethrough than if the face plate had not been subjected to our process.

Treating of the inside surface of the tube face plate as we do allows the fluorescent powders, normally used to coat the inside of the tube face, in forming the television screen, to adhere thereto more readily which is very advantageous to the tube manufacturer.

It should also be noted that due to the uniform strengthening of the surfaces of the glass, it it possible to subject the tube face plate to the high temperatures necessary in assembling a tube face with the body of a television tube without causing undue breakage thereof. This last feature is very important and economically advantageous to the manufacturer of the television tubes. It is also important to bear in mind that the surface treatment which we have outlined above is a permanent one which is not injured by the high temperatures during the sealing of the tube or any other high temperature operation carried on by the tube manufacturer.

Thus it may be seen that we have provided a new and improved dipping process for the treatment of television tube face plates, or the like, whereby there is a substantial elimination of the normal reflective qualities of the glass tube faces so treated coupled with the advantages of added and uniform strengthening of the face plate and the marked increase of adhesive qualities of the inner surface of the tube face for the fluorescent powders used in coating that face to make a television screen.

While we have herein described and illustrated several specific features and materials by which the steps of our process and the production of our product is accomplished, it readily will be recognized that various modifications, changes, and substitutions of equivalents may be utilized without departing from the spirit and scope hereof and, therefore, we do not wish to be limited to the specific embodiment herein illustrated and described except as may appear in the following appended claims.

We claim:

1. The process of producing a substantially

non-reflective, glass, television tube, face plate including the steps of cleaning and etching both surfaces of said plate with an initial mild strength hydrofluoric acid bath, removing said glass from said first bath, introducing said plate, while still wet from said first bath, to a supersaturated, heated glass-attacking second acidic bath composed substantially of hydrofluoric acid carried in water and diethelene glycol, removing said plate from said second bath, rendering said second acidic bath solution on said plate inactive and cleaning said glass of all residue, submerging said plate in a third bath of hydrofluoric acid that is milder than said second bath, but stronger than said first bath, for a time greater than the combined bath times of said plate in said first two baths, and removing said plate from said third bath and rendering said acid remaining thereon inactive to stop said process.

2. The method of rendering a glass face plate of a television tube substantially non-reflective with respect to external light sources without impairing its light transmitting properties with respect to light developed internally of said tube by an electron-beam excitation of a luminescent coating of the inner surface of said face plate, comprising the successive steps of: cleaning both surfaces of said plate and causing an initial etching thereof by subjecting said plate to a mild concentration acidic bath of hydrofluoric acid for a period of time sufficient to cause a light etching of both surfaces thereof, removing said plate from said first bath and allowing said bath solution to drain therefrom for approximately 15 seconds in open air, submerging said glass in a supersaturated second acidic bath while said surfaces of said glass plate are still wet from said first bath; said second bath being maintained at room temperatures and being composed of ammonium bifluoride, hydrofluoric acid, sodium chloride, diethelene glycol and water; maintaining said glass in said second bath for approximately two minutes thereby to accomplish said deep etching of both surfaces thereof, removing said glass from said second bath and rinsing the surface thereof with water, submerging said glass in a third bath of medium strength hydrofluoric acid for a period of time sufficient to modify the frosted etched appearance thereof and gain the desired image transmitting qualities thereof, and removing said glass from said third bath and rendering said acid remaining thereon inactive.

3. The method of rendering a glass face plate of a television tube substantially non-reflective with respect to external light sources without impairing its light transmitting properties with respect to light developed internally of said tube by an electron beam excitation of a luminescent coating of the inner surface of said face plate, comprising the successive steps of: cleaning both surfaces of said plate and causing an initial etching thereof by subjecting said plate to a hydrofluoric bath having an acid content of from 6% to 10% hydrofluoric acid by weight for a period of time ranging from 20 seconds to 3 minutes thereby to cause a light etching of both surfaces thereof, removing said glass from said first bath and allowing said bath solution to drain therefrom for approximately 15 seconds in open air, submerging said glass in a supersaturated, second acidic, glass-attacking bath while said surfaces of said glass are still wet from said first bath; said second bath being maintained at room temperatures of from 75° to 80° F. and composed substantially in the proportions of one pound of chemical grade 52% hydrofluoric acid, six pounds of technical grade ammonium bifluoride, seven ounces of 99.7% chemically pure sodium chloride, eighty-eight ounces of diethelene glycol, to four pounds of water; maintaining said glass in said second bath for approximately two minutes, removing said glass from said second bath and rinsing the surfaces thereof with water, submerging said glass in a third bath of hydrofluoric acid composed of approximately 15% to 35% by weight, commercial grade hydrofluoric acid, maintaining said plate in said third bath for a time in the range of from four to six minutes thereby to insure the desired image transmitting qualities thereof, and removing said glass from said third bath and rendering said acid remaining thereon inactive.

4. A substantially non-reflective television tube face plate adapted to cover over the image displaying end of said tube, said plate having both its interior and exterior faces substantially of a non-reflective character, the interior face being further adapted to receive a coating of luminescent powder for the reception of electron beam excitation thereof to produce a televised image; said non-reflective qualities of said plate being obtained by immersing said plate first in a relatively mild bath of hydrofluoric acid, second in a stronger acidic bath of ammonium bifluoride, hydrofluoric acid, sodium chloride, diethelene glycol and water, and finally into an intermediate strength hydrofluoric acid bath whereby both of said plate surfaces become adverse to reflecting exterior light sources but sufficient translucency is maintained for the clear transmission of a televised image therethrough.

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