Oct. 14, 1969 G. F. BARNETT 3,473,097

IONIZED GAS ELECTROSTATIC COPYBOARD

Filed Sept. 23, 1968 2 Sheets-Sheet 1

FIG. 1

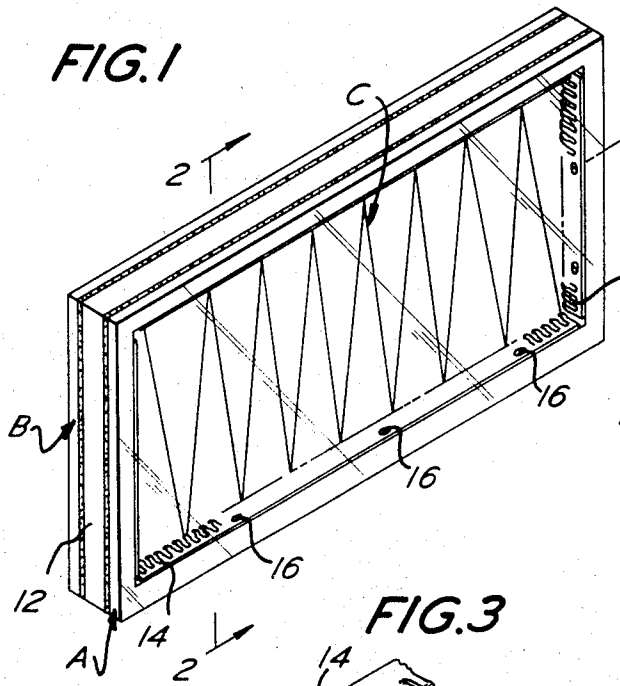


FIG. 2

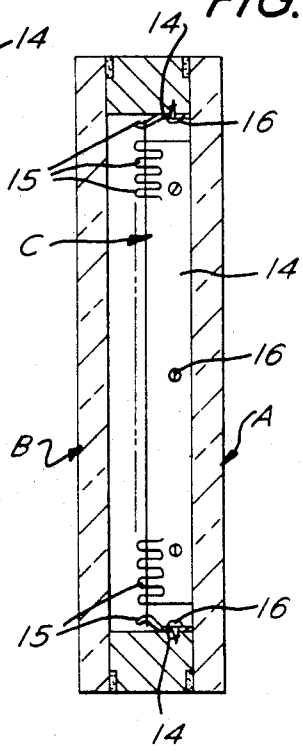


FIG. 3

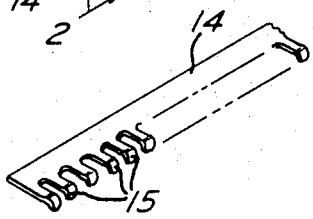
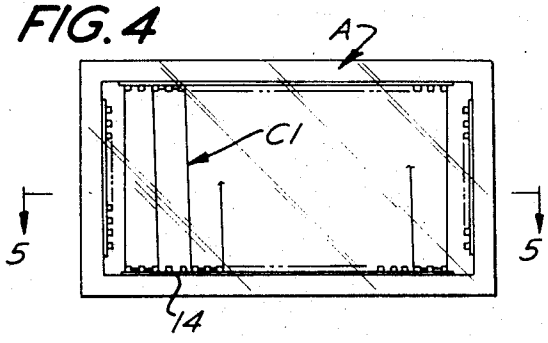


FIG. 4



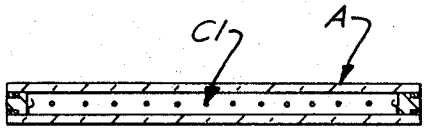


FIG. 5

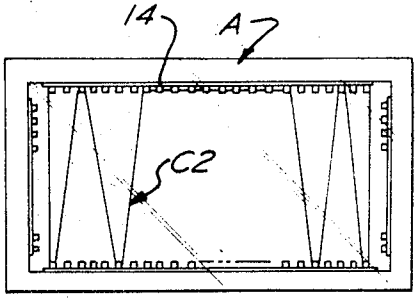


FIG. 6

INVENTOR
GUY F. BARNETT
BY
ATTORNEY

Oct. 14, 1969 G. F. BARNETT 3,473,097

IONIZED GAS ELECTROSTATIC COPYBOARD

Filed Sept. 23, 1968 2 Sheets-Sheet 1

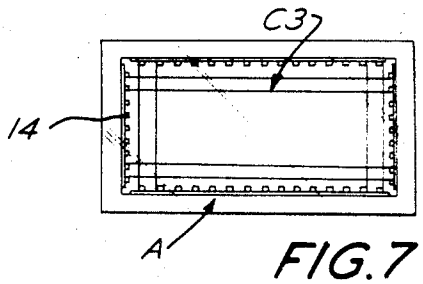


FIG. 7

FIG. 8

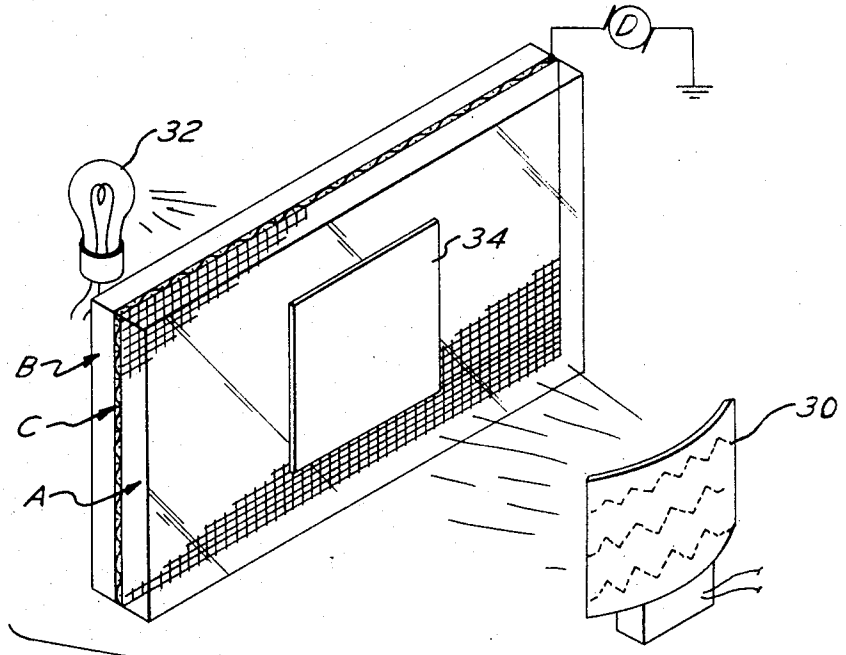


FIG. 9

INVENTOR
GUY F. BARNETT
BY
ATTORNEY

United States Patent Office 3,473,097 Patented Oct. 14, 1969

3,473,097

IONIZED GAS ELECTROSTATIC COPYBOARD

Guy F. Barnett, Warminster, Pa., assignor to The Simco Company, Inc., Lansdale, Pa., a corporation of Pennsylvania

Filed Sept. 23, 1968, Ser. No. 761,426
Int. Cl. H05f 1/02, 3/06
U.S. Cl. 317—262 10 Claims

ABSTRACT OF THE DISCLOSURE

An electrostatic copyboard in which a wire network to which a high voltage D.C. generator is coupled is adjacently spaced in a gas from the surface of a dielectric panel. The corona discharge from the fine wires causes the gas, such as air, in the gap to become conductive, and the gas ions contact and deposit on the adjacent surface of the dielectric panel causing it nominally to approach the wire potential. An article abutting the opposite surface of the dielectric panel and grounded is electrostatically adhered thereto. Heating the gas improves adhesion.

This invention relates to electrostatic holding devices and more particularly relates to electrostatic copyholders, such as are commonly used for holding articles, sheets and film preparatory to photographing and/or xerographing.

In prior U.S. Patent No. 3,359,469, there is shown and described an electrostatic copyboard in which a high voltage D.C. potential is applied to a conductive plate in contact with the back surface of an insulative panel. By abutting an article against the front working surface of the insulative panel and providing a conductive path from the article to the other side of the high voltage, the article electrostatically adheres to the working surface with great tenacity. The foregoing electrostatic copyboard is known as a front lighted system since the conductive plate used is opaque.

A backlighted copyboard is one in which light is directed from the rear of the copyholder and through the work supporting panel so as to illuminate semi-transparent articles, such as photographic or X-ray film, or to perform reproduction operations through a transparent plate, such as in photographic printers or xerographic copiers. Initial attempts to incorporate a transparent conductive coating upon a transparent dielectric plate have resulted in failures because of the tendency for the coating to break down and erode from the high voltage applied. Wire mesh screens which have previously been used as a conductive plate for the high voltages interfered considerably with the light transmission characteristics through the front plate and, in addition, cast shadows upon or obscured the characters or indicia on the articles or sheets to be reproduced. When liquids such as water or other solutions were employed as the transparent conductive member in abutment with the dielectric work supporting panel, considerable sealing problems arose because of the pressures developed by the hydraulic heads, especially when the copyboards weer placed in upright position.

The present invention overcomes all of the foregoing problems and difficulties through the use of a single fine wire or a selected minimum number of fine wires which are formed into a network or reticle of any desired pattern wherein the areas between adjacent wires are extremely large (inches) as compared to the wire diameter (1 or 2 mils). The wire network is adjacently air spaced from a dielectric panel or gas encapsulated in spaced disposition from a dielectric work supporting panel or between a pair of such panels separated from each other by a gap. A high D.C. voltage applied to the wire network creates a corona discharge from the fine wire, which acts as an infinite number of points and causes the gas to become conductive. The gas ions which are created are deposited on the adjacent surfaces of the dielectric panel as well as on surfaces remote from the wires whereby the surfaces become charged nominally to the same voltage as that imposed on the wire network. Hence, an article placed in abutment with the front working surface can be made to electrostatically adhere thereto. Since the wire used is extremely fine, approximately 2 mils or less, and since they are spaced from each other by a relatively large distance, approximately 2 inches, they are essentially invisible and do not materially interfere in any appreciable way with transparency or translucency of the dielectric panels themselves. Hot gas, such as air, can be directed through the channel between two adjacently spaced dielectric panels or against the work supporting panel so as to heat and drive off any film of moisture which might otherwise diminish the surface resistivity of the working surface and interfere with adhesion.

It is therefore an object of this invention to provide an electrostatic copyboard which is well adapted for transparent or translucent backlighting with minimal interference.

Another object of this invention is to provide an electrostatic copyboard in which electrostatic adhesion is produced solely by the creation of gas ions from a high voltage wire network interposed in spaced disposition from the rear surface of a dielectric working panel.

Still another object of this invention is to provide an electrostatic copyboard which utilizes a gas as the charging medium because of its ability to be heated and circulated against the dielectric working panel so as to drive off moisture which might otherwise reduce surface resistivity and interfere with adhesion.

Yet another object of this invention is to provide an ionized gas activated electrostatic copyboard.

Yet still another object of this invention is to provide an electrostatic copyboard in which there are no sealing problems.

Other objects of this invention are to provide an improved device of the character described which is easily and economically produced, which is sturdy in construction and both highly efficient and effective in operation.

With the above and related objects in view, this invention consists of the details of construction and combination of parts as will be more fully understood from the following detailed description when read in conjunction with the accompanynig drawings in which:

FIGURE 1 is a perspective view of an ionized gas actuated electrostatic copyboard embodying this invention.

FIGURE 2 is a sectional view taken along lines 2—2 of FIGURE 1.

FIGURE 3 is a fragmentary perspective view of a stringing element for supporting a network of corona discharge wires in the gas space.

FIGURE 4 is a plan view of the copyboard showing one pattern of stringing the wire network.

FIGURE 5 is a sectional view taken along lines 5—5 of FIGURE 4.

FIGURE 6 is a plan view of another mode for stringing the wire network.

FIGURE 7 is a plan view of still another manner of stringing the wire network in the electrostatic copyboard.

FIGURE 8 is a perspective view of a modified form of the ionized gas electrostatic copyholder in which hot air is circulated in the interspace.

FIGURE 9 is a perspective view of the electrostatic copyboard in which the front surface is heated by a radiant panel.

Referring now in greater detail to the drawings in which similar reference characters refer to similar parts, there is shown an ionized gas electrostatic copyholder which comprises a first dielectric panel A, a second dielectric panel B spaced from the first panel, a conductive wire network C strung in spaced disposition between the interior faces of the front and rear panels, and a high voltage D.C. generator D connected to the wire network.

While the front and rear panels A and B can be of any insulative composition, it is preferable to utilize glass because its volume resistively lies in a desirable range as compared to most plastic materials. In addition, for transparent materials, glass has a higher resistance to scratching than plastic compositions, such as acetates, vinyl or acrylic polymeric substances. The panels A and B can either be opaque, translucent or transparent. For example, where backlighting, one can use a translucent panel for diffused light as in X-ray viewing. Similarly a transparent panel may be employed for photographic printing or xerographic copying.

The two panels A and B which are in most arrangements identical in plan configuration are held in spaced disposition from each other by an annular insulative frame **12**, in this case of rectangular design. However, any peripheral outline may be employed depending upon the needs of the user or the orientation of the exterior panels. In order to stringedly support the wire network C in any one of a plurality of patterns, a conductive comb-like member **14** is secured about the inner periphery of the annular frame **12** by means of suitable mounting screws **16**. The comb **14** is preferably in strip form for convenience in cutting to length and of Phosphor bronze composition for both resilience and conductivity. A plurality of claw-like fingers **15** project from the strip and define hooks which permit the wire network to be strung in any configuration. As is apparent, a single wire may be stretched from fingers **15** extending from comb strips **14** at opposite and/or adjacent portions of the annular member **12**.

In FIGURE 1, the network C constitutes a single wire which extends in a series of equiangular diagonal lines between the upper and lower comb strips **14**. The wire is preferably 2 mil stainless steel for resistance to corrosion, strength and conductivity, and it is held in a plane which is approximately one-half inch from the interior surfaces of the panels A and B. In this embodiment, the lateral strips **14** are not utilized. In FIGURES 4 and 5, a network **C1** is illustrated in which the wire is strung in a plurality of spaced parallel lines in rectangular orientation between the upper and lower comb members **14**. The spacing of the wire is regular and equal and extends across the entire exposed area of the board in increments of perhaps two inches. In FIGURE 6, there is shown a network pattern **C2** in which the design constitutes a series of irregular diagonal lines adjacent the right and left margins with a clear space in the medial portion. In FIGURE 7, the network comprises a latticed pattern **C3** arranged with rectilinearly crossing wires at the margins and extending about a clear zone at the central portion. Many other variations and combinations of wire networks can be utilized depending upon the needs of the ultimate user and his adhesion requirements.

When the wire network C is suitably coupled to the hot side of a positive or negative high voltage generator, nominally rated at 5,000 to 15,000 volts at 2 milliamperes, the relatively small diameter wire acts as though it were an infinite number of points or point sources. Accordingly, the corona discharge from these plural wire point sources causes the gas to ionize in the space between the wire network C and the interior faces of the panels A and B. That is, gasses, such as air, nitrogen, argon and the like, are made conductive by the high intensity electric field at the fine wires. These ions contact and deposit on the inner surfaces of the dielectric panels A and/or B and within a very brief time cause the surfaces on which they are deposited to approach the same potential as that imposed on the wire network C by the high voltage generator D. By abutting articles, such as a sheet of paper against the front surface of either panel and providing a conductive path from the article to the ground side of the D.C. generator, the articles are caused to adhere to the work surface of the dielectric panel.

In FIGURE 8, the interior gap between the panels A and B is coupled to a hot air blower E. The blower E comprises a casing **20** having a fan **22** therein. The fan **22** directs air across a series of heating elements **24** through an inlet duct **26** formed in the annular frame **12** between the two dielectric panels A and B. The air from the gap exists through outlet duct **28** back into the casing **20** where the fan **22** recirculates the air across the heating elements **24**. Under high humidity conditions, moisture tends to form a relatively conductive film upon the surface of the dielectric panel. The heated air caused evaporation of this film of moiseture from the working surfaces of the dielectric panels so as to eliminate its shielding effect. Thus, raising the temperature of the dielectric panels A and B maintains the holding strength of the copyboard in the presence of high ambient humidity.

In FIGURE 9, the front surface of panel A is heated by a radiant panel **30** which evaporates the film of moisture directly rather than through the panel from the interior. A lamp **32** is illustrated to represent the backlighting arrangement, the higher voltage D.C. generator D again being coupled to the wire network. Also in FIGURE 9, a sheet **34** of paper, for example, is being electrostatically adhered tothe front surface of the panel A.

As is apparent from the foregoing description, the instant invention resides primarily in the use of a fine wire network to which a high voltage D.C. is connected for producing gas ions in the adjacent space, the ions of like polarity being deposited upon an adjacent dielectric panel which effectively becomes charged to the same voltage as the D.C. generator.

What is claimed is:

1. An electrostatic copyholder comprising a dieelectric panel including a front working surface thereon, a network of relatively fine wires adjacently spaced from the rear surface of said dielectric panel with a gas gap therebetween, and means for applying a D.C. high voltage to said wire network whereby gas ions produced by corona discharge from said wires will be deposited on the rear surface of said dielectric panel so that articles placed in abutment with the front working surface are adapted to adhere thereto by electrostatic attraction.

2. The copyholder of claim **1** including a second dielectric panel adjacently spaced from said wire network with a second gas gap therebetween, the exterior face of said second dielectric panel defining another working surface against which articles are adapted to adhere thereto by electrostatic attraction.

3. The copyholder of claim **2** including means to heat the dielectric panels.

4. The copyholder of claim **1** wherein the gas in the gap is air.

5. The copyholder of claim **1** wherein the dielectric panel is glass.

6. The copyholder of claim **3** wherein the means to heat comprises means to circulate hot gas in the gap between the panels.

7. The copyholder of claim **1** wherein said network lies in a plane parallel to the adjacent surface.

8. The copyholder of claim **7** wherein said network comprises a plurality of wire elements spaced from each other at regular intervals.

9. The copyholder of claim **7** wherein the wire elements are more closely spaced in one zone and have an open area in another zone.

10. The copyholder of claim 1 wherein said dielectric panel is transparent.

References Cited

UNITED STATES PATENTS

2,742,814	4/1956	Gage	355—3
2,834,132	5/1958	Taylor et al.	40—125
3,273,301	9/1966	Anderson	317—3 X
3,289,060	11/1966	Rubin	317—262
3,359,469	12/1967	Levy et al.	317—262

LEE T. HIX, Primary Examiner

D. J. HARNISH, Assistant Examiner

U.S. Cl. X.R.

40—125; 95—85; 355—3