

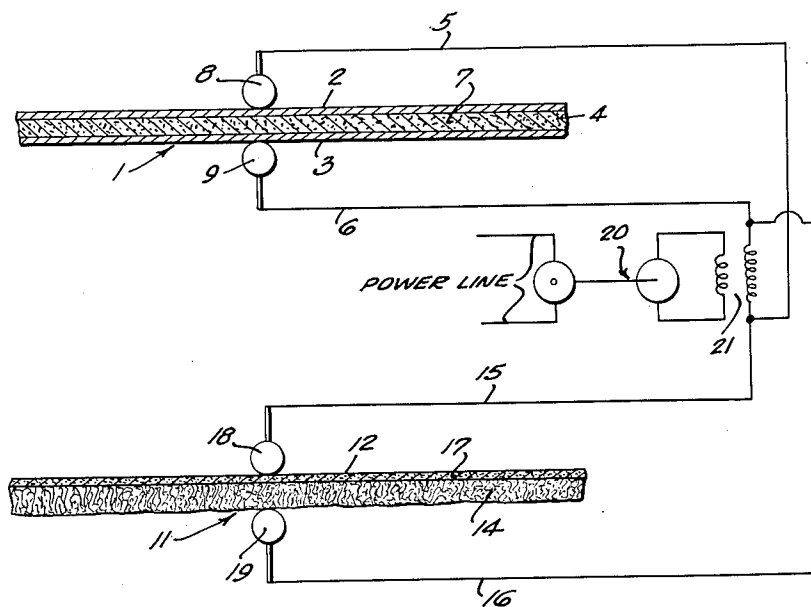
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I. H. WILSEY ET AL

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PERFORATION OF SHEET MATERIAL BY ELECTRICAL DISCHARGES

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Inventors:

IRVEN H. WILSEY +
JOHN W. MEAKER

By *Burton, Ryan & Hicks*
Attorney

UNITED STATES PATENT OFFICE

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PERFORATION OF SHEET MATERIAL BY
ELECTRICAL DISCHARGESIrven H. Wilsey, Chicago, and John W. Meaker,
Evanston, Ill.

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10 Claims. (Cl. 229—62.5)

This invention relates to the perforation by electrical discharges of sheet material such as paper, composite fabric consisting of paper sheets and coating or filling strata, or other like fabrics, by means, for example of the apparatus disclosed in patent to Irven H. Wilsey, No. 1,790,452, January 27, 1931, or the apparatus disclosed in the application of John W. Meaker, Serial No. 358,041, filed September 23, 1940, in which dielectric sheet material is perforated by high voltage currents produced by a step-up transformer or by means of other electro-perforating apparatus. The sheet material thus perforated may be used for the manufacture of various articles such as bags, valve bags for example, or other containers such as open mouthed bags. The invention, however, is not to be considered as limited to the perforation of paper, or composite paper fabrics; nor to the production of bags; nor to the use of any particular electro-perforating apparatus.

A primary object of the invention is to provide certain means and procedures whereby the piercing of the fabric sheet or sheets by electrical discharges is facilitated by associating with the sheet or sheets a substance, preferably in a pulverulent state and distributed with relative uniformity, upon, or within, or in case of the simultaneous perforation of several sheets, between said sheets, which substance is of such character, that is, of such relatively high electrical conductivity, as to facilitate the penetration of the sheet or sheets by the electric arcs. This not only makes possible the electro-perforation of more or less highly resistant sheet material, that is material of high dielectric strength, without proportionate increase in voltages and current intensities, but also increases, under any circumstances, the number of perforations made over a given area in a given time and with a given equipment by minimizing the tendency of the discharges through perforations already made instead of piercing the fabric with new perforations. That is, with the paper moving between a set of oppositely arranged electrodes there is always a tendency for the arcs to pass through already made perforations, due perhaps to the persistence of ionization, instead of forcing their way over the shorter but more highly resistant paths through the fabric.

The invention has for a specific object to provide for the perforation of paper coated or otherwise treated with some plastic material which resists electric arc perforation, such for example as asphaltum, used for the treatment of paper employed in the manufacture of bags, for example

valve bags, to make the bags waterproof. In such case the materials used for reducing the resistance of the dielectric may be distributed in the asphalt stratum.

5 The preferred form of the invention is illustrated by way of example, in the accompanying drawing which is a vertical section through a sheet made of two layers of paper with a layer of asphaltum therebetween and a vertical section
10 through a layer of patent leather. The electric equipment is illustrated diagrammatically.

Looking at the figure, 1 represents a section through a sheet made up of two sheets of paper 2 and 3 with a layer of asphaltum 4 therebetween.
15 Throughout the asphaltum are distributed particles of a substance of low di-electric resistance, as shown at 7. A pair of electrodes 8, 9 are arranged one on each side of the sheet 1. These are connected by conductors 5 and 6 with the
20 high voltage side of transformer 21 which, in turn, is supplied with current by a motor generator set 20.

At 11 is illustrated a sheet of patent leather or similar material. The fibrous hide is shown at
25 14 and the hard glossy finished layer is shown at 12. The latter has distributed throughout its thickness small particles of material with a low di-electric resistance, such as the particles shown at 17.

30 At 18, 19 are electrodes connected by conductors 15, 16, to the high voltage side of transformer 21.

In operating the device illustrated above, the sheet material would be moved along between the
35 electrodes so as to perforate different parts of the sheet. The voltage and amperage utilized will be dependent upon the sheet material being acted upon and the character of the perforation desired. For commercial practice, rows of elec-
40 trodes can be used and a relatively high voltage and low amperage is desirable with a high cycle output. One form of the arrangement of electrodes is disclosed in copending application 393,134.

45 The invention may also be utilized in the electro-perforation, simultaneously, of a plurality of sheets by distributing the material between the sheets.

Suitable substances for the purpose are graphite, carbon black, aluminum, bronze or other metallic powders, in fact any pulverulent, granular, flaked or otherwise finely divided material, the electrical resistance of which is relatively low.

Valve bags, or other bags having openings
55 which closely fit the filling spouts of filling ma-

chines, in case the bags are used for packaging cement or other pulverulent material, if made of one or more envelopes composed of waterproof material, are difficult to fill because of the impermeousness to air of the waterproofed paper which results in a trapping of air in the bag and necessitates, in actual practice, the use of larger bags for the same quantity of material than if the bags had been made of more porous paper. The use of waterproofed paper involves, therefore, increased expense in two respects, i. e. a large quantity of paper and paper of more expensive character. The waterproofing of bags intended to contain cement, for instance, is desirable because the penetration of moisture into the bag sets and destroys the usefulness of a certain quantity of the cement. It is, therefore, particularly desirable to perforate bags made in whole or partly of waterproofed paper, both so as to allow the escape of air from the bags during the filling operation, as referred to above, and also to provide a breathing action when the bags are handled which minimizes bursting in case the bag is dropped. This perforation may be effected by electrical discharges in which case the perforations will be made large enough to allow the passage of air but small enough so that no appreciable amount of liquid moisture can enter the bag. With asphalted paper the operation is difficult, requiring high voltages and current intensities; and it is also a relatively slow operation because of the tendency of the discharges, as adverted to above, to go through already made perforations instead of making direct paths by piercing the material with new perforations. By distributing graphite, carbon black or other pulverulent material through the asphaltum, the perforation of the paper-asphalt fabric (a fabric consisting, for example, of two sheets of paper with a stratum of asphaltum between them) is very much facilitated and the expense of the operation reduced. The use of carbon black in this connection is favored because of its low cost. The amount may be from 2% to 7% by weight of the asphaltum. A 2%-7% range is preferred as larger amounts of the material seem to increase the melting properties of the asphaltum. The invention, however, is not limited to the use of any particular amount of the material employed for reducing electrical resistance.

The invention may also be utilized in connection with the electro-perforation, simultaneously, of a plurality of sheets of paper, treated or untreated, that is, with the sheets superposed one upon or against the other. In such case the perforating operation is facilitated by distributing between the sheets a pulverulent substance of high electrical conductivity such as aluminum or bronze powder.

It would be possible to incorporate the pulverulent high conductivity substance in the paper itself; or in any manufactured fabric intended to be electrically perforated.

Considerable difficulty has been experienced in the electro-perforation of patent leathers, particularly patent leathers using the cellulose types of lacquer, methyl, ethyl or nitro. The electrical discharges, if intense enough to penetrate the material at all, were found to make irregular ruptures of the lacquer finish instead of clean, burned perforations. Also the ruptured openings were too wide apart, the tendency of the current being to go through previously made holes instead of making new perforations. These diffi-

culties have been overcome by adding to the lacquer about two per cent of carbon black based on the weight of the lacquer; or 6 per cent, by weight of bronze powder. The oxidized oil types of patent leather lacquers are more susceptible to electro-perforation than the pyroxylin type; but improved results are also obtained by the incorporation of pulverulent conducting material in such oxidized oil lacquers.

It is the intention to cover by patent all equivalents and modifications of the above described processes; and also the products of such processes.

We claim:

1. A bag comprising an envelope formed with a plurality of minute, electric arc pierced perforations, in the fabric of which envelope is dispersed a finely divided substance having a lower electrical resistance than the material constituting said fabric.
2. A bag, having a valved filling opening, comprising an envelope formed with a plurality of minute, electric arc pierced ventilating perforations to allow the escape of air when the bag is filled, in the fabric of which envelope is dispersed a finely divided substance having a lower dielectric resistance than the material constituting said fabric.
3. A bag comprising a paper envelope treated with a stratum of waterproofing material in which is dispersed a finely divided substance having a lower dielectric resistance than the material constituting said stratum, said envelope being formed with a plurality of minute, electric arc pierced perforations.
4. A bag, having a valved filling opening, comprising a paper envelope treated with a stratum of waterproofing material in which is dispersed a finely divided substance having a lower electrical resistance than the material constituting said stratum, said envelope being formed with a plurality of minute, electric arc pierced ventilating perforations to permit escape of air when the bag is being filled.
5. A bag comprising an envelope formed of asphaltum treated paper and provided with a plurality of electric arc pierced perforations; the asphaltum containing dispersed therein a finely divided substance having a lower dielectric resistance than the asphaltum.
6. A bag, having a valved filling opening, comprising an envelope formed of asphaltum treated paper and provided with a plurality of electric arc pierced ventilating perforations; the asphaltum containing dispersed therein a finely divided substance having a lower electrical resistance than the asphaltum.
7. Method of producing a multiplicity of perforations, by electrical discharges, in sheet material consisting of paper and asphaltum which comprises: incorporating in and distributing through the asphaltum a substance, in a finely divided and dispersed state, having a lower dielectric resistance than that of the asphaltum; and causing a plurality of electrical discharges to arc through said sheet material over said paths of reduced resistance.
8. Method of producing a multiplicity of perforations, by electrical discharges, in sheet material consisting of paper treated with asphaltum, which comprises: incorporating in and dispersing through the asphaltum carbon black in a finely divided and dispersed state; and causing a plurality of electrical discharges to arc through said sheet material.
9. Method of producing a multiplicity of per-

forations by electric discharges in a sheet material having a substantially continuous coextensive coating characterized by a dielectric strength so high that electric discharges have a marked tendency to jump to nearby perforations rather than to pierce the sheet to form new perforations comprising uniformly incorporating in and distributing substantially throughout the area of said coating a substance, in finely divided and dispersed state, having lower dielectric resistance than that of said coating and facilitating electrical arc penetration therethrough, to provide paths of reduced resistance for electrical discharges, and causing a plurality of electrical discharges to arc through said sheet material and coating over said paths of reduced resistance, whereby the piercing of said sheet material with a relatively large number of perforations for a given area is facilitated.

10. Method of producing a multiplicity of perforations by electric discharges in a paper sheet

material having a substantially continuous coextensive waterproof coating characterized by a dielectric strength so high that electric discharges have a marked tendency to jump to nearby perforations rather than to pierce the sheet to form new perforations comprising uniformly incorporating in and distributing substantially throughout the area of said coating a substance, in finely divided and dispersed state, having lower dielectric resistance than that of said coating and facilitating electrical arc penetration therethrough, to provide paths of reduced resistance for electrical discharges, and causing a plurality of electrical discharges to arc through said sheet material and coating over said paths of reduced resistance, whereby the piercing of said sheet material with a relatively large number of perforations for a given area is facilitated.

IRVEN H. WILSEY.
JOHN W. MEAKER.