

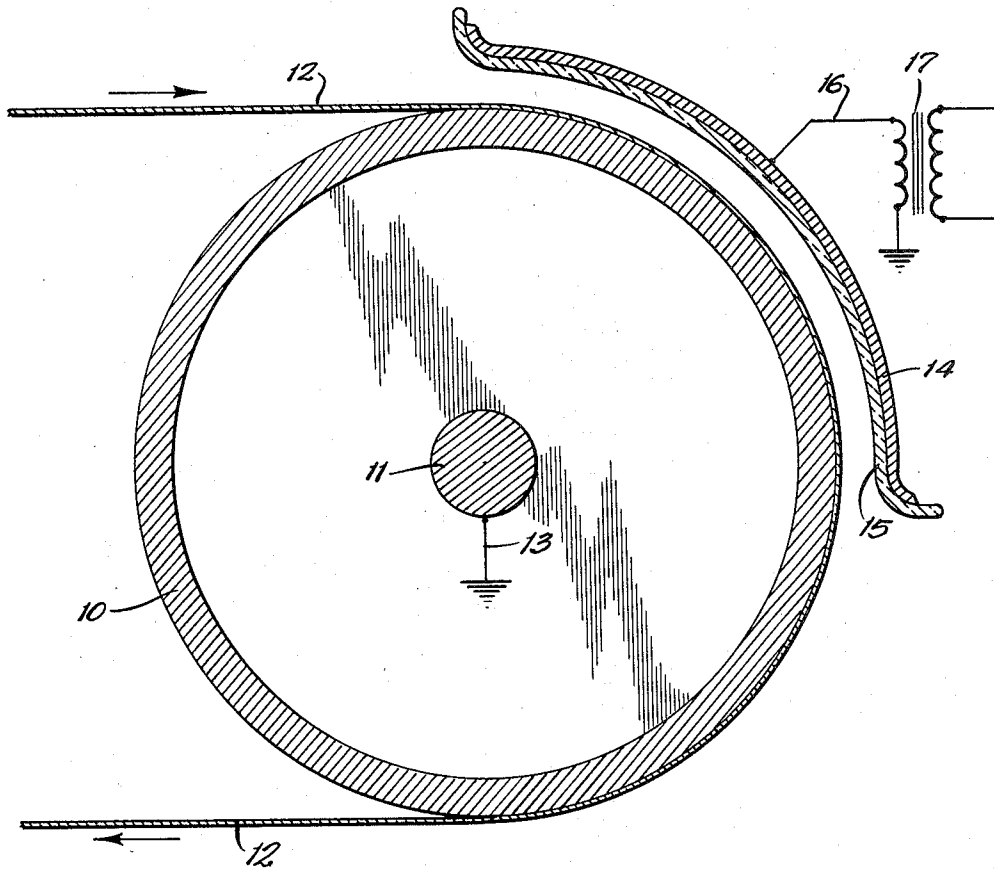
Jan. 13, 1959

M. F. KRITCHEVER

2,867,912

METHOD FOR THE DECONTAMINATION OF METAL FOILS

Filed May 11, 1956



INVENTOR:
Mathew F. Kritchever,
BY *Dawson, Tilton & Graham,*
ATTORNEYS.

1

2,867,912

METHOD FOR THE DECONTAMINATION OF METAL FOILS

Mathew F. Kritchever, Glencoe, Ill., assignor of twenty-five percent to Horace Dawson, Evanston, Ill.

Application May 11, 1956, Serial No. 584,242

6 Claims. (Cl. 34—1)

This invention relates to the decontamination of metal foils and is particularly useful in the removal of light oils from foil film.

Under present practice, aluminum, tin, copper and other metal foils require the use of light oils in the manufacture of the foil film. While a portion of this oil is removed during the annealing process, sufficient oil remains as a contaminating material which inhibits the adhesion of inks or glues desired for printing, laminating and forming seals in subsequent converting operations.

To meet the above problem, it is common practice to apply a wash coat between squeeze rolls, the coat consisting of solvent in which there is dissolved a very small percentage of resin. The action of the wash coat is to dissolve the oil film and to remove it insofar as possible through the use of squeeze rolls and the resin is apparently used to entrap the residual oil, and form a bond to the foil surface. This method is unsatisfactory in that the amount of oil on different foil stock being treated varies and the solvent treatment does not give uniform removal, but leaves some of the foil stock with substantial amounts of oil thereon. Further, the method is expensive and requires a subsequent drying step, thus taking up valuable machine space and giving uncertain results.

Other methods employed involve the use of flame and the use of oxide solutions. Neither method is satisfactory, since flame quickly embrittles the metal and may discolor it, while oxidizing solutions are difficult and costly to use and impair the appearance of the foil.

An object of the present invention is to provide a method by which the foregoing disadvantages are eliminated and in which an oil-free foil is obtained in a single treating step. A still further object is to provide a method for decontaminating metal foil without the use of heat or oxidizing solutions or solvents, and which further is effective regardless of the amount or extent of contaminating oil on the surface being treated. Yet another object is to provide means and process steps which are effective in a single operation for removing oil from the contaminated sheet or foil film and within a minimum of time. Other specific objects and advantages will appear as the specification proceeds.

The invention may be practiced with apparatus of different structures or types, but for the purpose of illustration herein, it is shown in connection with apparatus set out diagrammatically in the accompanying drawing.

In the illustration given, a drum 10 is mounted upon a rotating shaft 11 and is adapted to receive thereon a foil film 12. 13 designates a ground which may lead from the metal conductor drum 10 or, if desired, from the foil itself.

At a spaced distance from the foil, but preferably in contact with the electrode is mounted a dielectric barrier or sheet 15. The barrier 15 completely covers the electrode surface, as shown in the drawing, so as to prevent disruptive discharges. Alternating current is supplied to the electrode 14 through the lead 16 and such current

2

may be supplied by transformer 17 or by any other suitable high voltage generator.

The electrode 14 is subjected to high voltage alternating current of such intensity as to produce an electron discharge against the contaminated foil surface for removing oil from the surface. I prefer to employ sufficient voltage to create a corona or brush discharge between the electrode and the foil.

It will be understood that the voltage may vary with different spacings between the electrode and foil or with the speed of operation or with the amount of contaminated material to be removed. Generally I find that the transformer should supply at least 1,000 volts at the secondary for optimum results, and for effective commercial operation at high speeds I prefer to employ voltages in excess of 5,000 volts, and under certain conditions voltages as high as 20,000 volts or more are found effective in producing rapid decontamination of the foil.

In the foregoing operation the activating force is directed against the surface oil in such a manner as to vaporize it or to cause it to leave the foil surface. For commercial reasons the treatment or activation must proceed very quickly (preferably within one second of time). As stated above, I prefer to employ an electrostatic field of substantial force and normally accompanied by a brush discharge or corona. If desired, the foil itself may be allowed to act as one electrode in the system, thereby promoting electron flow from the foil surface through the oil and on into the air gap between the foil and the electrode 14.

I am unable to explain the phenomenon by which the oil is caused to leave the foil surface, but apparently the intense electron flow is effective in some manner in causing the oil to leave the foil surface. It is possible that the alternating current operates in the following fashion to cause the oil removal:

As the electrons proceed from electrode 14, accelerating through the air gap and passing through the oil film to impinge upon the foil surface, the oil may become activated by the electrons so that on the reversal to electron flow which is characteristic of the alternating current method, the electrons may carry with them the activated oil, leaving a chemically clean foil surface. Under certain operations it is desirable to employ a venting system for the removal of ozone and the dissipated oil fractions. Another possible explanation is that the ozone generated in the foregoing operation combines with the oil, transforming it into a new combine which does not have the inhibiting properties of oil in relation to inks and adhesives. Whatever the explanation, it is found that the foregoing operation does bring about the dissipation of the oily action or the disappearance of the oil from the foil surface, and the conditioned foil can then be effectively printed, laminated or coated, using the usual printing inks or adhesives, etc.

While the spacing between the foil and the electrode may be varied widely under different conditions, I prefer generally to employ a spacing of about one-half inch to one-sixteenth inch, and preferably between one-fourth inch and one-sixteenth inch. The spacing affects the speed of operation and for commercial reasons it may be desirable to exceed the above maximum and minimum spacings.

Examples of the process may be set out as follows:

Example 1.—An aluminum foil 18 inches wide having an oil film on one surface thereof was passed beneath a metal electrode one-half inch in diameter covered with a sheath of glass as the dielectric material of three-thirty-seconds of an inch thick. On the oil film used on the air gap between foil and electrode, 10,000 volts A. C. were applied to the electrode for a period of one second with a spacing of one-eighth of an inch between the elec-

trode and the foil surface. Upon the application of a shellac base ink and a drying time of ten seconds thereof, it was found that the ink adhered tenaciously to the area under the electrode, whereas the ink applied outside of the treated area to the same foil surface was easily removed by rubbing or Scotch tape.

Example 2.—A tin foil eighteen inches wide having an oil film on one surface thereof was passed beneath a metal electrode one-half inch in diameter covered with a sheath of glass as the dielectric material of three-thirty-seconds of an inch thick. On the oil film used on the air gap between foil and electrode, 10,000 volts A. C. were applied to the electrode for a period of one second with a spacing of one-eighth of an inch between the electrode and the foil surface. Upon the application of a shellac base ink and a drying time of ten seconds thereof, it was found that the ink adhered tenaciously to the area under the electrode, whereas the ink applied outside of the treated area to the same foil surface was easily removed by rubbing or Scotch tape.

Example 3.—A copper foil eighteen inches wide having an oil film on one surface thereof was passed beneath a metal electrode one-half inch in diameter covered with a sheath of glass as the dielectric material of three-thirty-seconds of an inch thick. On the oil film used on the air gap between foil and electrode, 10,000 volts A. C. were applied to the electrode for a period of one second with a spacing of one-eighth of an inch between the electrode and the foil surface. Upon the application of a shellac base ink and a drying time of ten seconds thereof, it was found that the ink adhered tenaciously to the area under the electrode, whereas the ink applied outside of the treated area to the same foil surface was easily removed by rubbing or Scotch tape.

Example 4.—Aluminum foil eight inches wide having a film of oil on a surface thereof was spaced one-sixteenth of an inch beneath a one inch wide electrode having a dielectric coating of ten mills of polystyrene sheet. The oil film on the aluminum was placed so that it fell between the aluminum foil and the electrode. After applying two thousand volts for three seconds, it was found that a dextrine adhesive adhered perfectly to that portion of the aluminum foil that had been under the electrode, whereas surrounding areas of the same foil failed to show any receptivity for the dextrine adhesive.

Example 5.—The operation was carried on as described in Example 4 except that tin foil was substituted for the aluminum foil, and the results obtained were comparable.

Example 6.—The operation was carried on as described in Example 4 except that copper foil was substituted for the aluminum foil, and the results obtained were comparable.

Example 7.—Fifteen thousand volts were applied to an aluminum foil having on one face thereof a substantial coating of light machine oil, within a system comprising a support roller grounded to the transformer case and an electrode spaced three-sixteenths of an inch from the oily surface of the foil. The electrode had a coating of twenty mills of polyethylene as a dielectric completely encasing said electrode. Upon exposure for one second, it was found that the polyvinyl acetate water emulsion adhesive possessed great adhesion to that portion of the aluminum film which was treated, whereas surrounding portions completely repelled the adhesive.

Example 8.—The process was carried on as described in Example 1, except that the metal foil was utilized as the electrode, the metal foil being wound upon a mandrel and the foil being grounded. In this operation, the electrode 14 was advanced gradually toward the mandrel

as the film was withdrawn, thus compensating for the reduction in diameter of the roll of film and providing a constant space of approximately one-eighth of an inch between the electrode 14 and the surface of the foil being treated.

While in the foregoing examples I have referred to metal foils as the material to be treated, it will be understood that the process is applicable to other metal sheet bodies under conditions which will bring about a removal of oil or dissipation of the oil or the conversion of the oil into a material which does not resist adhesion, etc.

While, as stated above, I am not certain as to the explanation for the effectiveness of the process in rendering the foil surface highly adherent to adhesives, inks, etc., it is my belief that the process is effective by reason of the actual removal of the oil rather than by the conversion of the oil into non-interfering or adhesion-inhibiting substances, and I believe that this removal is effective by reason of the electron bombardment or by reason of the activation of the oil through electron bombardment.

While in the foregoing specification I have set forth certain apparatus in considerable detail and steps of procedure in considerable detail, it will be understood that such details of structure or procedure may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. In a process for treating oil-contaminated foils, the steps of passing the foil surface carrying oil at a spaced distance from an electrode, grounding the foil, interposing between said electrode and said foil a dielectric barrier, and subjecting said electrode to a high voltage alternating current to produce an electron discharge against said foil to remove the oil therefrom.

2. The process of claim 1 in which the dielectric is in contact with said electrode.

3. The process of claim 1 in which the foil is spaced from said electrode by from one-half to one-sixteenth of an inch.

4. The process of claim 1 in which the foil is spaced from the electrode by a distance of one-fourth to one-sixteenth of an inch.

5. In a process for treating an oil-contaminated foil surface carrying oil film, the steps of passing the foil between an electrode and a grounded conductor, interposing between said film and said electrode a dielectric sheet covering said electrode, and subjecting said electrode to a high voltage alternating current to produce a corona between said electrode and said foil.

6. In a process for treating oil-contaminated foils to remove the oil therefrom, the steps of passing the oil bearing surface of the foil at a spaced distance from an electrode, grounding said foil, interposing between said electrode and said foil a dielectric barrier, and subjecting said electrode to a high voltage alternating current to produce an electron discharge accompanied by a corona against said foil to remove the oil therefrom.

References Cited in the file of this patent

UNITED STATES PATENTS

2,648,097	Kritchever	Aug. 11, 1953
2,668,134	Horton	Feb. 2, 1954
2,767,103	Loukowsky	Oct. 16, 1956

FOREIGN PATENTS

159,822	Australia	Nov. 16, 1954
771,234	Great Britain	Mar. 27, 1957