

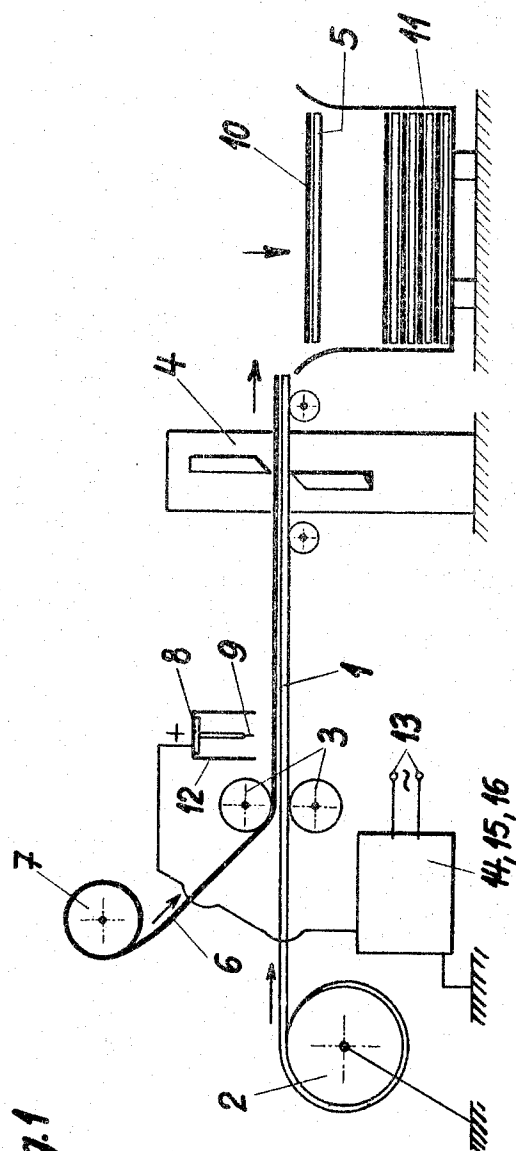
May 9, 1967

F. UNGERER ET AL
APPARATUS FOR FORMING METAL-PAPER LAMINATE
ELECTROSTATICALLY

3,318,751

Original Filed March 14, 1961

3 Sheets-Sheet 1



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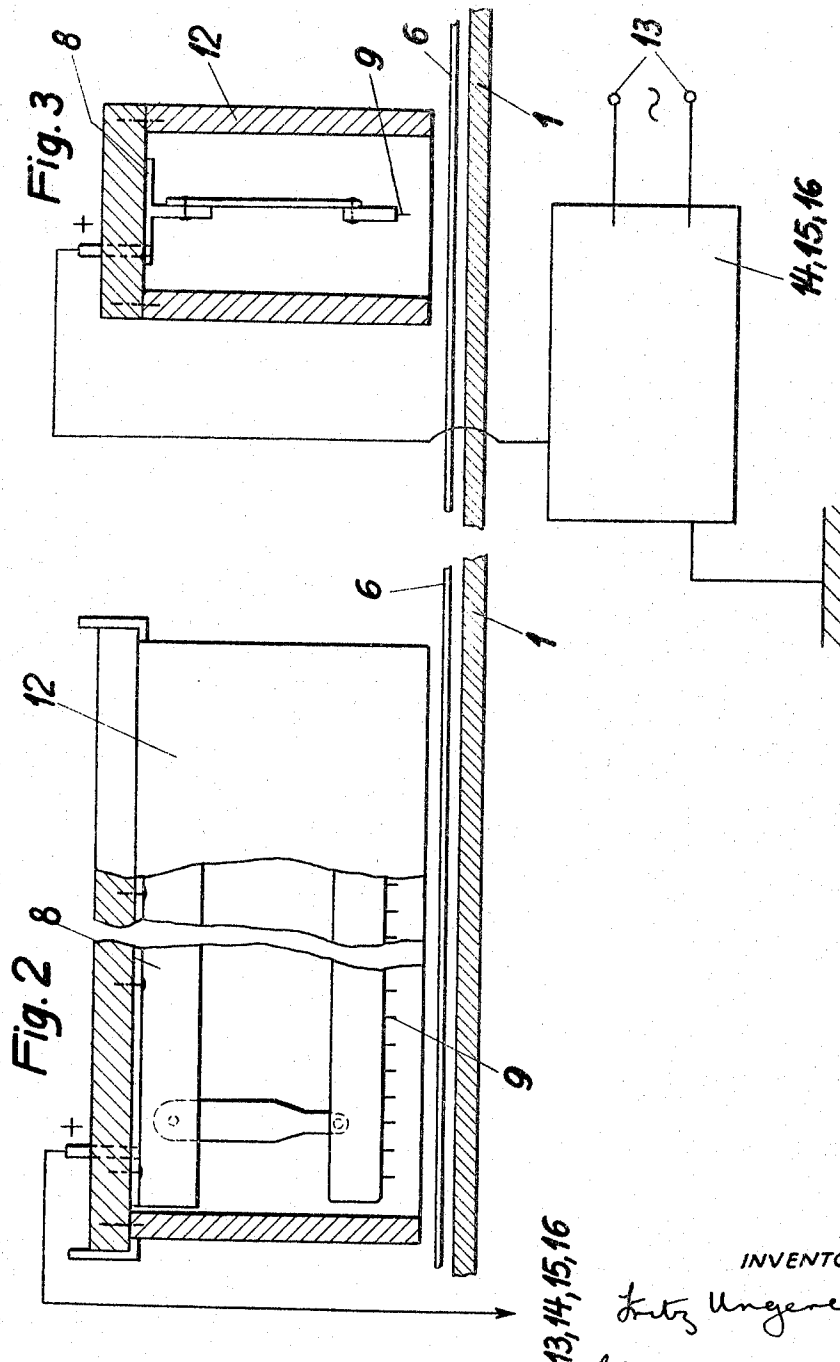
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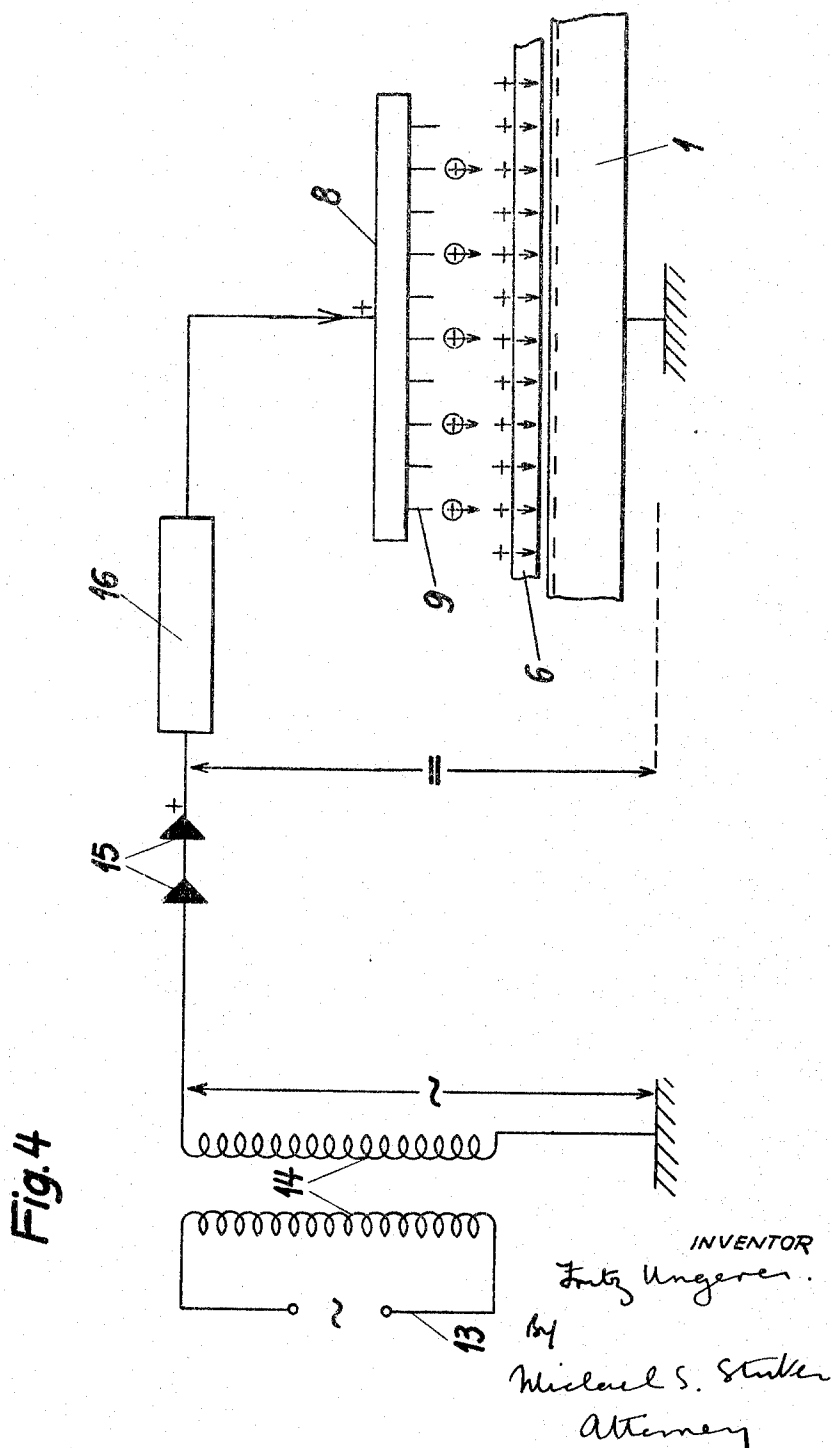
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APPARATUS FOR FORMING METAL-PAPER LAMINATE ELECTROSTATICALLY

Fritz Ungerer, Pforzheim, Germany; Irma Ungerer, heir of Fritz Ungerer, deceased, and Günther Bethe, Karlsruhe, Germany, assignors, by direct and mesne assignments, to Irma Ungerer, Pforzheim, Germany
Original application Mar. 14, 1961, Ser. No. 95,629. Divided and this application Feb. 2, 1965, Ser. No. 435,112

Claims priority, application Germany, Mar. 22, 1960, U 6,996

5 Claims. (Cl. 156—380)

This is a division of application Ser. No. 95,629, filed Mar. 14, 1961, now abandoned.

This invention relates to a process and apparatus for adhesively connecting a paper strip to a continuous metal strip, particularly a brass strip, which paper strip is intended as an interlayer between the metal plates to be stacked after they have been cut from said metal strip.

When metal strips, particularly brass strips, pass through flying shears for being cut to metal plates, paper strips are supplied as a covering, to serve as an interlayer between stacked sheet metal plates after the cutting operation and to protect the surface of the plates. During the cutting and stacking of the sheet metal plates, this covering of thin paper tends to be displaced owing to air movements and the like so that a perfect protection of the sheet metal surface is not achieved. The use of adhesives for connection at localized points is not feasible because this would adversely affect the bright sheet metal plates, particularly brass plates.

The process and apparatus according to the invention afford a solution to this problem. The process according to the invention for adhesively connecting a paper strip to a continuous metal strip, which paper strip is to serve as an interlayer between the metal plates to be stacked after being cut, is characterized in that electric charges for establishing electric fields between the paper and metal strips are applied to the paper strip which is superimposed on the metal strip and together with it is fed to the cutting shears, whereby electric fields are established between the paper and metal strips to retain the paper strip for a short time until these charges have been automatically dissipated on the metal strip. As a result, the paper strip firmly adheres to the metal strip or the metal plates during the cut and after the cut during stacking whereas the electric fields dissipated within short time, i.e., in about four to five minutes, so that the adhesive force disappears too. Since the cutting and stacking operation performed after the electric charging takes only a few seconds, the time of four to five minutes during which the adhesive force is maintained is entirely sufficient to achieve the desired purpose and the thin covering paper can be readily removed for the subsequent further processing of the metal panels.

Transversely extending pointed electrode members may be disposed over the metal strip fed to the cutting station and having the paper strip superimposed thereon. Having a high voltage applied to them these pointed electrode members are adapted to transmit charges by a corona discharge to establish the fields. Air ions are formed at the point of the electrode members which consist suitably of sewing needles arranged one beside the other in a comb-like arrangement in an open-bottomed, elongated housing of insulating material. These air ions move to the paper under the action of the electrode field and pass through the slightly conducting paper layer and through the interlayer between the paper and sheet metal. Owing to the unevenness of the materials, an extremely thin air gap exists between the paper layer and the sheet metal backing.

The insulation value of this air gap is very high compared to that of the paper. The electric charge carriers are discharged only in very small amounts through this gap to the other pole, formed by the metal backing. The paper surface which faces the metal backing and the surface of the latter form thus the plates of a capacitor, which attract with the force $K = \text{const. } U^2/d^2$ (U =voltage at the capacitor and d =spacing of capacitor plates) per unit of area. When the supply of new charge carriers is discontinued because the feeding of the strips toward the shears is continued, the capacitor will be gradually discharged because the interlayer is not an ideal insulator.

Brush rollers, e.g., of plastics, which rotate at a peripheral speed higher than the speed of the strip and which contact the metal strip fed to the cutting station and having the paper strip superimposed thereon, may be provided to supply the charges for the generation of fields by means of friction. In the first case the corona discharge device is supplied with a rectified alternating current at a high voltage and a low current value, which alternating current is obtained from the alternating current supply system and transformed to a high voltage by means of a transformer. In the second case the charge is applied by frictional electricity. The first method is simpler and more reliable than the second because the second process requires a special, high-speed drive for the friction brushes and the generated field and consequently the adhesive force does not have the same intensity.

The drawing shows by way of example an embodiment of apparatus for carrying out the process according to the invention. Specifically,

FIG. 1 is an elevation showing diagrammatically the corona discharge apparatus according to the invention for a metal strip covered by a paper strip, which apparatus serves for causing the paper to adhere for a short time on the metal strip during and after the cutting of the metal to metal plates.

FIGS. 2 and 3 are diagrammatic fragmentary elevation and longitudinal and transverse sectional views showing the corona discharge device of FIG. 1.

FIG. 4 shows diagrammatically in elevation the circuit of the corona discharge device of FIG. 1.

As is apparent in FIG. 1 of the drawing, the metal strip, e.g., a brass strip 1, is withdrawn in known manner from a coil 2 and with the aid of feed rollers 3 is moved to the cutting shears 4, which cut the strip into metal plates 5 of the desired size. Before the cut, a paper strip 6 is fed to the metal strip 1 from a roll 7 with the aid of the rollers 3. The top roller may be rubber-coated to apply the paper strip 6 under slight pressure to the metal strip 1. The corona discharge device 8 according to the invention is arranged behind this feeding device and consists of pointed electrode members 9 which are spaced from each other transversely to the metal strip and have a high voltage, e.g., of 8,000–10,000 volts applied to them while passing a low current, e.g., 0.001 ampere, to generate electric fields which cause the paper strip 6 to adhere to the metal strip 1. This ensures a firm adherence for a short time during the cutting to form metal plates 5 having a paper covering 10 and the subsequent stacking in the car 11. The electric fields have dissipated after about 4 to 5 minutes so that the paper 10 can readily be removed during the further processing of the metal plates 5. The cutting and stacking operations taking only a few seconds, the time of adherence is entirely sufficient for the desired adhesive effect.

As is apparent from FIGS. 2 and 3, the corona discharge device 8 comprises an open-bottomed, elongated housing 12 of insulating material, which housing accommodates the pointed electrode members 9 in the form of sewing needles spaced one beside the other in a comb-

3

like arrangement. As is apparent from FIG. 4, the corona discharge device 8, 9 is fed from the supply system 13 by means of the transformer 14 with high-voltage alternating current of about 8,000–10,000 volts at a current value of about 0.001 ampere. This current is preferably rectified by means of series-connected rod-type rectifiers 15, which are connected by a high resistance 16 to the needle points 9.

According to a further concept of the invention the metal strip 1 fed to the cutting station and the superimposed paper strip 6 may be electrically charged by means of plastic brush rollers contacting the paper strip and having a peripheral speed which is higher than the strip speed. This is not particularly shown on the drawings. In such case, however, a special drive, having a higher speed, for the friction brushes is provided and the intensity of the field and the adhesive force are not so large as in the case described first.

In the drawings, the process as well as the apparatus according to the invention are indicated only diagrammatically. The installation comprises additional machines, such as a withdrawing device for withdrawing the metal strip from the coil, a straightening machine, which succeeds the withdrawing device and straightens and feeds the strip. A cleaning device may also be provided in dependence on the conditions of the individual case. The stacking device disposed behind the flying shears intended for continuous operation is also indicated only diagrammatically because various machines may be used for this purpose and several machines may also follow here. The invention ensures that the paper adheres to the surface of the metal strip during the cutting operation and when the metal plates have been cut off and during the fall in the stacking machine so that the surface of the plates is protected and cannot be scratched during their further handling. The paper coverings can then be removed without difficulty for the subsequent further processing.

I claim:

1. Apparatus for temporarily securing a pair of superimposed elongated strips at least one of which is electrostatically chargeable and the material of said strips exhibiting the tendency of temporarily adhering to each other when said one strip is electrostatically charged, comprising, in combination, feeding means for continuously feeding said pair of superimposed elongated strips along a predetermined path; electrostatic means adjacent said predetermined path for applying to said one strip an electrostatic charge whereby said strips adhere to each other; severing means located along said path close to and down-

4

stream of said electrostatic means for severing the adhering superimposed strips into individual laminated plates of corresponding adhering strip sections; and stacking means located close to and downstream of said severing means for stacking said plates fed from said severing means while the electrostatic charge persists and the strip sections constituting each of said plates continue to adhere to each other.

2. An apparatus according to claim 1, wherein said electrostatic means includes a plurality of electrodes extending at right angles to said strips and spaced from each other transversely of said strips, each of said electrodes having a pointed free end spaced from said strips, and means for applying a high voltage to said electrodes to cause electric charges to be applied to said one strip by a corona discharge, said plates being adapted to be stacked face to face on said transfer means with the sections of said one strip alternating in stacked position with the sections of the other.

3. An apparatus as set forth in claim 2 wherein said means for applying a high voltage to said electrodes comprises a circuit connected to said electrodes and including a rectifier and a transformer, said transformer being adapted to be connected to an alternating current supply and to deliver a high voltage, alternating current of low current value to said rectifier, which latter is adapted to transform said current into rectified current prior to feeding the same to said electrodes.

4. An apparatus as set forth in claim 2, wherein said electrodes are needle-like and are arranged in a comb-like manner, said apparatus further comprising an open-bottomed housing of insulating material containing said needle-like electrodes.

5. An apparatus according to claim 1, wherein said electrostatic means comprises thereon, brush roller means contacting said paper strip, and means for driving said brush roller means at a peripheral speed which is higher than the feeding speed of said strips.

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