

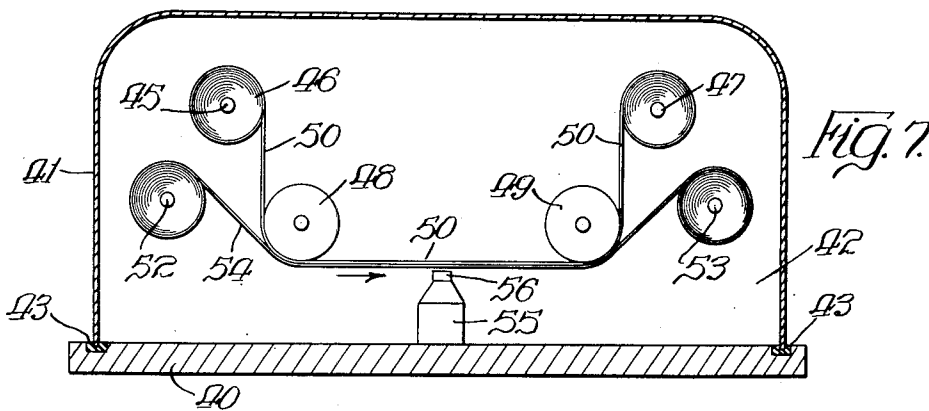
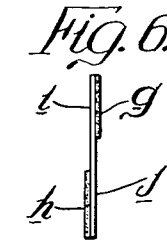
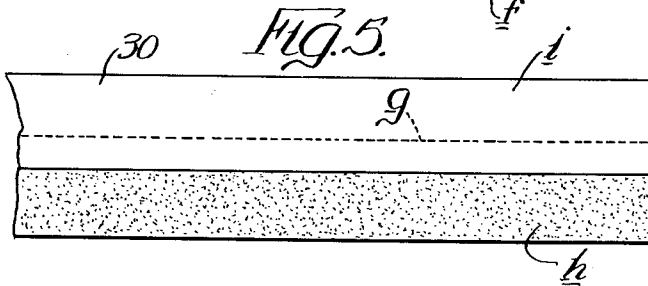
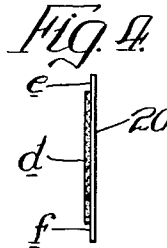
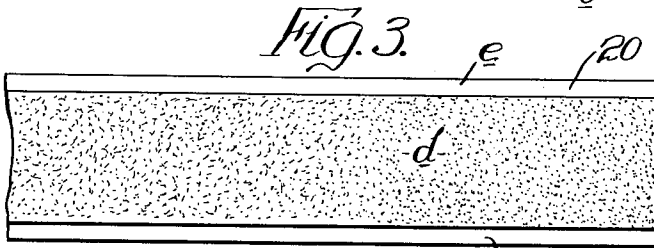
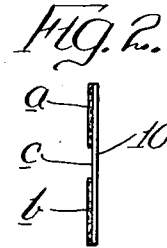
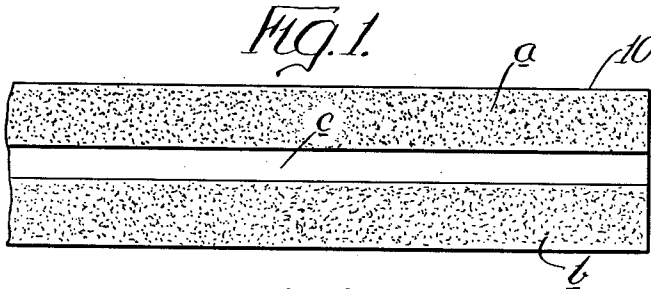
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METALLIZING PROCESS AND APPARATUS.

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METALLIZING PROCESS AND APPARATUS

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This invention has to do with the art of surface metallization, and relates more specifically to an improved process of metallizing long strips of paper or the like where it is required to restrict the metallic deposition to one or more bands of aggregate width less than that of the carrier strip. A suggestive application for strip material so metallized is in the manufacture of electrostatic capacitors of the roll or wound type.

Heretofore conventional wound capacitors have consisted generally of several superposed elongate strips of suitably treated kraft or linen paper with interleaved elongate strips of metal foil. It has been proposed to substitute for the foil thin metallic films adhered to the paper or other dielectric sheet material, and formed by subjecting the dielectric strips to metallic vapor, under vacuum—zinc being the metal best suited to the purpose. To confine the metallic deposition to a band or bands of restricted width less than that of the dielectric carrier strips—and it is essential to do so if any advantage is to be realized—it is necessary to mask the areas of the carrier strips from which the metallization is to be excluded. The method of masking heretofore employed has consisted in selectively applying oil in vapor form to the dielectric strips, the application of oil vapor being confined to the areas which were not to be metallized. That method of masking has been successful to only a limited degree, but it is far from satisfactory for the reason that it has not been possible to precisely delineate the masked areas so as to bring about production of metallic films having edges of sufficient regularity to meet the exacting requirements of capacitor manufacture.

The primary object of the present invention is to provide a commercially practicable method and means of masking the carrier strips which will facilitate the production of adherent metallic films having sharply defined edges, and which is entirely feasible from the standpoint of comparative manufacturing costs.

In carrying out my invention, I employ a mask or masks, as the case may be, in the form of tape covering the areas which are not to be metallized and mounted to advance, either continuously or at frequent intervals, lengthwise of the dielectric carrier strip. By so doing excessive deposits of metal on the masking tape are avoided, such as would tend to defeat my primary objective. A very high rate of production is also achieved because the process can go on continuously at relatively high speed, without interruption save as

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it is necessary to reload the metallizing equipment.

In the drawing which accompanies this specification:

Fig. 1 illustrates a portion of one face of a long strip of paper or other dielectric sheet material having two parallel thin metallic films adhered thereto and extending lengthwise thereof, the metallic films having been applied by the metallizing process herein described, and Fig. 2 is an endwise view of the strip so metallized;

Fig. 3 illustrates a portion of one face of long strip of paper or other dielectric sheet material having a single thin metallic film adhered thereto and extending lengthwise thereof, the metallic film having been applied by the same metallizing process as in the case of Fig. 1, and Fig. 4 is an endwise view of the strip so metallized;

Fig. 5 illustrates a portion of one face of a long strip of paper or other dielectric sheet material having two parallel thin metallic films extending lengthwise thereof and adhered, respectively, to opposite sides thereof in non-facing relation, these films having been applied by the same metallizing process as in the case of Figs. 1 and 3, and Fig. 6 is an endwise view of the strip so metallized; and

Fig. 7 is a schematic illustration of certain equipment that is adapted to carry out the improved metallizing process of this invention.

The three metallized strips shown in Figs. 1–6 are intended for use as components of electrostatic capacitors, the metallic films being functionally analogous to the metal foil strips heretofore commonly employed in capacitors of the wound type.

In the showing of Figs 1 and 2, the strip 10 may be of kraft or linen paper, or other suitable dielectric material such as polystyrene or other plastic having appropriate properties. Two parallel, elongate thin metallic films *a* and *b* extend lengthwise of the dielectric strip, and are firmly adhered to the same face thereof by the metallizing process herein to be described. The two metallic films *a* and *b* are spaced apart edge-to-edge to form an unmetallized gap surface *c* therebetween.

In Figs. 3 and 4 the dielectric strip 20 may be identical with that of Figs. 1 and 2. Adhered to one face of such a strip is a single thin metallic film which extends lengthwise of the dielectric strip. This film is of considerably less width than the dielectric strip, there being two border areas *e* and *f* which are not metallized.

In Figs. 5 and 6 the dielectric strip 30 may be

identical with the dielectric strips 10 and 20 of the previous figures. Adhered to opposite faces of such a strip are two parallel, elongate thin metallic films *g* and *h* in non-opposing relation. In this case there are two relatively wide unmetallized surface areas *i* and *j* on opposite sides of the strip.

To avoid metallizing the gap surface *c* of strip 10 (Figs. 1 and 2), or the border surfaces *e* and *f* of strip 20 (Figs. 3 and 4), or the surfaces *i* and *j* of strips 30 (Figs. 5 and 6), it is necessary that those surfaces be masked while the metal is being applied. It is not commercially feasible to apply adhesive masking tape, nor is it practicable to utilize a stationary mask or masks in conjunction with a moving dielectric strip because a mask of that kind would quickly become fouled with deposited metal, thus necessitating frequent mask replacements and incidental shutdowns, with concomitant production losses.

A solution of the problem in accordance with the present invention and one which has proved highly successful, is illustrated schematically in Fig. 7. The equipment there indicated includes an impervious base plate 40 and an impervious cover 41 resting on the base plate and forming with the latter a vacuum-tight chamber 42. A suitable seal, such as a gasket 43, should be provided to insure against leakage of air into the chamber 42. A vacuum pump (not shown) is connected either through the base plate 40 or the cover 41, as may be most convenient, to maintain a high vacuum within the chamber while the metallizing operation is in progress.

The equipment shown within the chamber 42 includes a spindle 45 on which is mounted a supply roll 46 of paper or other dielectric sheet material corresponding to the dielectric strips of Figs. 1-6; a motor-driven spindle 47 mounting a reel on which the metallized strip is wound; two idler pulleys or guide rolls 48 and 49 around which passes the dielectric strip 50 in its lengthwise passage from the supply roll 46 to the reel on the spindle 47; a spindle 52 mounting a supply roll or a plurality of rolls, as the case may be, of masking tape—usually paper, cellophane or the like; a motor-driven spindle 53 mounting a reel on which the used masking tape is wound; and a vaporizer 55.

The vaporizer is a small electrically-heated container designed to receive the metal to be vaporized—usually zinc—and has a spout 56 at its upper extremity through which the metallic vapor emerges. As will be apparent, the discharge end of this spout is immediately adjacent the under surface of the dielectric strip 50 and likewise the under surface of the masking tape 54.

The masking tape (or tapes) corresponds in width to the surface (or surfaces) on the under side of the dielectric strip which is not to be metallized, but which otherwise would be directly exposed to the metallic vapor emanating from the vaporizer 55. If, for instance, a metallized strip such as that of Fig. 1 is to be produced, there would be employed a single masking tape of a width corresponding to that of the gap surface *c*; or in the case of the metallized strip of Fig. 5, there would be employed a single masking tape of a width corresponding to that of the surface *i* or the surface *j*, the strip of Fig. 5 then being metallized first on one side and then the other. On the other hand, if a metallized strip such as that of Fig. 3 is to be produced, having two laterally spaced unmetallized surfaces *e* and *f* on the same side of the strip, two masking tapes

are employed. In each case the masking tape (or tapes) directly underlies the area to be masked, and is maintained firmly in contact therewith at the point of metallic application.

The driving mechanism for the masking tape or tapes preferably is designed to rotate the driving spindle 53 at a slow continuous rate such that the amount of metal deposited on the masking tape cannot become excessive. Inasmuch as the film of metal to be deposited on the dielectric strip is ordinarily exceedingly thin, it follows that the masking tape may be advanced at a much slower rate than that of the dielectric strip without allowing an excessive thickness of metal to build up on the masking tape. Usually about ten to fifteen inches per minutes is a satisfactory speed at which the masking tape may be driven, whereas the dielectric strip ordinarily is advanced at many times that speed, depending upon the desired thickness of metal film. Instead of a slow continuous speed, the masking tape may, alternatively, be advanced intermittently to achieve the purposes of this invention. It is not essential that the masking tape move in the same direction as the dielectric strip, notwithstanding that in Fig. 7 a common direction of movement is indicated.

Due to the fact that the dielectric strip is desirably advanced at a different lineal speed than the masking tape, the metallic film deposited on the strip is instantly sheared from the metal deposited on the masking tape along a straight line or lines coinciding with the lineal edge or edges of the tape, as the case may be.

It will be apparent that the improved process above described is capable of facilitating rapid production, on a commercial scale, of metallized dielectric strip suitable for use in the manufacture of electrostatic capacitors and having metal edges devoid of objectionable irregularities.

I claim:

1. The herein-described process which comprises continuously advancing a strip of dielectric material lengthwise past a source of metallic vapor in such physical disposition with respect to said source that an exposed portion of the strip facing said source is metallized, maintaining a masking tape in masking contact relation with said exposed portion of the dielectric strip with an edge of the masking tape at a longitudinal margin of the exposed portion of the dielectric strip throughout the entire length of said exposed portion during the metallizing thereof, and continuously advancing the masking tape lengthwise relatively to said source in a direction parallel to the length of the strip while maintaining contact therewith and at a speed rate many times different from that of the strip and thereby producing a concurrent and continuous shearing of the deposited metal at a uniform speed sharply along the edge line defined by the tape when in masking relation to the strip.

2. The herein-described process which comprises continuously advancing a strip of dielectric material lengthwise past a source of metallic vapor in such physical disposition with respect to said source that an exposed portion of the strip facing said source is metallized, maintaining a masking tape in masking contact relation with said exposed portion of the dielectric strip with an edge of the masking tape at a longitudinal margin of the exposed portion of the dielectric strip throughout the entire length of said exposed portion during the metallizing thereof, and continuously advancing the masking tape

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lengthwise relatively to said source in a direction parallel to the length of the strip while maintaining contact therewith and at a constant lineal speed less than that of the strip and thereby producing a concurrent and continuous shearing of the deposited metal at a uniform speed sharply along the edge line defined by the tape when in masking relation to the strip.

3. The herein-described process which comprises continuously advancing a strip of dielectric material lengthwise past a source of metallic vapor in such physical disposition with respect to said source that an exposed portion of the strip facing said source is metallized, maintaining a masking tape in masking contact relation with said exposed portion of the dielectric strip with an edge of the masking tape at a longitudinal margin of the exposed portion of the dielectric strip throughout the entire length of said exposed portion during the metallizing thereof, and intermittently advancing the masking tape lengthwise relatively to said source in a direction parallel to the length of the strip while maintaining contact therewith and at a uniform lineal speed less than that of the strip and thereby producing a concurrent and continuous shearing of the deposited metal at a uniform speed sharply along the edge line defined by the tape when in masking relation to the strip.

4. Metallizing apparatus including means for guiding and feeding lengthwise an elongate strip of dielectric material continuously, a metal vaporizer located beneath the strip and operative to

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progressively metallize an exposed surface of the strip as the strip advances, means for supporting an elongate masking tape in masking contact relation to a portion of the lower surface of the strip with a longitudinal edge of the tape located at a longitudinal margin of the surface to be metallized and precluding metallization of the masked surface of the strip, and means independent of the feeding means of the strip for advancing the masking tape lengthwise of the strip while maintaining contact therewith at a uniform speed and at a rate of speed sufficient to preclude excessive deposition of metal on the tape and sufficiently different from the rate of speed of the strip to produce a continuous shearing of the deposited metal at a uniform speed sharply along the edge line defined by the tape.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,892,755	Scheppmann	Jan. 3, 1933
2,139,640	Stuttgart	Dec. 6, 1938
2,375,237	Morgan	May 8, 1945
2,505,063	Palermo	Apr. 25, 1950

FOREIGN PATENTS

Number	Country	Date
530,198	Germany	July 23, 1931