

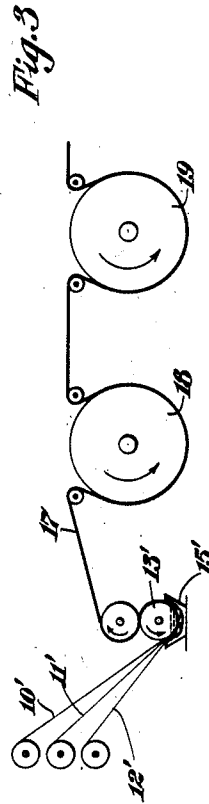
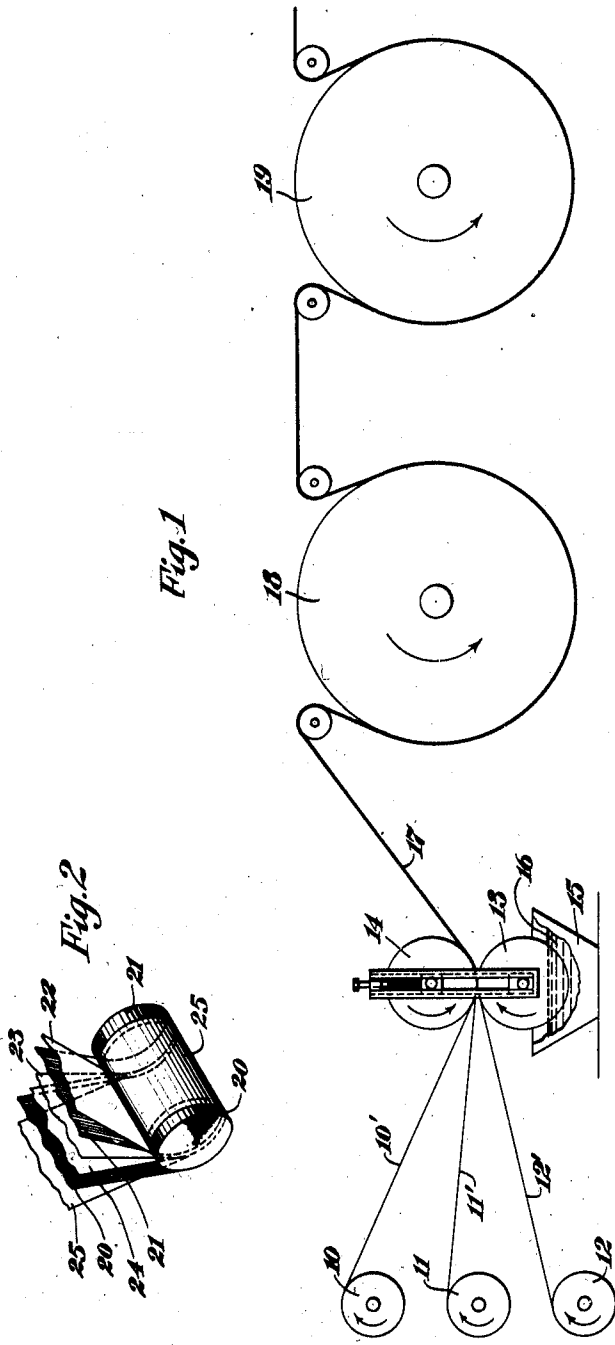
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CONDENSER PAPER AND METHOD OF MAKING THE SAME

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CONDENSER PAPER AND METHOD OF MAKING THE SAME

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My present invention relates generally to paper manufacture, and has particular reference to the manufacture of paper layers or strips suitable for use in wound electrical condenser bodies.

Before describing the features of my present invention, I will premise that electrical condensers of the so-called "paper dielectric" type consist essentially of a condenser body composed of interwound layers or strips of conducting material such as foil and dielectric material such as paper. Because of the nature of such condensers, the qualifications of the paper entering into their manufacture are accurate and stringent in nature, and any paper which does not precisely comply with the specifications laid down by the condenser manufacturer will be rejected by him. For example, the paper must be of uniform thickness throughout its length, it must be totally devoid of any impurities, particularly those which might be electrically conductive, it must embody a certain uniform porosity, etc.

Condenser bodies of the foregoing character are usually formed by means of winding machines. Thus, two rolls of foil may be suitably mounted in association with four rolls of paper so that six strips may be guided toward a mandrel and wound about the latter, each foil strip being sandwiched between a pair of paper strips. In a condenser body thus formed, the resultant assembly will have two layers of paper interposed between each two adjacent foil layers. It frequently is necessary or desirable to increase the thickness of the paper layer interposed between the foils, in which case it has been customary to mount additional paper rolls on the winding machine so that three, four, or more strips of paper are ultimately interposed between adjacent foil strips in the wound assembly.

It is a general object of my present invention to provide a paper strip which is the equivalent, in the wound condenser body, of two or more strips of the paper heretofore employed, the single strip or web of the present invention thereby serving to simplify the manufacture of condenser bodies by

avoiding the necessity for extra rolls of paper and the consequent additional handling and likelihood of wastage thereof.

The important and valuable characteristics of the present invention will be more fully appreciated when I point out that it has been unsatisfactory in the past merely to manufacture a single-ply paper strip of increased thickness. It is true that within certain limits a condenser manufacturer may call for different weights of paper. But while he may, for example, specify either a 4-pound or a 5-pound paper strip (which means that the strip weighs 4 or 5 lbs. per ream of 480 sheets, each sheet 20" x 30"), he will not call for nor will he accept a single-ply paper of, say, a 12-pound or 15-pound variety but will achieve his purpose by winding two or more of the 4-pound or 5-pound paper strips into the condenser body. The reason for this lies in the fact that the manufacture of the heavier paper with the prescribed and necessary degree of accurate uniformity and purity is extremely difficult, if at all possible. Uniformity in thickness is more difficult to achieve, irregularities in porosity are more likely to occur, and impurities of a conductive character are harder to avoid, not to speak of the fact that such impurities will be of greater dimensions because of the increased thickness of the paper. Furthermore, a group of thin sheets have, together, a greater insulation strength than a single sheet having the same overall thickness. For example, two sheets of .4 mil paper are better insulators than one sheet of a .8 mil paper, etc.

Nor is a multi-ply or so-called "duplex" paper of ordinary well-known character any more satisfactory. Where the manufacture of such multi-ply paper consists in forming two or more webs of paper stock and uniting them prior to the completion of each thereof (particularly so far as drying is concerned), the possibility of attaining the requisite uniformity through periodic testing and control is absent, for there is no way of ascertaining, for example, the porosity or weight distribution or purity of each individual wet web of which the "duplex" paper is made.

In the light of the foregoing, the features

of my present invention will be evident when I point out that the single web or strip of paper which I produce is of such a character that its salient characteristics, from the standpoint of the condenser manufacturer's purposes, are not only accurately uniform, resulting from periodic and even continuous testing, observation, and control, but are of such demonstrable and provable uniformity and character that the paper is acceptable by 5
10 played by condenser manufacturers.

It is a feature of my invention to provide a paper which is from one aspect a composite paper, being formed of individual strips of paper each by itself accurately uniform in weight, porosity, and other vital characteristics, and each by itself being, as a matter of fact, of the very character heretofore employed by condenser manufacturers. 15

One feature of my invention lies in providing this desirable type of paper strip without any recourse to adhesive, sizing, or to the use of similar foreign substances to which the condenser manufacturer would properly 20
25 object.

A further feature of my invention lies in providing such a paper without the necessity for re-designing or re-modeling the well-known Fourdrinier machines upon which the condenser paper of the present day is customarily made. As a matter of fact, my present method of manufacture involves the completion of the individual component paper strips upon the Fourdrinier machine or machines in the same manner as heretofore, and resorts to subsequent treatment of the paper strips to achieve the desired end. 30
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Briefly, I provide my present improved type of condenser paper by compressively uniting two or more individual strips each of which is complete in itself except that it remains uncalendered. 40

In the accompanying drawing I have diagrammatically illustrated my present invention. 45

Figure 1 illustrates a method of treatment of individual paper strips whereby my invention may be carried into effect;

Figure 2 is a perspective view of a condenser body of the character for which my improved paper is designed; and 50

Figure 3 is a view similar to Figure 1, illustrating a modification.

In accordance with my present invention I first produce two or more paper webs or strips upon a Fourdrinier machine or machines in the well-known manner, each of these strips being, for example, a .4 mil or .5 mil condenser paper of the character heretofore widely used by condenser manufacturers. Although not illustrated in the drawing, I will state briefly that each strip is manufactured by forming and advancing a web of paper stock, such stock being composed of 60
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water. During the advancement of the web it is successively passed over a number of felts of well-known character, between various press rolls, and ultimately over a set of dryer rolls which are suitably heated. Until the web is self-sustaining it is impossible to accurately ascertain its qualities for the purpose of controlling the same. During the completion of each web, however, it is not only possible but necessary and customary to test successive samples at periodic intervals, and in some cases continuously, to ascertain the weight and other characteristics and adjust or control the manufacture accordingly. For example, at least twenty-four times a day a sample of the paper is subjected to a test whereby the presence of electrically conductive impurities may be detected; on even more occasions the porosity is tested by a suitable meter and one or more of the innumerable factors affecting the porosity are thereupon adjusted or controlled. In a similar manner, the weight of the paper may be either continuously or periodically measured to furnish a similar basis for continuous control of weight-uniformity. 70
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In Figure 1 I have shown three rolls 10, 11, and 12 of condenser paper manufactured in the foregoing manner. This paper would be ordinarily acceptable without question by the condenser manufacturer except that each roll would usually be subjected to a calendering process which I omit. The paper strips 10', 11', and 12' leading from these rolls are guided into superposed relationship between a pair of rollers 13 and 14, the former being preferably of rubber or the like, and the latter being of brass or similar non-rusting material. The rolls 13 and 14 are so mounted as to be adjustable in compressive relationship whereby the plies or strips passing therebetween will be squeezed together. 95
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Suitable means are provided for rewetting the paper strips during the compression thereof and I have illustratively shown a container 15 within which a supply of pure or distilled water 16 is contained, the roller 13 being so mounted as to be immersed at least in part within the water 16. 115

The roller 13 is driven and drives the roller 14 by frictional engagement therewith. The roller 13 picks up water from the container 15 and serves to wet the plies passing between the two rollers. 120

The successful carrying out of my present invention lies in the fact, which I have ascertained by actual experiment, that completely dried but uncalendered paper strips of the character shown and described may be actually united into a single mass under the combined action of compression and rewetting. The composition of each individual strip is unaffected by this treatment since nothing but pure water was originally employed as a carrying medium for the pulp. It is most 125
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probable that the rewetting softens the fibers of pulp and facilitates the intimate interlocking of the exposed fibers on the surfaces of the strips. Regardless of the particular action which is effected, I have found that the single resultant web 17 is of a unitary character, unseverable into its component parts, and of a uniformity in vital characteristics heretofore unattainable by other means.

If the strips 10', 11', and 12' are of the usual well known four or five-pound type, then the strip 17 will be a twelve or fifteen-pound paper. A paper of this weight, having the requisite uniform qualities, composition and characteristics to render it acceptable by condenser manufacturers for use in the winding of condenser bodies, has, I believe, been unknown up to the present time.

The strip 17 is caused to pass around several dryer rolls 18 and 19 of the character employed on the well-known Fourdrinier machine, and it is finally subjected to a calendering process (not indicated on the drawing) which renders it ready for use in the winding of condenser bodies.

In Figure 3 I have shown a slightly modified arrangement wherein the strips 10', 11', and 12' are passed beneath the roller 13', thereby becoming completely immersed within the water in the container 15'. In this instance, the plies pass between the rollers in the opposite direction but are thereafter conducted as a single resultant web 17 around the dryer rolls 18 and 19, and are ultimately subjected to the calendering above referred to.

In Figure 2, I have illustrated the type of condenser body with which my present paper is to be used. I have shown a pair of foil strips 20 and 21, each thereof being sandwiched between a pair of paper strips. The foil strip 21 is sandwiched between the strips 22 and 23, and the foil strip 20 is sandwiched between the paper strips 24 and 25. The winding machine upon which this body is made will be provided with six spindles upon which the corresponding rolls of paper and foil will be mounted. Without altering this winding machine and thereby complicating the manufacture, my paper makes it possible to provide condensers of differing characters. For example, if each of the strips 22-25 is of a single four-pound type of paper, then a condenser of a particular capacity will be produced. Where additional paper rolls have heretofore been added for the production of condensers of greater capacity, it is now only necessary to employ paper strips of the character shown at 17. A condenser thus resulting will have a capacity equal to that which would have heretofore required the addition of eight spindles to the winding machine.

It will thus be seen that I have provided a novel type of paper for use in the manufacture of paper dielectric condensers, the

uniformity of weight, porosity, and purity being such as to render the paper acceptable by condenser manufacturers. The accurate control during the manufacture of the individual strips of which my present paper strip is made assures a proper quality; the absence of any sizing or other substance foreign to the individual strips by themselves obviates any objection on this score; and the employment of a single strip in place of a plurality of separated individual strips in the winding of condenser bodies is a highly desirable advantage which my invention renders possible.

It will be obvious that changes in the details herein described and illustrated for the purpose of explaining the nature of my invention may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is therefore intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. The herein-described method of making a paper insulating layer for an electrical condenser body, which consists in compressively associating at least two dry and uncalendered webs of uncoated paper into superposed relationship, wetting said webs with water during said association whereby they will physically unite to form a single web of increased thickness, and finally expelling said water, whereby the resultant web is substantially homogeneous throughout.

2. The herein-described method of making a paper insulating layer for an electrical condenser body, which consists in guiding a plurality of uncalendered and uncoated but otherwise complete paper webs into superposed relationship between a pair of pressure rollers, immersing one of said rollers at least partially into a supply of distilled water, whereby said webs will be wetted during their passage through said roller pair, the fibers of the adjacent surfaces thereby uniting physically with each other to bond the webs together into a single, substantially homogeneous web, and finally drying and calendering the resultant single web.

3. The herein-described method of making a paper insulating layer for an electrical condenser body, which consists in continuously forming and advancing a web of paper stock composed of pulp and water, treating said web to dry the same and render it self-sustaining, whereby the weight, porosity, and purity thereof may be periodically ascertained and controlled; forming, advancing and treating a second web in the same manner; thereupon squeezing said webs under pressure into superposed association,

rewetting the same with water during said association, so that the fibers of the adjacent surfaces of said webs will physically unite to form a substantially homogenous web of increased thickness, and then drying said resultant web to expel said water.

4. As a new article of manufacture, a paper insulating layer for use in a wound electrical condenser body, said layer comprising a plurality of compressively united superposed individual paper strips each of which is uniform throughout its length in weight, porosity, and purity, and the fibers of the adjacent surfaces of said strips being physically and non-adhesively intertwined.

5. The herein-described method of making a paper insulating layer for an electrical condenser body, which consists in squeezing a plurality of dry and uncalendered paper webs composed of pulp fibers into superposed relationship, each web being of uniform porosity and thickness throughout, wetting said webs with a non-adhesive liquid during the squeezing thereof to cause the fibers of the adjacent surfaces of said webs to intertwine with each other and form a single, substantially homogeneous web of increased thickness, and finally drying and calendering said resultant web to expel said liquid.

In witness whereof I have signed this specification this 17 day of April, 1929.

LOUIS P. SCHWEITZER.

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