

UNITED STATES PATENT OFFICE.

ERNST FAHRIG, OF LONDON, ENGLAND.

PROCESS OF MANUFACTURING A COMPOSITION APPLICABLE FOR ELECTRICAL INSULATING PURPOSES, &c.

SPECIFICATION forming part of Letters Patent No. 460,056, dated September 22, 1891.

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To all whom it may concern:

Be it known that I, ERNST FAHRIG, electrical engineer, a subject of the Emperor of Germany, residing at 24 Listria Park, Stamford Hill, London, in the county of Middlesex, England, have invented a new and useful Process of Manufacturing a Composition Applicable for Electrical Insulating and other Purposes, of which the following is a specification.

10 This invention relates to the process of manufacturing a composition which is applicable for electrical insulating purposes, for high-speed bearings, for acid-proof and water-proof containers and battery-cells, for
15 electric-light lead coverings, for underground cable channels or conduits, and for various other useful purposes in electrical and other industries.

The stock composition I prepare in the following manner: I first prepare and treat the celluloid, cellulose, or cellulin contained in silk, cotton, linen, or other fibers by subjecting the same to the action of combined acids in closed vessels so arranged that the washing
25 and neutralizing can be carried on without disturbing the cellulose. For neutralizing I prefer to use ammonia in a gaseous state; but other alkalies may be used. When the cellulose is perfectly neutral to all chemical
30 tests and thoroughly washed, I form it into a pulp by subjecting it to boiling for twenty minutes under a pressure of three atmospheres or at a temperature of 273° Fahrenheit, and during such boiling or pressure I
35 add a solution of from ten to twenty-five per cent. of sodium bicarbonate and five to fifteen per cent. of silicate of soda or potash (soda preferred) in from one hundred to one hundred and fifty per cent. of distilled water. In place of this stock composition, however, I may use ordinary linen pulp, although it is not likely to give such good results on account of the impurities which it usually contains. The pulping stuff so prepared or
45 taken I place in an ordinary pulping-engine, and to insure great strength I add from five to fifteen per cent. of manila or other strong fibers which have previously been boiled and beaten in the engine. When the pulp and
50 fibers are thoroughly mixed and beaten, which should be carefully continued for from four and a half to six hours, I add the coloring-

matter, if such is desired, giving preference to aniline colors fixed with vegetable acid. Next I add a soap solution made by dissolv- 55
ing fifty-six pounds of soap in twenty-three gallons of water per ton of pulp, and mix this thoroughly with the pulp. Then a mixture of about ninety per cent. alum, five per cent. borax, and five per cent. acetate of soda or
60 phosphate of ammonia in a finely-divided state, supplying the said mixture to the pulp in the engine by degrees until precipitation shows itself in the whole mass. If the usual tests for consistency show the pulp to be
65 ready, it may be pumped up into a reservoir and run onto an ordinary paper or board making machine or other machine which will work up materials in a similar or analogous manner. Arranged in line with and over the
70 cylinder of the machine is a large gutter or trough with a sieve bottom of a very fine meshed gauze, to which a rocking motion is imparted. In this gutter or trough I place suitable electrical insulating material in finely-
75 divided condition, (not under one hundred mesh,) such as mica, tale, heavy calcined magnesia, magnesite, carbonates, sulphur, gums, ozocerite, stearine, shellac, paraffine-wax, horn, ivory, bone-dust, flint, glass, silicate-cotton or mineral wool, mineral asbestos, or any
80 other suitable materials or mixtures of materials. These insulating-powders are sifted onto the surface of the composition as the sheets roll round the drum of the machine, which said drum is kept in continuous motion. Thus the powdered insulating materials are
85 evenly and equally distributed between the thin sheets made at each revolution of the drum, and the process proceeds until the required thickness is attained. If preferred, however, the insulating materials may be
90 mixed with the pulp in the pulping-engine; but for economical reasons the sifting method is preferable, as the water required to run on the pulping-engine separates and carries away a
95 large percentage of the heavier insulating-powders. I have found in practice that it is most difficult to pulverize silicate-cotton or mineral wool and mineral asbestos, and therefore when using these ingredients I beat them
100 up with the pulp in the pulping-engines. The composition may also be formed into sheets of various thicknesses in an ordinary hand

mill-board mold and the insulating-powders sifted on by hand or power arranged over the molds or mixed with the pulp, which latter method I prefer in this case. In this way the sheets can be built up into any desired thickness, or any shape or mold, or to form any design, or may be made into blocks, cylinders, cones, square battery-cells, containers, &c. The material thus prepared and formed is subjected to one hundred tons pressure and slowly dried in a steam-heated oven at a temperature of 150° or 200° Fahrenheit. An insulating solution is now prepared by dissolving various electrical insulating raw material—such as gutta-percha, rubber, gum, guaiacum, shellac, ozocerite, paraffine-wax, stearine, resin, amber-gum, &c.,—and heating it or them in a steam-jacketed pan or other protective means—such as a sand-heated bath—until the whole mass, being well stirred during the heating process, becomes a perfectly mixed and incorporated juicy liquid. If special color is desired, the coloring-matter should be added now. The sheets, blocks, or forms of the insulating compound are now taken from the drying-room and in the heated condition are plunged into baths containing the above insulating-liquid, maintained nearly at the boiling-point, and they are kept immersed until bubbles cease to rise to the surface. To drive off air from the blocks or forms of the insulating compound, I may, if desired, place them in a vessel, from which the air is exhausted in the ordinary manner, and when sufficiently exhausted I add the heated insulating-liquid. The heating process first described, however, is preferred as being the cheaper of the two. The said sheets, blocks, or forms are then taken from the bath and are pressed at the heaviest obtainable pressure. The greater the pressure to which they are at this stage subjected the higher the resultant quality of the material. They are then trimmed, calendered, or finished according to requirements.

The herein-described process may be summarized as follows: First, cellulose is formed; second, washed or neutralized; third, boiled, or ordinary linen pulp is taken, and, fourth, beaten in engine and mixed with fibers; fifth, dyed; sixth, soap solution added; seventh,

precipitating solution added; eighth, run onto board-making or other machine; ninth, insulating-powder sifted on; tenth, subjected to pressure, about one hundred tons; eleventh, dried; twelfth, heated to drive off air or air to be exhausted; thirteenth, insulating solution added; fourteenth, subjected to great pressure to incorporate the whole mass.

A material prepared in accordance with this invention is of extremely high electrical insulative properties. It is also of great strength, very hard, and perfectly acid and water proof. It can be used in place of wood, vulcanite, or metal, and sawed, filed, bored, turned, polished, and finished, or colored and enameled according to the purpose for which it is required.

I do not confine myself to the details or chemical proportions given, as these may be varied and added to according to the nature of the product required. As, for example, when a flexible product is required, I use only about one-third ($\frac{1}{3}$) of the maximum pressure for incorporating the whole, or I add a small percentage of a non-drying material, such as boiled oil, glycerine, &c., when the composition is in the pulping-engine.

What I claim is—

The herein-described process of manufacturing a composition for insulating and other purposes, consisting in taking a pulping staff substantially such as described, then mixing and beating it up with manila or other like fibers, then adding to this mixture a soap solution, and treating the resulting mass with a precipitate until the precipitate shows itself in the mass, then forming the pulp thus prepared into sheets and applying an insulating-powder to the same, next subjecting the material thus prepared to pressure and drying heat, and finally treating the said material with insulating solution and then subjecting the treated material to great pressure, substantially as specified.

ERNST FAHRIG.

Witnesses:

B. E. KNIGHT,
23 Prospew Road, Highgate.
THOMAS LAKE,
17 Gracechurch Street, London, E. C.