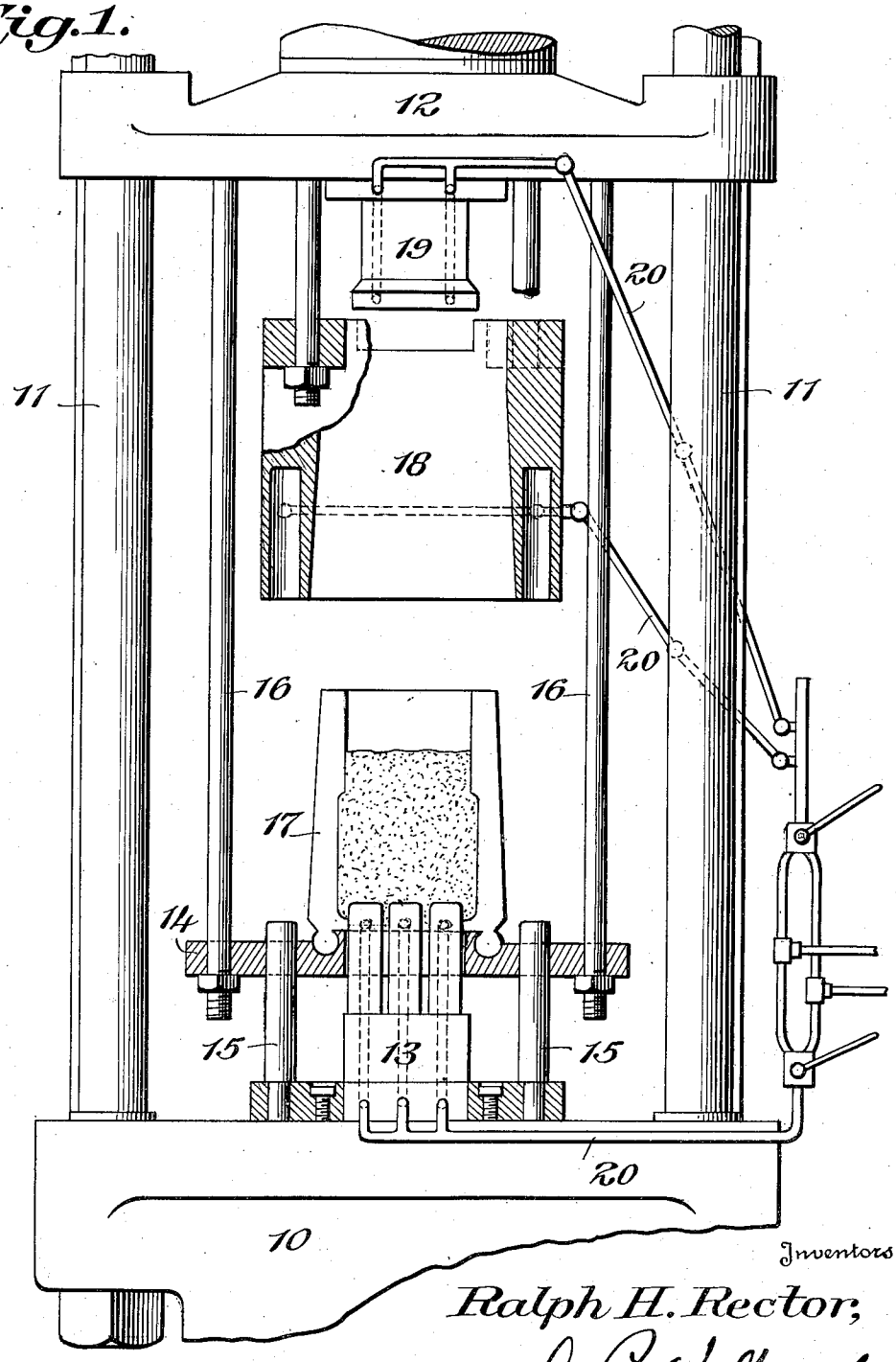
June 20, 1939. R. H. RECTOR 2,162,747

METHOD OF MOLDING PRODUCTS OF ACID-RESISTANT COMPOSITION

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Fig. 1.




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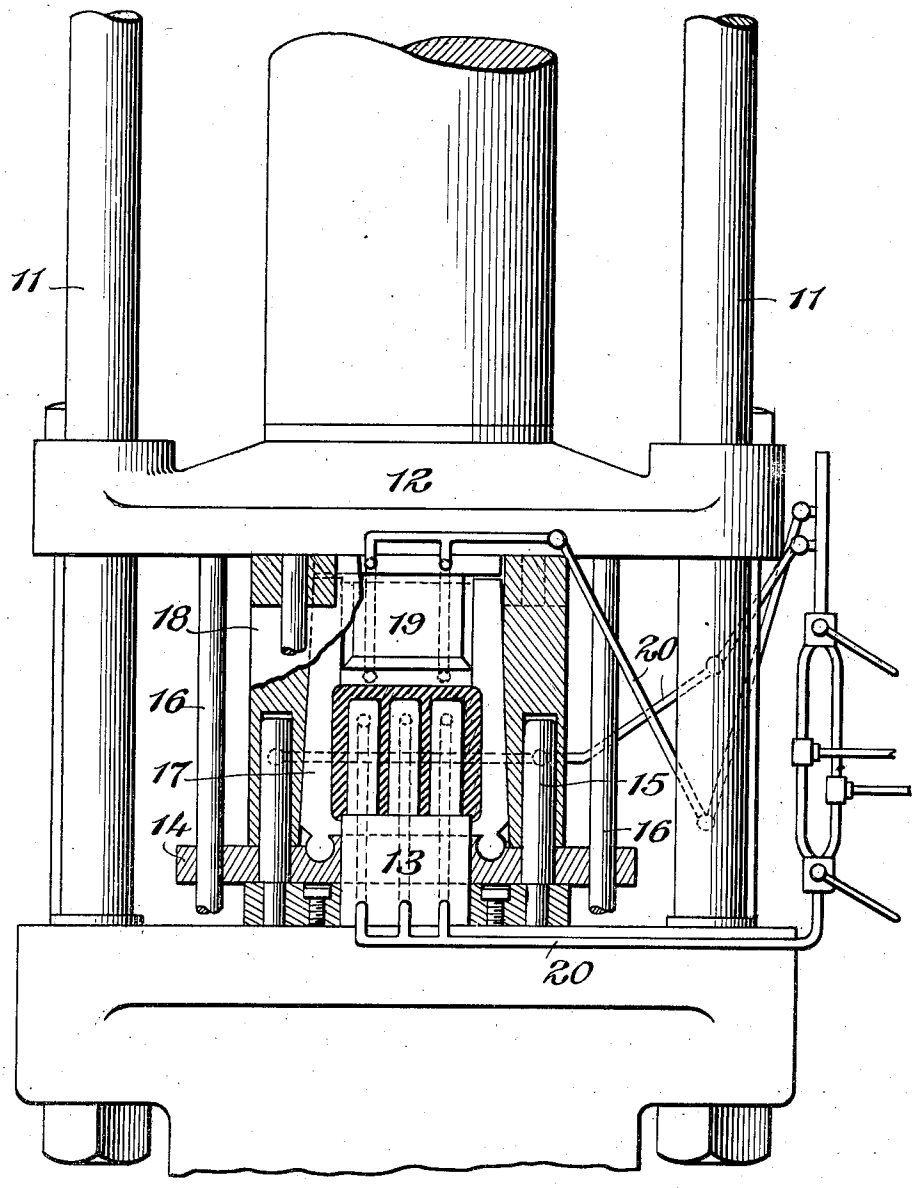
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Fig. 2.




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# UNITED STATES PATENT OFFICE

2,162,747

## METHOD OF MOLDING PRODUCTS OF ACID-RESISTANT COMPOSITION

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2 Claims. (Cl. 18—55)

This invention relates to an improved composition of matter for use in the manufacture of storage battery containers, and other acid resistant and electrical insulating articles; to an improved process of mixing or preparing said composition; to an improved method of molding or forming articles from said composition, and to the improved characteristics of the products obtained by employing said composition, mixing process and molding method.

According to present practice, most storage battery containers and many electrical insulating articles are formed from a composition comprising a filler, such as asbestos, clay diatomaceous earth or the like, a binder, such as bitumen, and an organic fibre, such as cotton, to afford tensile strength. Various different manners of mixing these ingredients have heretofore been employed. Invariably, however, dependence for blending said ingredients, especially the binder and the fibre, has been placed upon heating the binder to render the same soft or tacky, and to its consequent action, during the mixing operation, in pulling the fibres apart sufficiently to cause them to enter into suspension in the binder. Consequently, according to present general practice, only such binders as have a relatively low melting point (approximately between 240° F. and 250° F.) can be used, as otherwise the heat required to render the binder soft or tacky will char or destroy the fibre. For this reason, storage battery containers and other articles made from a composition mixed as stated are susceptible to considerable distortion under the action of heat at relatively low temperatures. Moreover, when the ingredients are mixed in the manner stated, the fibres have a decided tendency to roll into balls, and in order to tear these balls apart it has been necessary to employ a long, tedious mixing operation which tends to wear out the fibres and to destroy them by heat and friction. In any event, the fibres do not become saturated or impregnated by the binder, but simply become coated, which means that the maximum amount of fibre which may be used in any given composition, and insulated sufficiently to meet the acid resistance requirements in cases where the composition is to be used for making such articles as battery containers, is only a relatively low proportion of the whole—not over 14% by weight—and that the amount of binder is excessive. Thus, due to the weakened fibres, their lack of saturation by the binder, the limited amount of fibre which may be employed and insulated sufficiently to be acid resistant, and the excessive amount of binder which must be employed, containers and other articles produced according to present general practice also are comparatively weak and incapable of withstanding any severe impact or harsh usage generally.

According to the present invention the same ingredients are employed, or may be employed, as heretofore; viz. a filler, a binder and fibre. In this connection an important object of the invention is, however, to provide a new process of mixing or compounding said ingredients, and to provide a novel method of molding the composition, whereby a binder having a relatively high melting point, (from 350° F. upward for example) may be used so that the formed articles are not susceptible to distortion by heat even under relatively high temperatures.

Another object of the invention is to provide a new process of mixing or compounding the ingredients of the present composition, and to provide a novel method of treating said composition, preferably in the molding or the forming of articles therefrom, whereby the fibre is not harmed and becomes not only coated, but thoroughly saturated or impregnated by the binder, so that a greater amount of fibre and a lesser amount of binder may be employed than heretofore, with consequent material advantages respecting the impact and tensile strength of articles produced from the composition. On the other hand, because of the thorough impregnation of the fibre by a binder having a higher melting point than has been employed heretofore, it is possible, according to the present invention, to produce containers and other articles which are strong and not susceptible to distortion under the action of heat at relatively high temperatures, and which, at the same time, embody in their compositions considerably lower proportions of fibre and considerably higher proportions of binder than heretofore, should this be desired.

Another object of the invention is to provide a composition and a novel process of mixing the same, and a novel method of molding or forming articles therefrom, whereby the mixing operation may be effected, and articles may be produced, in considerably less time than heretofore.

Another object of the invention is to provide a composition, a process of mixing the ingredients thereof, and a method of forming articles therefrom, whereby the material comprising the formed articles is very dense, impervious to electrolytic action and of uniform nature throughout.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the

same consists in the novel composition and in the novel process of mixing the ingredients thereof, and in the novel method of treating the composition, preferably in the forming of articles therefrom, as well as in the characteristics of the finished articles, as will be hereinafter more fully described and defined in the appended claims.

In the accompanying drawings which are illustrative of an apparatus suitable for molding the present composition according to the present method:

Figure 1 is a vertical section through the apparatus showing the initial molding step; and

Figure 2 is a similar view showing a subsequent molding step.

While, as heretofore indicated, the present composition may comprise any suitable binder, any suitable filler and any suitable fibre, the binder employed preferably is a bitumen, or a blend of bitumens, having a relatively high melting point, the fibre preferably is organic and may consist, for example, of cotton, and the filler preferably is of some good grade of talc, clay or diatomaceous earth. All of said ingredients are of such nature that they may be put into a finely divided state, and in preparing said ingredients they are first finely divided in any suitable manner, as, for example, by grinding, shredding or beating. In their correct proportions they then are mixed in any suitable manner, as, for example, in a conventional dry mixer, in the absence of heat, until the ingredients are thoroughly intermingled.

Practical proportions of the ingredients, by weight, may be as follows:

| | Per cent |
|---|---|
| Binder | 40 |
| Vegetable fibre | 20 |
| Filler | 40 |

Following the dry mixing of the ingredients until the same are thoroughly intermingled, which may be accomplished within a comparatively short period of time far less than the amount of time required for the mixing when the binder is heated and in a soft or tacky condition according to prior practice, the composition then is ready for molding or forming into commercial articles.

The molding apparatus may be of any suitable type which provides a cavity having sufficient volume to hold a desired amount of the composition in its dry condition by gravity, and which has the necessary parts of the mold provided with means whereby the same may be heated and cooled.

The drawings conventionally illustrate a practical molding apparatus comprising a base 10 from which rise standards 11 on which a crosshead 12 is mounted for vertical movement; a mold core 13 mounted on said base 10; a plate 14 guided by pins 15 for vertical movement relative to the mold core and suspended in a raised position relative to the core 13 when the crosshead is in its raised position by headed rods 16 depending from the crosshead, which rods are slidable through said plate so that the crosshead may continue its descent after it has moved downwardly sufficiently to lower the plate and the articulated mold cavity or chamber 17 carried thereby to their lowered or operative positions relative to the mold core 13 in surrounding relationship thereto; a mold casing 18 carried by the crosshead to embrace the articulated mold cavity or chamber 17 when the crosshead is lowered; a plunger 19 movable within the mold casing 18 to enter the open top of the articulated mold cavity or chamber when the mold casing is in embracing relationship to the mold cavity or chamber, thereby to exert pressure upon the composition contained within the mold cavity or chamber to cause said composition to conform to the mold as represented by the mold chamber 17 and the mold core 13, and means comprising pipes 20 connected with core or hollow parts of the mold core and the mold casing for the supply of a hot or a cold fluid to said parts, either to heat or cool the same.

In the present instance the mold core and the mold cavity or chamber are designed for the forming of a cellular storage battery container. They may, however, be designed for the forming of any other article. In any event, in forming an article by means of an apparatus of the general character shown having some suitable means for heating and cooling the mold parts, a predetermined amount of the dry mixed composition is placed in the mold cavity while the parts of the apparatus are in the relative positions shown in Fig. 1, the mold casing then is moved downwardly into embracing relationship to the mold cavity or chamber as illustrated in Fig. 2, steam or other heating fluid is supplied through the pipes 20 to the mold core and casing, and the plunger 19 is operated to exert pressure upon the composition to cause the same to become shaped as determined by the mold cavity and the mold core.

Due to the finely divided state in which all of the ingredients enter into the composition, and to the dry mixing of said ingredients, it is possible to obtain a far more thorough dispersion or blend of said ingredients, particularly with respect to the binder and the fibre, than has heretofore been obtained by processes according to which the ingredients are mixed while the binder is in a hot and soft or tacky state. Therefore, the composition at atmospheric temperature readily flows to all parts of the mold under very little pressure. Moreover, despite the relatively high melting point of the binder employed in the present composition, it is not necessary to subject the mold parts to heat over any considerable period of time. On the contrary, the mold parts may be heated rapidly to a temperature sufficiently high above the boiling point of water to melt the binder, and this heat need be maintained over only a relatively short period of time until the moisture and intercellular air contained within the fibre is driven off, since, due to the thorough dispersion of the ingredients of the composition, the fibre is ready to enter and to saturate or impregnate the binder immediately the binder has been melted and the moisture and the air have been expelled from the fibre. Accordingly, after a relatively short period of time sufficient to melt the binder and to drive off the moisture and the air from the fibre, the supply of heating fluid is cut off and immediately thereafter a suitable cooling fluid, such as water, is supplied to the mold parts. The consequent lowering of the temperature of the composition has the effect of creating a partial vacuum in the fibres on account of the previous expulsion of moisture and air and as a consequence the binder is actually drawn into the fibres and saturates or impregnates them, thereby creating a much firmer bond between the fibres and the binder than is the case where the fibres simply become coated by the binder according to prior practice. In this

connection, although the fibres are subjected to greater heat than heretofore, they are not subjected to any prolonged relatively high heat, nor to any heat appreciably after any contained moisture has been expelled therefrom. Consequently, they are not harmed but retain their strength and thereby impart to articles formed in accordance with the present invention increased strength, other things being equal, as compared with articles formed in accordance with prior practice.

After a relatively short cooling period, sufficient for the formed article to become "set", the supply of cooling fluid to the mold parts is cut off, the mold casing is raised and the formed article is removed from the apparatus.

Heretofore in the molding of compositions of the present general type the common practice has been to place the composition at a relatively high temperature within a molding press and, without heating the mold parts, simply to operate the press to squeeze the hot composition into desired shape. According to this practice it has been extremely difficult to make the composition flow properly to produce dense homogeneous articles free from knit lines, flow line and fine cracks. This is particularly true if any portion of the composition is exposed to the air for any appreciable length of time and becomes chilled, for the chilled composition will not unite with the warmer material under pressure and structural defects result which render the finished articles very susceptible to the action of acid and to the breaking down of their electrical insulating properties. By the present molding method these difficulties are overcome. The material, being placed in the mold at atmospheric temperature and in a finely divided and thoroughly blended state, will flow to all parts of the mold under very little pressure and is in its final position before sufficient heat is transmitted to it to cause the binder to soften sufficiently to bind the ingredients together in a plastic mass. Consequently, upon subsequently subjecting the formed article to sufficient heat to melt the binder, the composition becomes dense and uniform and defects of the character aforementioned are not developed.

Because of the substantially perfect dispersion of the ingredients of the present composition and the thorough impregnation and coating of the fibre by the binder, it is evident that the relative amounts of the ingredients may be widely varied. On the one hand, with a lesser amount of binder than has been required heretofore there can be obtained a more perfect bond or union between more fibre than has heretofore been considered the maximum amount usable. Therefore, the amount of fibre which may be used in the present composition may comprise as high as 26% of the composition by weight. A finished battery container in which the composition contains this percentage of fibre is highly resistant to acid and electrolytic action and will not show any appreciable discolorization in 1.3 Sp. Gr. sulphuric acid at 160° F. for thirty days. Moreover, it possesses great tensile and shatter strength, as these qualities are derived almost entirely from the fibre and by the avoidance of unnecessary binder.

On the other hand, it is possible to reduce the amount to as low as 6% or 7% of the composition by weight and still obtain a good container.

An alternative method of mixing the ingredients of the present composition may consist in preparing the filler and the fibre in a finely divided state as heretofore described and in stirring or agitating these ingredients while the binder, in hot and liquid condition, is supplied in atomized form under considerable pressure, so that it strikes the fibre and filler in a very finely divided liquid state, coats and permeates the fibre, and almost immediately chills. The resultant composition has practically the same properties as the dry mixed composition.

Economic advantages of the present composition are that it is possible to prepare and store the same in advance of use and to readily weigh the mold charges, which is not practicable when it is necessary to handle a composition which must go into a mold in a heated, plastic condition.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. The method of producing an article from a dry mixture of a finely divided bituminous binder, a finely divided acid resistant filler and finely divided organic fibre, which consists in placing a quantity of said mixture in a mold, subjecting said mixture in its dry state to pressure to cause it to conform to the mold contour, heating the mixture to soften the binder and to drive off moisture and intercellular air from the fibre, and then cooling the mixture to cause the binder to impregnate the fibre.

2. The method of producing an article from a dry mixture of a finely divided bituminous binder, a finely divided acid resistant filler and finely divided organic fibre, which consists in placing a quantity of said mixture in a mold, subjecting said mixture to pressure in its dry state to cause it to conform to the mold contour, heating the mixture above the boiling point of water to soften the binder and to drive off moisture and intercellular air from the fibre, cutting off the heat as soon as the moisture and air have been driven off from the fibre and prior to the heat harming the fibre, and thereafter cooling the mixture to cause the binder to impregnate the fibre and to cause the article to be form sustaining upon its removal from the mold.

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