March 24, 1942. R. E. REED ET AL 2,277,050

INFUSOR

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Fig. 1.

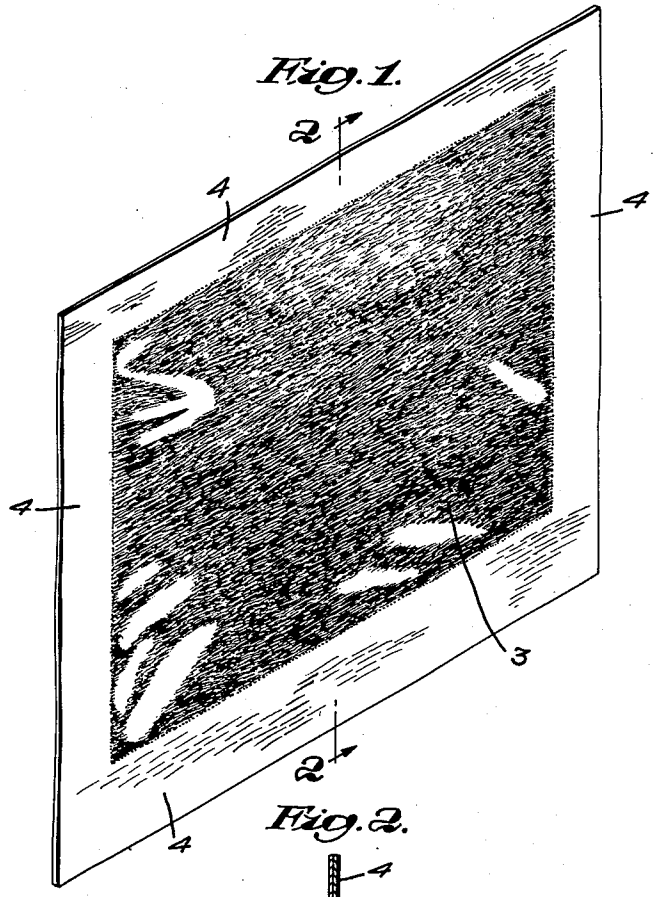
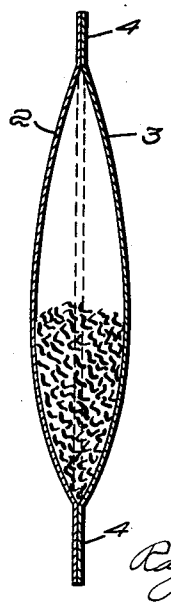


Fig. 2.



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INFUSER

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17 Claims. (Cl. 99—77.1)

This invention relates to tea bags and other infusers.

Such articles are not only much used by the general public but also by chemists, druggists, and others. In fact, it is becoming a common practice for manufacturers to package such foodstuffs as coffee, tea, spices, and the like, in small, water-permeable containers of the infuser type, each adapted to confine a suitable quantity of the material for an individual use. For convenience containers of this character will frequently hereinafter be referred to collectively as "tea bags" and the packaged material will be referred to as "tea."

As customarily made, a tea bag consists of a small fabric bag or envelope containing a quantity of tea leaves suitable for the brewing of a single cup or a specified number of cups of tea.

To be entirely satisfactory a tea bag should meet three fundamental requirements:

(1) The bag must be sufficiently water-permeable to allow rapid infusion and effusion of the liquid in order that the beverage may be prepared in a reasonably short period of time.

(2) The structure of the bag should be such that it will prevent any substantial sifting of the tea leaves through it, even when they are broken or more or less powdered, and both during storage prior to use and also during the operation of making an infusion from the material.

(3) It must be very inexpensive. A tea bag is ordinarily discarded after a single use and the expense of the bag, plus that of the labor involved in measuring and packaging the tea in it, adds materially to the cost per pound of this commodity.

The first and third of these requirements naturally dictate the use of a cheap open-mesh fabric, such as cheesecloth, and that has been the material used almost universally in the manufacture of these articles. The second requirement, however, suggests the use of a closely woven fabric which, of course, is relatively expensive, as compared to cheesecloth, and also has characteristics unfavorable to the first requirement above stated.

One serious objection to the conventional commercial forms of fabric tea bags is that the powdered tea sifts through the mesh, and an important reason that coffee (which for such uses must be pulverized) is not more generally put up in bags of this nature is the difficulty of preventing these finely divided materials from working through the interstices in the walls of the bag.

With a view to overcoming this difficulty it has been proposed to make tea bags of paper, and this material has been used commercially to some extent. It is not entirely satisfactory for the reason that the rate of infusion and effusion of the liquid is low, and also because the fibers of paper are bonded to each other by degraded forms of cellulose which, being water-soluble, consequently have a tendency to adversely affect the character of the beverage. Moreover, the wet strength of paper is low and it is usually considered necessary to pre-treat it in some special way to overcome this difficulty, thus adding to the expense of manufacture.

The present invention aims to devise a tea bag in which the conflicting requirements of a container of this type will be reconciled. In other words, to provide a novel tea bag having the desirable characteristics above described while at the same time avoiding the objectionable features of prior art containers of this type.

It is a further and important object of this invention to reduce materially the expense of manufacture of tea bags while still producing an article superior to the prior devices of this kind.

We have found that we can avoid the necessity for using a woven fabric, with a consequent reduction in expense and still obtaining the desirable characteristics above described, by producing an unwoven fabric from unspun fibers and so constructing it as to meet the requirements of this particular product. This preferably is done by mixing textile fibers of the common types with other fibers having latent adhesive properties, and then developing such properties and thereby uniting a sufficient number of the fibers to produce a coherent, porous fabric structure.

The mixing operation may be performed in a variety of ways, preferably by using such machines as cotton pickers, garnets and cards. All of these machines are well known in the textile art, and they will handle such a mixture very satisfactorily because it consists of the kinds of fibers which these machines are designed to operate on.

As an example, a fabric which has proved very satisfactory for tea bags is made by mixing together bleached cotton fibers with cellulose acetate fibers, preferably by feeding the two materials in proportions of, say, 40% of the latter to 60% of the former into a picker lapper. After the mixture has been converted into lap rolls on this machine, it is then carded and the webs from three carding machines are next superposed or combined to produce a single web which is subsequently treated to develop the latent adhesive properties of the cellulose acetate fibers.

Such a treatment may consist in hot-calendering the combined web, the rolls being heated to a sufficient temperature to soften, somewhat at least, the exterior of the cellulose acetate fibers and thus make them adhere firmly to the cotton fibers.

In order to minimize the heat required in performing this operation, it is preferable to use cellulose acetate fibers containing a non-volatile, high-boiling-point solvent which will combine with the acetate and is thereafter not easily removed from it. Such a material is commonly referred to as a plasticizer and it has the ability not only to lower the softening point of the cellulose acetate fibers, but also to make them more pliable. This class of solvents should, however, be distinguished from the volatile solvents which can be used to develop the adhesive properties of the cellulose acetate, whether plasticized or not, but which thereafter are readily driven off by evaporation. Since the softening point of the cellulose acetate fibers is much above the boiling point of water, a very considerable proportion of plasticizer can be used in their composition while still leaving them stable in, or not affected to any serious degree by, hot water during the use of the infuser for its intended purpose.

Any plasticizer suitable for use in a food product may be employed and only a very small amount thereof is present in any individual tea bag. Some of these plasticizers are extractible to some degree in boiling water but the minute quantities which go into solution have no adverse effect on the beverage. Of course if a plasticizer is at all toxic it must not be extractible to any significant degree under conditions of use. That class of plasticizers known as Santicizers are particularly well adapted for the present purposes. Santicizer E–15 is preferred. It is known chemically as ethyl - phthalyl - ethyl-glycolate. Other members of this group of Santicizers which also are useful for this purpose are the corresponding compounds in which the first ethyl radical is replaced by a corresponding methyl or butyl group. Cellulose acetate fibers containing 30% of one of these plasticizers in such a mixture as that above described can be softened sufficiently to unite with the other fibers when the calender rolls are heated to a temperature of from 350° F. to 375° F.

The fabric so produced is composed of unspun textile fibers united directly to or bonded with each other by a water-insoluble binder, namely, cellulose acetate. In this product the fibers are heterogeneously disposed, although it may have a very definite grain, and the binder is distributed throughout the entire product in a discontinuous form. Since this binder material is originally introduced in fiber form, the distribution of it can be readily controlled and even though its original form may be modified greatly by the heating and pressing operation, such form perhaps being completely destroyed, still the positional relationship of the binder so broken down to the cotton fibers will be maintained so that it will effectively perform its function of securing these fibers together into a coherent porous structure, highly permeable to both air and water. Since neither the cotton fibers nor the binder constituent are seriously weakened by water, the product retains a high degree of its tensile strength when wet.

This fabric is highly satisfactory in a tea bag because its properties may be so controlled as to suit the requirements of these particular articles, a result which has not before been obtained so far as we are aware. In making the three-card product above described, a material running approximately thirty square yards to the pound is commonly prepared and in such a product the interstices between the fibers are large enough to allow rapid infusion and effusion of the liquid but are still so small as to be non-sifting or, in other words, to prevent any material escape of the broken and powdered particles of tea, coffee, or the like. Also, in such a web, the balance of properties may be easily controlled to suit the requirements of individual food products. For example, a bag adapted to handle tea can have larger pores or interstices than one for pulverized coffee or spices.

A further control of the properties of this fabric which are valuable in a tea bag may be obtained by varying the concentration of the different kinds of fibers in the mixture, the higher concentrations of cellulose acetate fiber producing more numerous and more closely spaced bonds, other conditions being equal, and thus reducing the sizes of the interstices. The thickness of the web also is easily controlled by combining a larger or smaller number of carded webs.

While a considerable variety of textile fibers can be successfully used in the manufacture of fabrics intended for this purpose, the most practical fibers at present available in commercial quantities and within reasonable prices ranges are cotton fibers, preferably bleached cotton, and rayon fibers produced by the viscose or the cuprammonium processes. Also, while the binder fiber preferably used at the present time is made of cellulose acetate, other binder fibers are available which can be used entirely satisfactorily. Among them may be mentioned particularly other cellulose esters, such as cellulose acetate propionate; cellulose ethers, such as ethyl and benzyl cellulose; vinyl compounds, including vinyl chloride, vinyl acetate and the copolymers of the same; polymers of styrene; polyamides such as Nylon, and others. In fact, some of these fibers can be used as the body forming fibers in place of bleached cotton or rayon, provided some suitable form of binder fiber is used with them, the adhesive properties of which may be developed by heat, some solvent, or some medium to which the body forming fibers are relatively resistant under the conditions employed to effect unification of the fibrous structure.

A further property which can readily be given to a fabric of the character above described and which is of great value in the manufacture of tea bags from this fabric, is that of making them heat-sealable so as to confine the foodstuff therein. This is conveniently done by increasing to a suitable degree the concentration of the thermoplastic binding material in one or more of the plies of the fabric. For example, in the preparation of the tea bag material above described a web delivered by one of the cards and composed of approximately 60% cellulose acetate fibers and 40% of bleached cotton fibers, may be combined with webs taken from two additional cards, each fed with a mixture containing a considerably higher percentage of bleached cotton fibers, say for example, 90% to 95% and from 5% to 10% of cellulose acetate fibers. The web containing the higher percentage of binder is placed at one side of the other two webs. After the composite web has been hot-calendered, as above described, it will be found that the resulting fabric is soft and

cottony on one side and considerably firmer and more dense on the other side, the latter being the surface layer containing the higher concentration of acetate.

In making tea bags from this material the usual margin-closing sewing and tying operations may be employed but are preferably entirely eliminated by folding a section of the fabric upon itself or superposing two pieces of the fabric, one upon the other, and applying sufficient heat and localized pressure at the margins of these pieces to heat seal said margins together, say in a width of ⅛"–¼", or thereabouts. To obtain the strongest union, the surfaces containing the 60% of cellulose acetate should be placed face to face and united in the manner just described to provide a substantially continuous "frame" around the periphery of the tea bag.

If the bag is left open when initially made in order to facilitate the subsequent filling operation, it may thereafter be heat-sealed. In some cases, however, the tea or other material to be enclosed in the bag is placed on one of the sections of the bag while it is flat, the other is then placed over it, and all four margins next are heat-sealed, preferably simultaneously.

This heat-sealable characteristic is not confined to the particular laminated product just described since those composed of the three plies of cellulose acetate and bleached cotton in the proportions of 40% of the former to 60% of the latter also have this property but to a lesser degree. A somewhat higher concentration of the binding medium is preferable, however, for best results in heat-sealing.

The property of being inherently heat-sealable is especially valuable in a tea bag for the reason that it reduces the expense of manufacture of such an article very materially and enables it to compete in price with the paper bags now being sold commercially to some extent and which are the cheapest bags on the market.

A typical commercial embodiment of the invention is illustrated in the accompanying enlarged drawing, in which

Figure 1 is a perspective view of a bag made by the method above described; and

Figure 2 is a vertical, sectional view of the bag shown in Figure 1.

In the drawing the opposite sides or walls of the bag are shown at **2** and **3**, respectively, the margins of these walls being heat-sealed together, as shown at **4**. If desired, some type of lifting device such as the usual string and tag can be heat-sealed or otherwise attached to the bag.

In addition to the envelope type of tea bag above described, another which may be aptly called the "pouch type" is also in common use. It comprises a sheet of confining material, the charge of tea being placed on about the center of it, and the margins are then gathered or puckered and are secured by a string or metal staple. Both of these types may be made with applicant's material.

Tea bags made in accordance with this invention have the advantage over similar products made with gauze in that they are more economical to manufacture and are substantially non-sifting when either wet or dry. As compared to prior art paper tea bags, the physical characteristics of confining material used by applicants can be more readily varied or adjusted to secure those properties particularly desirable for this purpose. In addition, papers are subject to the disadvantage of having a very limited degree of stretch when wet, and they therefore tend to rupture under the abuse which these products must be expected to withstand. The walls of the tea bags made in accordance with the preferred embodiment of this invention have the ability to stretch to a degree several times that obtainable with paper, and thus are not likely to be ruptured. For example, a tea bag made in accordance with the specific disclosure above will, when wet in use, stretch from approximately 20% to 30% before rupturing.

A further advantage of this bag is the fact that the permeable material of which it is made is inherently heat-sealable. This is believed to be a novel feature in this construction because prior attempts to make a heat-sealed bag have involved the addition of some material having disadvantages which are avoided in the product of this invention.

While we have herein disclosed a preferred form of our invention, it will be evident that some, or all, of the advantages and novel features of the invention may be obtained in modified embodiments of it. For example, it is not necessary in making some tea bags that the entire bag structure shall consist of the special fabric or sheet material above described, but a substantial portion, at least, of the bag should be made of this special fabric, and usually it is found more economical to make the entire bag of this material.

Having thus described our invention, what we desire to claim as new is:

1. An infuser comprising a porous envelope for enclosing a material adapted to be infused in a liquid, a substantial portion at least of said envelope consisting essentially of heterogeneously intermingled unspun water-insoluble fibers bonded together to form a fibrous structure highly pervious to liquids, a substantial proportion of said fibers having normally latent adhesive properties adapted to be developed by heat.

2. An infuser comprising a porous envelope for enclosing a material adapted to be infused in a liquid, a substantial portion at least of said envelope consisting essentially of heterogeneously intermingled unspun water-insoluble fibers bonded together to form a fibrous structure highly pervious to liquids, a substantial proportion of said fibers being thermoplastic and the envelope including overlapped layers united by the direct adhesion of the thermoplastic fibers of one layer to fibers of another layer.

3. An infuser according to preceding claim 1, in which said fibers having normally adhesive properties are stable in hot water but are adapted to become adhesive at temperatures above that of boiling water.

4. An infuser comprising a porous envelope for enclosing a material adapted to be infused in a liquid, a substantial portion at least of said envelope consisting essentially of an unwoven sheet material composed of unspun fibers and a water-insoluble binder distributed in a discontinuous form substantially throughout said portion of the envelope, said binder and said fibers being adhesively united into a sheeted structure, highly pervious to air and water but capable of substantially preventing sifting of dry particles of said material therethrough, said binder having normally latent adhesive properties adapted to be developed by heat.

5. An infuser comprising a porous envelope for enclosing a material adapted to be infused in a liquid, a substantial portion at least of said

envelope consisting essentially of heterogeneously intermingled unspun water-insoluble fibers bonded together to form a fibrous structure highly pervious to liquids, a high proportion of said fibers having normally latent thermoplastic properties and being present in such quantity as to make said portion of the envelope inherently heat-sealable due to the presence of said thermoplastic properties.

6. An infuser according to preceding claim 4, in which said binder consists of a break-down product of thermoplastic fibers.

7. An infuser according to preceding claim 4, in which said binder consists of a cellulose derivative.

8. An infuser according to preceding claim 4, in which said binder contains a substantial proportion of a substantially odorless non-toxic plasticizer.

9. An infuser according to preceding claim 4, in which said binder consists of fibers composed essentially of one or more cellulose esters.

10. An infuser according to preceding claim 4, in which said sheet material is composed essentially of cellulose fibers and binder fibers composed essentially of one or more cellulose esters.

11. An infuser according to preceding claim 4, in which said sheet material is composed essentially of bleached cotton fibers bonded together by fibers composed essentially of one or more cellulose esters.

12. An infuser according to preceding claim 4, in which marginal portions of said envelope are united by the adhesive properties of said thermoplastic binder.

13. An infuser according to preceding claim 4, in which the concentration of said binder is much higher in one surface of said sheet material than in the opposite surface.

14. An infuser according to preceding claim 4, in which said binder is present in fiber form and the concentration of binder fibers is considerably higher in one surface of said sheet material than in the opposite surface.

15. An infuser according to preceding claim 4, in which said binder is present in fiber form and the concentration of binder fibers is considerably higher in one surface of said sheet material than in the opposite surface, the surface containing the higher proportion of binder fibers having a minimum of 40%, of said binder fibers.

16. An infuser comprising a porous envelope for enclosing a material adapted to be infused in a liquid, a substantial portion at least of said envelope consisting essentially of an unwoven sheet material composed of unspun textile fibers and water-insoluble thermoplastic binder fibers intimately intermingled with each other and united by the coalescence of the fibers, said binder fibers being stable in hot water but being adapted to become adhesive at temperatures above that of boiling water.

17. An infuser according to preceding claim 16, in which both said unspun fibers and said binder fibers are of a cellulosic nature.

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