March 9, 1948. F. W. MANNING 2,437,265

TAMPON, SANITARY NAPKIN, SURGICAL DRESSING, INSULATING MATERIAL, FILTER CARTRIDGE, UPHOLSTERY, AND THE LIKE

Filed Dec. 10, 1943

Fig. 1

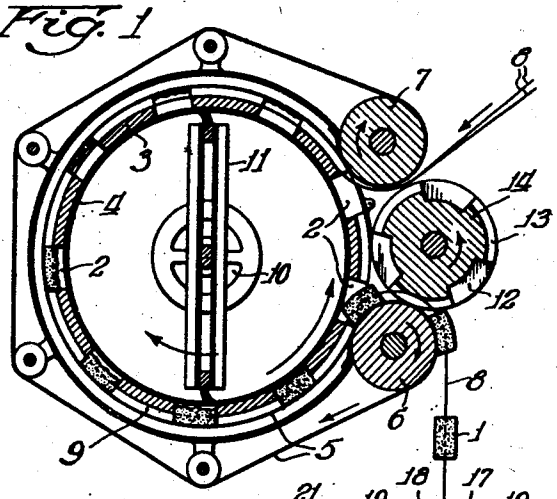
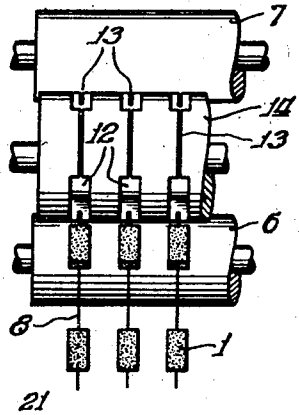


Fig. 2



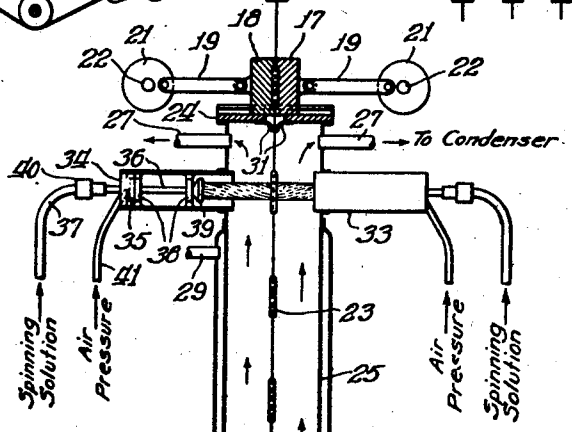


Fig. 4

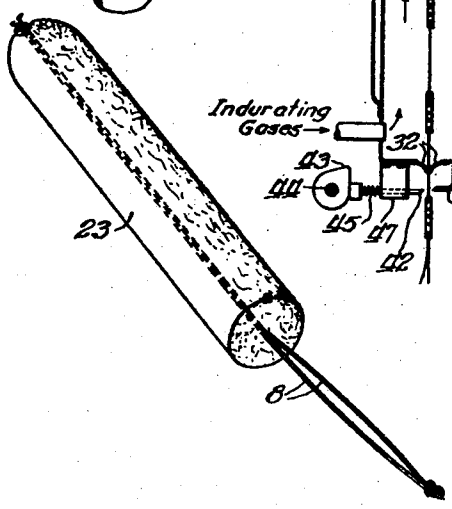
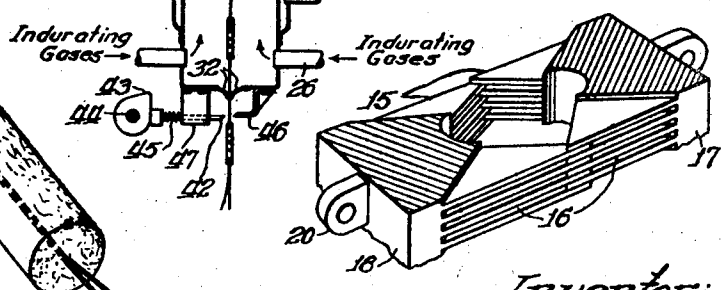


Fig. 3



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2,437,265

TAMPON, SANITARY NAPKIN, SURGICAL DRESSING, INSULATING MATERIAL, FILTER CARTRIDGE, UPHOLSTERY, AND THE LIKE

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Application December 10, 1943, Serial No. 513,787

4 Claims. (Cl. 154—54)

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My invention relates to pads for use as tampons, sanitary napkins, surgical dressings, insulating materials, upholstery, bath sponges, cartridges for the purification of liquids and elastic fluids, and similar purposes. This application is a continuation-in-part of my copending application, "Method and apparatus for making tampons," Serial No. 421,125, filed December 1, 1941, and issued as Patent No. 2,336,744.

Prior practice has been to treat natural fibres by various disintegrating and cleaning processes, reassemble the fibres into pads of crepe wadding, fibre fluff, etc., and then wrap or enclose the pads within woven fabrics. Woven fabrics are quite expensive and their use prevented extension of the pads for absorption purposes, and very often the assembling of the natural fibres into pads of different shapes for various purposes resulted in uneven distribution and pilling of the fibres throughout the pads.

It is therefore an object of my invention to spin directly over pads of crepe wadding, fibre fluff, and other assemblies of natural fibres, integral webs of extensible filaments to allow for maximum expansion of the pads and prevent sluffing of the fibres and disintegration of the pads when in use. The extensible enclosures may have elastomeric characteristics, and may also be used to cover or enclose pads of discrete fibres made from similar plastic materials. Another object is to uniformly distribute and consolidate discrete fibres in the formation of the pads to prevent pilling or lumpiness, and to accomplish this by more economical methods than heretofore used. A further object is to spin continuous uniform enclosures and thereby make unnecessary the usual joints and folds, and to make the enclosures of sufficient strength for the pads to be self-retaining. Other objects and advantages of the invention will become apparent from the following description, a portion of which refers to the drawings.

In accordance with my invention preformed pads of crepe wadding, or other fibrous material, may be discharged onto a traveling belt in a uniform manner and a filamentous web spun over one side, which can then be coated with a wetting agent, fire retardant, water repellent, etc., the pads then flipped over and the opposite side similarly coated and treated; or the pads may be corded together, or connected by their attenuated ends, and passed through a vertical spinning chamber and both sides, or the complete periphery of the pads, coated and treated at the one time. Uniformity and consolidation of pads of

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discrete fibres is preferably obtained by use of adjacent and parallel primary and secondary foraminous walls positioned on each side of an intermediate wall having pockets therein of the required shape and size, and passing a conveying fluid through the pocket portions of the three walls while simultaneously rabbling fibres in a disintegrated and discrete condition over the surface of the primary foraminous wall. Apparatus for such uniform distribution and consolidation of fibre solids is described in my U. S. Patents, Nos. 2,152,901; 2,218,338; and 2,336,744.

The pads may vary as to material, shape and density: Wood, cotton, asbestos, fur, sponges derived from cellulose, rubber compounds, the animal organisms obtained from the floor of the ocean, and similar absorbent and normally highly compressible vegetable, animal and mineral fibres, may be used where it is desirable to absorb obnoxious gases, or liquid fluids, or for the filtering of elastic or liquid fluids; and such fibrous materials may be deposited with, or be impregnated by, granular solids of the order of decolorizing carbon, fuller's earth, silica gel, etc., for the same purpose. Smooth surface inorganic fibres, such as glass, asbestos, metal wool, etc.; smooth surface organic fibres, such as nylon, rayon, Vinyon, etc.; animal fibres, such as fur, hair, feathers, etc.; and vegetable fibres, such as kapok, cattails, milkweed, etc.; are usually found to be acceptable for insulating and upholstery purposes. All of the above fibres, however, have more or less value for all the purposes mentioned, and may be deposited separately, or in mixture, to form pads by the apparatus described in the above paragraph. If the pads are to be used as tampons, cartridges for oil filters or air cleaners in motor vehicles, etc., they will usually be cylindrical in shape and of sufficient density to make them relatively rigid when dry; if used for surgical dressings and sanitary napkins, the compaction may be little and the pads will be sufficiently flexible to conform to the shape of the body; if used for insulating and upholstery purposes, their size may be comparatively great and the density of the pads will depend upon the purposes for which they are to be used.

Integral fabrics and continuous integral enclosures may be spun from: thermosetting compounds, such as urea-formaldehyde, phenol-formaldehyde, etc.; thermoplastic resins, such as vinylidene chloride, vinyl chloride-acetate, polyvinyl chloride, polyvinyl butyral, polystyrene, polysulphide, polyvinyl alcohol, polyvinyl acetate, methyl methacrylate, polymeric amides, and the

usual glass mixtures, latex compositions, cellulosic and petroleum derivatives, protein-base materials, etc.; plastics that are both thermoplastic and thermosetting, i. e., that become plastic under heat alone, or heat with pressure, and under a continuation of such conditions become indurated; plastic mixtures of thermoplastic and thermosetting materials; plastic mixtures of organic and inorganic materials; and almost all substances that are now spun or extruded into filaments, films and foils. All of these plastics may be modified by other materials, such as plasticizers, coloring agents, volatile solvents, etc. After being spun into web enclosures the covered pads may be sprayed with: a fire retardant, such as ammonium sulfamate; a water repellent, such as methyl silicon chloride; a wetting agent, such as sodium sulfonate dioctyl succinate; or a lacquer to coat and strengthen the filaments, or to coat both filaments and the interstices formed by their insections to make the enclosure impervious to certain fluids.

I am aware that it is old in the art to orient the molecular structure of a continuous thermoplastic filament by stretching to give it strength, and that continuous thermoplastic filaments have been deposited by gravity in a uniformly intersecting condition to form an integral web for decorative and other purposes where little strength was required. My filamentous structures differ, however, from such prior practice in that the filaments are stretched during formation of the web to make a fabric of substantial strength, a continuous integral enclosure of intersecting filaments without joints or folds may be formed, discontinuous filaments may be deposited in a promiscuously intersecting condition to make the enclosure, and, when desirable, extensible filaments can be used to cover pads that should be allowed to swell when taking up soakage. Filaments spun from some of the above mentioned plastics, such as certain polymeric amides, copolymers of vinyl acetate and vinyl chloride, etc., may be stretched in a plastic state to have great strength, but for lower strengths and greater softness the stretching will be corresponding less; and after setting or induration they can again be greatly extended, and upon reaching a certain point become truly elastomeric until the elastic limit is reached, returning to their initial point of elasticity when the extending force has been removed. These characteristics I utilize in my invention to permit the requisite swelling of pads required for absorption purposes.

The plastic fabric may become an indurated enclosure without any bonding action between the enclosure and pad; or the enclosure may be bonded to the pad at their points of contact by the adhesiveness of the filaments before induration takes place; or the enclosure may be bonded to the pad by the evaporation of a solvent common to both the filaments of the enclosure and the fibres of the pad so as to be physically homogeneous at their points of contact, as would be the case if acetone were used with cellulose acetate to form a filamentous covering for a pad of cotton fibres; or the enclosure may be bonded to the pad by an adhesive that has no solvent action on either the enclosure or fibres of pad, such as silicate of soda in a water solvent. Where recovery of the solvent is difficult it is sometimes advisable to use plastics with inexpensive solvents, such as an aqueous solution of polymerized vinyl alcohol from which the water

can be allowed to evaporate into the atmosphere. I usually prefer, however, to spin the plastics from a molten state, and without the aid of solvents to bring the plastics to a fluid condition. In any of the above instances, the pads may be considered as webs of non-binder fibres bonded or enclosed by webs of binder fibres which have potentially adhesive characteristics.

The disruption of a plastic filament or an attenuated plastic stream into a plurality of filaments, and the propulsion, conveyance and deposition of the filaments may result from the flow of a liquid, but preferably is accomplished by a blast of elastic fluid, such as air, steam, nitrogen, hydrogen, carbon dioxide, argon, helium, etc., or a mixture of such fluids. The disruption of a plastic filament or stream into filaments may also be accomplished in an electrostatic field by using a transformer and a half-wave or a full wave rectifier to step up and rectify the usual alternating current to give a pulsating unidirectional voltage of 50,000 to 100,000 volts or more that may be required to shatter the fluid plastic. Or both blast of an elastic fluid and electrostatic field may be used for such spinning operations. The stretch-orienting of smooth surface, non-elastomeric filaments cannot ordinarily be accomplished by force of fluid streams alone, but must be executed between a holding means and a pulling means, as indicated by all spinning operations of silkworms and spiders, and these two said means may even be the opposing actions of centrifugal force and a rotating spinneret.

Induration or setting the filaments and a bonding agent, if the latter is used, may be as varied as the plastics used for spinning purposes, such as vulcanization for latex compositions, evaporation for solutions containing a cellulosic derivative in a volatile solvent, a cooling agent for plasticized rubber or molten plastics, absorption of oxygen for air-drying petroleum derivatives, hot air for heat reactive phenol-formaldehyde resins, etc.

The invention is exemplified in the following description, and a preferred arrangement is illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a cross-section of the depositing apparatus and spinning chamber.

Fig. 2 is a part elevation view of the driving rolls of the depositing cylinder.

Fig. 3 is a perspective view of the compression blocks.

Fig. 4 is a perspective view of a finished cartridge.

Referring to the drawings more specifically by reference characters: The fibre fluff pads 1 are formed in the pockets 2 of the wooden cylinder 3, which is positioned between the screen 4 and the foraminous endless belt that is carried on the drive rolls 6 and 7, as described in my copending application, entitled, "Sanitary napkins and surgical dressings," Serial No. 392,921, now abandoned. Strings 8 pass around the cylinder in grooves 9, the bottom of the grooves being midway between the screen and the belt. An air current conveys the fibrous material through opening 10 and deposits it on the screen where the air pressure and rabbling action of the rotating brush 11 cause the fibres to be distributed uniformly through the screen into the pockets positioned over the endless belt. As the pockets fill the strings become embedded within the center of the pads, which become quite firm under the

combined action of air pressure and rotating brush; and the corded pads are then further compressed and discharged from the apparatus by means of compression pockets 12 and string grooves 13 in the center roll 14. As indicated in Fig. 2, a great number of parallel lines of pads on strings may be turned out of the one machine.

After the pads are corded together on strings and receive their initial compression and are discharged from the depositing apparatus, each one is dropped into an opening of substantially the same shape as the pads, made by the fingers 15 meshing into spaces 16 of the complementary compression blocks 17 and 18, respectively. The two blocks are then forced into closer relationship by means of connecting rods 19 that engage the lugs 20 of the former, and which are driven by eccentrics 21 that are fastened to rotating shafts 22. During the early part of the compression operation, the sides of the pad become slightly ridged due to the openings between the fingers, but this is removed as the blocks come together to form a continuous peripheral surface, which may be cylindrical, or oval, or of any other desired configuration, to give the completely compressed cartridge 23 its ultimate size and shape.

The spinning chamber consists of: top cover plate 24, which is grooved to serve as a guideplate for the compression blocks; upright tank 25, having inlets and outlets 26 and 27, respectively, for the indurating and spinning fluids; heating jacket 28, having steam inlet and outlet 29 and 30, respectively; and top and bottom flexible strips 31 and 32, respectively, to permit ingress and egress of the cartridges without escape of the indurating gases. The spinneret tube consists of: cylinder 33, cylinder end plate 34, fluid motor 35, inner and outer spinneret pipes 36 and 37, respectively, ball bearings 38, rotating spinneret 39, turning joint 40, and a feed pipe 41 for the compressed air required for rotating the motor and spinneret and conveying the disrupted and whirling filaments for coating the cartridges. After passing out of spinning chamber the strings of cartridges are cut at suitable intervals by: a cutter blade 42, which is driven by a cam 43, on the rotating shaft 44, and retracted by spring 45; a cutter bracket 46, which is fastened to the bottom of the spinning tank; and a bracket 47, which guides the cutter blade. The cut strings are knotted at either end of each cartridge to prevent withdrawal therefrom when the latter is to be used as a tampon, and the cartridge is then run through a sterilizing temperature, and finally wrapped in tissue paper or Cellophane for marketing purposes.

The above example indicates how a relatively rigid cylindrical cartridge of dense absorbent fibres may be manufactured for use as a tampon, or for insertion in a filter container of a motor vehicle, such as described in my U. S. Patents, Nos. 2,055,870; 2,093,090; 2,128,589; and 2,218,339. If used for the latter purpose, the connecting cord can be withdrawn from the cartridge leaving an opening for insertion of the filtrate thimble of the container. It will, however, be obvious that the shape and size of the pads can be easily regulated for any purpose by making the necessary alterations to the pockets of the intermediate cylinder and the compression devices. The initial compaction results from the combined action of the rotating brush and pressure of the fibre conveying fluid forcing the fibres into the pockets; additional compaction is obtained from the rolls used for discharging the pads from the pockets; and a still further compaction is given to the pads by the external compression blocks.

It will be evident that plastic filaments directed against a cylindrical pad from opposite sides will automatically wrap themselves about the pad during progress of the latter through the spinning chamber, but for rectangular and other shaped pads the spinning tubes may be caused to oscillate about the pads, as described in my copending application, "Method and apparatus for spinning unwoven fabrics," Serial No. 414,809, now Patent No. 2,336,743, issued December 14,1943; or the indurating and filament conveying fluids may be given a peripheral movement about the pads by means of helicoid vanes placed within the spinning chamber; or the corded pads may be caused to rotate about their own axis during the period in which the filamentous structure is being spun over them. Any such relative movements of the pads and filaments after contact has been made, if sufficiently rapid, will give stretch to the latter.

It will also be evident that if a plurality of spinning tubes are placed sufficiently close in the spinning chamber, one tube may be used to spin thermoplastic filaments and the other thermosetting filaments, in which case the filaments from the different tubes will be deposited to form a continuous integral web and enclosure of the mixed filaments; likewise, organic and inorganic filaments may be spun from different tubes to form a continuous integral web or enclosure of the mixed filaments; or one tube may be placed in advance of another tube so that the filaments spun from a thermosetting material may be coated with filaments spun from a thermoplastic material, or the coating may be reversed; and in similar manner organic and inorganic filaments may be spun so that one will coat the other.

It will furthermore be evident that the pads may be discharged from the depositing apparatus in a continuous operation, or in an intermittent operation that must be synchronized with the movements of the compression blocks. However, if the movement of the pads from the depositing apparatus is continuous, the compression blocks will close upon one pad while the string from the following pad piles up thereupon, the excess being taken up the moment the compacted pad is released. Likewise, the spinning tubes may operate continuously, or they may be synchronized to spin at the moment a pad is in juxtaposition to a tube.

It will also be apparent that a strip of commercial absorbent cotton, or crepe wadding, or other fibrous material, may be continuously drawn from a source of supply and wound into a spiral roll about a string, and that a plurality of such spirally wound rolls may be corded together and fed between the compression blocks and through the spinning chamber, as above described.

It will be understood throughout the specifications and appended claims that a "stretch oriented filament" is one whose strength has been substantially increased by stretching between a holding means and a pulling means to, or beyond, the point at which it forms a substantially straight line without the aid of support between the two said means, or forms a spiral where centrifugal force and a revolving centrifuge constitute the two said means; "integral web of filaments" is a web whose filaments have been united

at their points of contact; and "pilling" is to form into minute balls.

I claim as my invention:

1. A fibrous article enclosed within a continuous web of promiscuously intersecting, stretch-oriented filaments bonded together by the adhesive character of the filaments to form an integral web.

2. A fibrous article enclosed within a continuous web of promiscuously intersecting, stretch-oriented, extensible filaments bonded together by the adhesive character of the filaments to form an integral web.

3. An article comprising a web of non-binder fibres enclosed within a continuous web of promiscuously intersecting, stretch-oriented, binder fibres, the two said webs being bonded together by the adhesive character of the binder fibres.

4. An article comprising: a fibrous material enclosed within a continuous web of stretch-oriented filaments bonded together by the adhesive character of the filaments to form an integral web of promiscuously intersecting filaments having interstices thereamong; and an impervious impregnant filling the said interstices and adhesively connected to the said filaments.

FRED W. MANNING.

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