

Jan. 23, 1940.

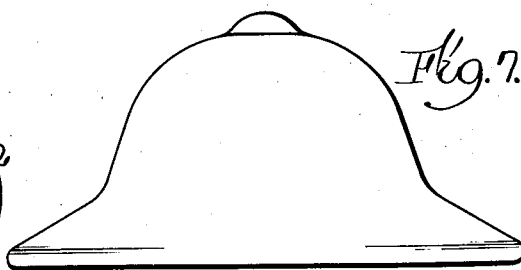
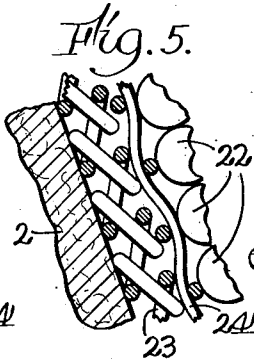
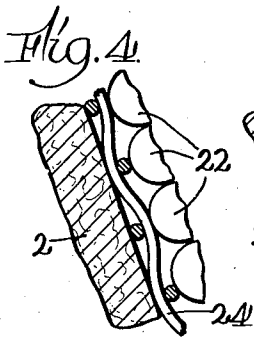
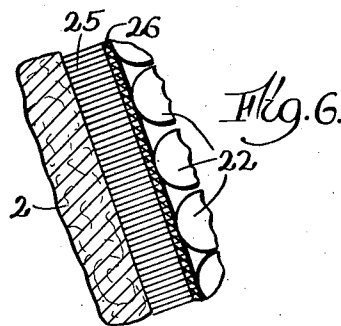
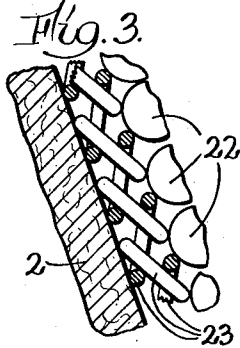
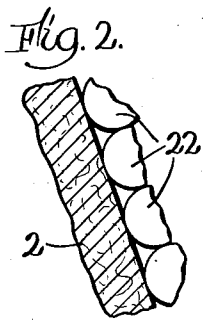
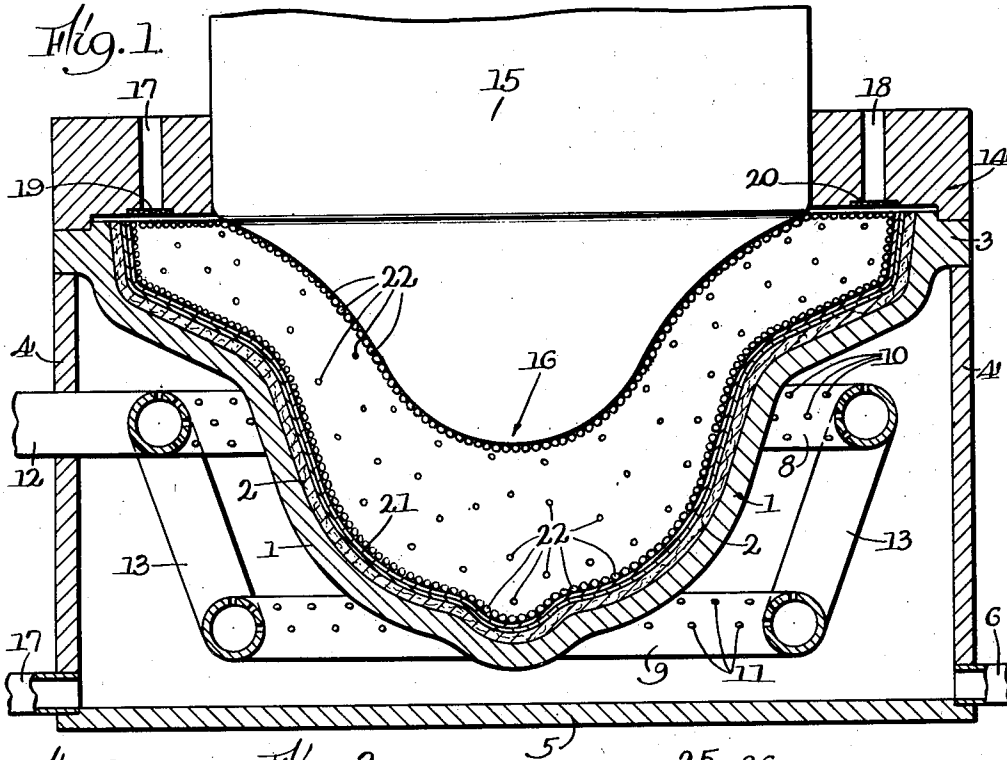
E. C. SLOAN

2,187,918

DRYING DIE FOR FIBROUS ARTICLES

Filed March 28, 1936

2 Sheets-Sheet 1



Inventor:
Edward C. Sloan
BY: Parkinson & Lane, Attys.

Jan. 23, 1940.

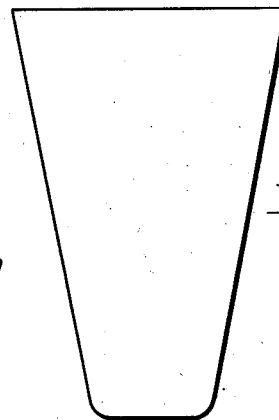
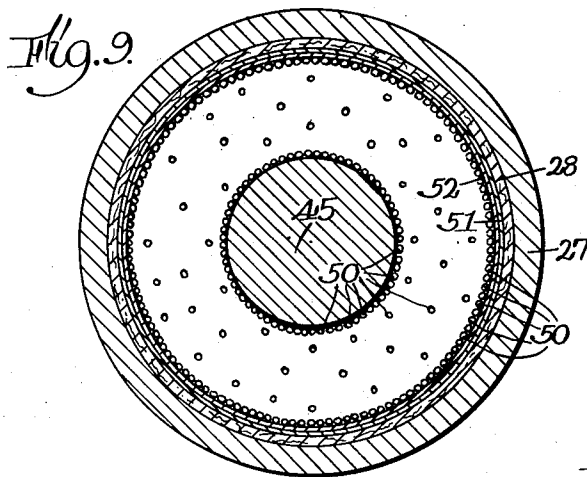
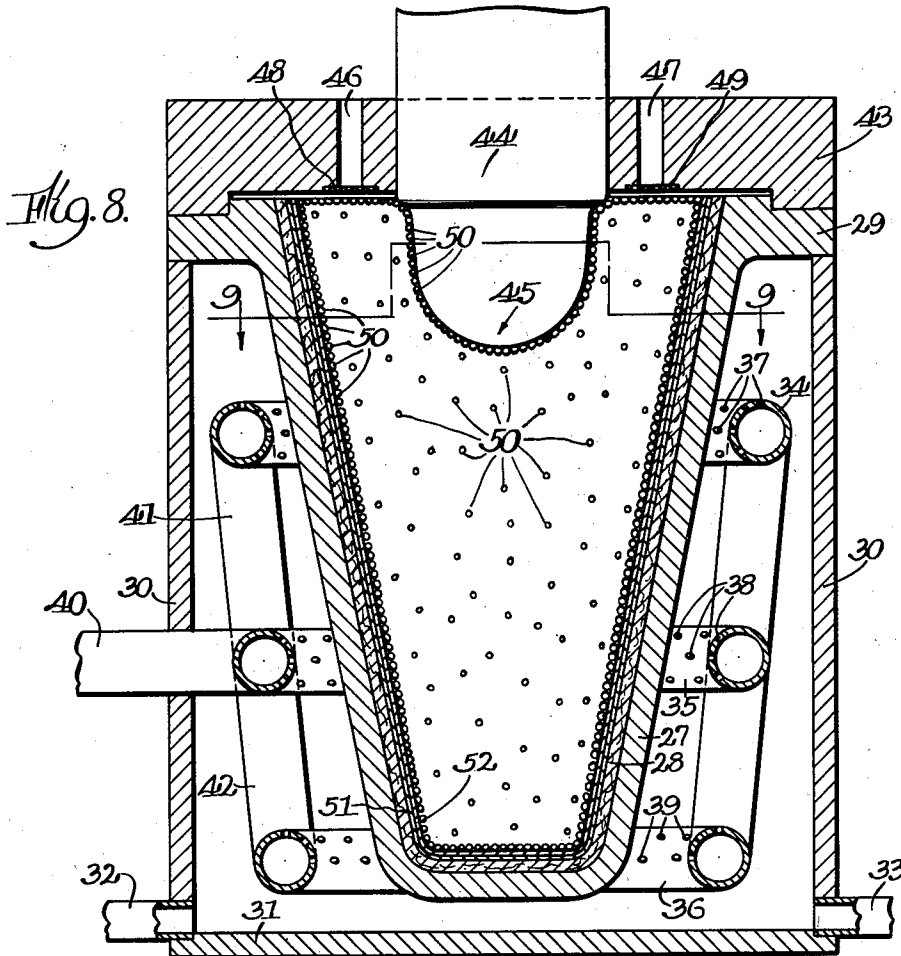
E. C. SLOAN

2,187,918

DRYING DIE FOR FIBROUS ARTICLES

Filed March 28, 1936

2 Sheets-Sheet 2



Inventor.
Edward C. Sloan
By: Parkinson & Lane Attys.

UNITED STATES PATENT OFFICE

2,187,918

DYEING DIE FOR FIBROUS ARTICLES

Edward C. Sloan, Geneva, Ill., assignor to Jesse B.
Hawley, Geneva, Ill.

Application March 28, 1936, Serial No. 71,525

3 Claims. (Cl. 92—59)

The present invention relates to devices for drying articles composed of fibrous material initially accreted, interlaced and integrated into the final given and desired form from suspended
5 fibres in a fluid suspending medium and having a predetermined or given contour.

Among the objects of the invention is to provide a novel device for drying articles of the character or type mentioned above and comprising a rigid die member having a contoured face portion conforming to a contoured face portion of the article, with suitable means to heat such portion of the die member to supply heat to the article, and a yieldable die member on the opposite side of the contoured face portion of the article, such yieldable die member comprising a series or aggregate of rigid or firm elements, whether in the form of solid free bodies or rigid bodies connected to a yieldable member, or forming elements of a fabric, such as a metal fabric, or elongated fine elements, such as stiff wire-like elements held at an end thereof to a yieldable fabric or sheet, or the like, with or without an additional series or aggregate of rigid or firm solid
15 bodies, such as small balls, pellets, or the like, or with or without means, such as a plunger or the like, for applying a pressure on the same so as to effect a distributive pressure in all directions on the article, there being spaces or voids among the elements or bodies or both for the escape
20 of water, steam, vapors, gases, and the like driven off by the heat acting on the article.

Other objects, capabilities, advantages, features, and the like are comprehended by the invention as will later appear and as are inherently possessed by the invention.

Referring to the drawings:

Fig. 1 is a vertical sectional view of an embodiment illustrative of the invention;

40 Figs. 2, 3, 4, 5 and 6 are fragmentary sectional views on an enlarged scale of various forms of yieldable die members embodied in the invention;

Fig. 7 is a side elevation view of an illustrative form of article dried and finished by the die means shown in Figs. 1 to 6 inclusive;

Fig. 8 is a vertical sectional view of another embodiment illustrative of the invention and applicable to another form of article;

50 Fig. 9 is a horizontal sectional view taken in a plane represented by line 9—9 in Fig. 8 of the drawings; and,

Fig. 10 is a side elevation view of another form of article produced by the embodiment shown
55 in Figs. 8, 9, 2, 3, 4, 5 and 6 of the drawings.

Referring more in detail to the drawings the embodiments chosen to illustrate the invention are shown as comprising a rigid female die and a yieldable male die between which the article blank or carcass is heated, pressed and finished. 5 In Fig. 1 the female die comprises a rigid contoured wall or face portion 1 conforming to the contoured face portion of the article blank or carcass 2, the part 1 having a flange 3 secured in any suitable manner to the upper end of a chamber having side walls 4 and a bottom wall 5. 10 At low points in the chamber are connected drain ducts 6 and 7 for conducting away the heating fluid. In the chamber and beneath the wall 1 are suitably located annular spray members 8 15 and 9 having apertures 10 and 11 so arranged as to direct jets or sprays of the heating medium or fluid to different parts of the wall 1 so as to distribute the heat over different areas or extents of the wall 1 as desired. The heating fluid is fed in through a duct 12 connected to the member 8 and between members 8 and 9 are connected one or more ducts 13 as desired. The heating fluid may be any heat bearing fluid whether in the form of a gas, vapor, liquid or the like, but in the present invention is preferably in the form of a vapor which as it gives up its heat to the wall 1 condenses into the form of a liquid which is drained out by way of the ducts 6 and 7. A vapor is preferable because of the abundant heat of vaporization obtained when the fluid is converted from a gaseous to a liquid state.

At the upper end of the die is provided a plate 14 having a closing fit with the lower rigid die and to which the plate may be secured in any suitable manner. This plate has an opening through which operates a plunger 15 having a nose 16 for projecting into the chamber of the male die, and apertures 17 and 18 acting as escape outlets for the water, steam, vapors, gases or the like given off when drying the article blank or carcass, and to which may be connected, if desired, any suitable source of suction. The outlets 17 and 18 are preferably covered by screen discs 19 and 20 of such a mesh as to prevent escape of any of the free rigid bodies forming a part of the yieldable die member of the device more fully later described.

The yieldable die member may consist simply of a series or aggregate of free rigid bodies or elements 22 having spaces or voids among them for the escape of the fluids driven off by the heat of the female die acting on the article adjacent to it, or may comprise a yieldable member 21 generally and conventionally shown in Fig. 1 and 55

more specifically shown in various forms in Figs. 3, 4, 5 and 6 of the drawings, this member including as a part thereof the aggregate of free rigid bodies or elements 22 as above mentioned. These bodies may be in the form of more or less rounded solids of hard, rigid or firm material such as metal balls, pellets, polyhedrons, and the like and are capable of displacement by the pressing of the plunger 15 against the aggregate so that the movement of these bodies in the confined space of the chamber in the male die is fluidal or similar to that of a liquid so that the pressure is transmitted in all directions to press more or less equally or evenly over the whole area of the inner face of the article blank or carcass.

The term "yieldable" is used in this case as movable in every or all directions and comprehends bending, flexing, stretching, contracting, shrinking, displacement, fluidal or like movement, and all like or similar strains. The expression "yieldable die member" comprehends the aggregate of the free rigid bodies, or the same together with such other yieldable element as has spaces for the escape of the water, steam, vapors, gases and the like driven off by the heat acting on the article blank or carcass.

In the form shown in Fig. 2, the flexible die member consists simply of the aggregate of rigid bodies 22 bearing in direct contact with the article blank or carcass, and having among them innumerable interspersed spaces or voids for the ready escape of water, steam, vapors, gases or the like driven off by the action of the heat on the article blank or carcass. As the plunger 15 is forced inward the bodies 22 are displaced and they press at every point to apply a compressing thrust which is substantially uniform or even over the area of contact of the article.

The yieldable die member shown in Fig. 3 comprises the aggregate of bodies 22 and an interposed fabric or mail having rigid elements 23 bearing against the blank 2. This fabric or mail may consist of interlinked elements of any desired shape, such as rings or the like, and so arranged and disposed as to contact at innumerable points on the blank 2 and also to provide for innumerable interspersed spaces or voids for the ready escape therethrough of the water, steam, vapors, gases and the like driven off by the action of the heat on the blank 2. Against this fabric bears the aggregate of free bodies 22 so that as the plunger 15 is forced inward pressure is effected on the fabric 23 and thence on the blank 2 so as to compress the latter, and to permit free escape of the water, steam, vapors, gases and the like by the action of the heat on the blank 2, the pressing on blank 2 being substantially even over the area of contact thereof.

In Fig. 4 is shown another form of yieldable die having a fabric 24 of the textile type and the elements of which are so woven, knitted or netted as to permit yielding in all directions, and of which the mesh is such as to provide innumerable spaces or voids for the free escape of the water, steam, vapors, gases or the like driven off by the action of the heat on the blank 2. In this case also the aggregate of free bodies 22 are so arranged as to press the fabric to compress the blank 2 as above explained.

In the form of means shown in Fig. 5 the yieldable die member comprises a fabric 23, such as that shown in Fig. 3, in contact with the blank 2, a fabric 24 such as that shown in Fig. 4, and the aggregate of free bodies 22, the latter acting in the same manner as indicated above,

In Fig. 6 is shown another form of yieldable die member comprising an aggregate of fine elongated stiff or rigid elements 25, in the nature of fine wires or the like. The elements are anchored at an end thereof to a yieldable backing 26 which may be a sheet of fabric such as textile fabric either woven, knitted or netted or the like, or other flexible or yieldable material such as rubber, gutta percha or the like. The elements 25 may be in the form of staples similar to those used in card clothing in the textile industry. The fabric 26, if woven, has the threads woven on a bias so that the sheet may yield in every direction along the sheet besides also yielding transversely to conform to the contour of the surface of the blank 20. The mesh of the fabric 26 is of such as to provide innumerable spaces or voids for the escape of water, steam, vapors, gases, or the like as in the above mentioned cases. The aggregate of the free rigid bodies may also press against the backing 26 to apply pressure thereon and the elements 25. The elements 25, although closely aggregated, have innumerable spaces or voids among them for the free escape of the fluids driven off by the action of the heat on the blank 2. When applied to curved portions of the blank 2 the free ends of the elements 25 contacting the blank will accommodate themselves in either closer or less close arrangement so that there is a substantially complete contact at all points of contact against the surface of the blank 2. Because of the close aggregating of these elements and the points or tips thereof being all in the same surface, the pressing of this aggregate against the surface of the blank is virtually smooth. Whether or not there be some penetration in the blank 2 I am not prepared to state, yet it appears that a certain amount of penetration is present and beneficial in that avenues of escape are opened up around the penetrating tips for assisting in the escape of the water, steam, vapors, gases and the like from the interior of the blank 2. No perceptible marks are left on the surface of the blank.

In Fig. 7 is shown a finished article which in this case is a hat for wearing in warm or hot weather or in warm or hot climates. The hat may be suitably covered with a fused and solidified permanent thermoplastic substance of a vinyl resin base type preferably of the polymerization group or covered with textile fabric bonded firmly to the surfaces of the hat by such thermoplastic substance.

The device shown in Figs. 8 and 9 is designed to dry an article of more elongated form and which may be used as a container (see Fig. 10) such as a vase, drinking vessel, pot, or the like, the container being preferably covered with a fused and solidified permanent thermoplastic substance of a vinyl resin base type preferably of the polymerization group so that the article may have rigidity as well as be impervious to liquids. Similar to the device shown in Fig. 1 this device comprises a rigid die member having a contoured base portion 27 conforming to the contoured face portion of the article blank or carcass 28, the part 27 having a flange 29 secured in any suitable manner to the upper end of the chamber having side walls 30 and a bottom wall 31. At low points in the chamber are connected drain ducts 32 and 33 for conducting away the heating fluid. In the chamber and beneath the wall 27 are suitably located annular spray members 34, 35 and 36 having apertures 37, 38 and 39 so arranged as to direct jets or sprays of the heating medium or fluid to different parts of the

wall 27 so as to distribute the heat over different areas or extents of the wall 27 as desired. The heating fluid is fed in through a duct 40 connected to the member 35 between which and members 34 and 36 are connected one or more ducts 41 and 42 as desired. The heating fluid may be any heat bearing fluid whether in the form of a gas, vapor, liquid or the like but in the present invention is preferably in the form of a vapor which as it gives up its heat to the wall 27 condenses into the form of a liquid which is drained out by way of the ducts 32 and 33. A vapor is preferable because of the abundant heat of vaporization obtained when the fluid is converted from a gaseous to a liquid state.

At the upper end of the die is provided a plate 43 having a closing fit with the lower rigid die and to which the plate may be secured in any suitable manner. The plate 43 has an opening through which operates a plunger 44 having a nose 45 for projecting into the chamber of the male die, and apertures 46 and 47 acting as escape outlets for the water, steam, vapors, gases or the like given off when drying the article blank or carcass, and to which may be connected, if desired, any suitable source of suction. The outlets 46 and 47 are preferably covered by screen discs 48 and 49 of such a mesh as to prevent escape of any of the free rigid bodies forming a part of the yieldable die member of the device.

The yieldable die member may consist simply of a series or aggregate of free rigid bodies or elements 50 having spaces or voids for the escape of the fluids driven off by the heat of the female die acting on the article adjacent to it, or may comprise one or more yieldable elements 51 and 52 generally and conventionally shown in Fig. 8 and more specifically shown in Figs. 3, 4, 5 and 6, the element 51 corresponding to elements 23 or 24 in Figs. 3 and 4 and the element 52 corresponding to element 24 in Fig. 5, the elements 51 and 52 being parts of the flexible die member.

The free rigid bodies 50, corresponding to the bodies 22 in Fig. 1, may be in the form of more or less rounded solids of hard rigid or firm material, such as metal balls, pellets, polyhedrons, or the like, and are capable of displacement by the pressing of the plunger 44 against the aggregate so that the movement of these bodies in the confined space of the chamber in the male die is fluidal or similar to that of a liquid so that the pressure is transmitted in all directions to press more or less equally or evenly over the whole area of the inner face of the article blank or carcass.

The specific description of the forms of the yieldable die member shown in Figs. 2, 3, 4, 5 and 6 apply to this form of die means for drying the particular form or type of article shown in Fig. 10, and repetition is unnecessary. The article blank is preferably produced by the method or process disclosed in the co-pending application of Jesse B. Hawley, Ser. No. 4,866, filed February 4, 1935, and entitled Hats which issued March 15, 1938, as Patent No. 2,111,212. In the production of the article it is first produced by the accreting, interlacing and integrating upon a suitable contoured porous former or molding die of fibrous material, such as pulp or other fibres, suspended in a fluid bath, such as water, in a vat, by the action of a suction in the former or molding die, the suction drawing the water through the pores or apertures of the molding die to cause an accretion, interlacing and integrating of the fibres on the contoured surface of the die,

thus forming an integral unit which initially receives the final desired or given form and contour. When the desired thickness of the accreted fibres is attained the molding die is raised out of the bath with the suction still maintained to prevent any sloughing off of some of the fibres of the water as the die and the accreted blank is raised out of the bath. The drawing of air through the raised blank will remove a portion of the water held by the fibres by adhesion or capillary attraction.

The fibres in the vat are preferably treated with suitable substances so as to render each fibre proof against absorption of water, moisture or the like, as explained in the above referred to application of Jesse B. Hawley.

The wet blank on the molding die may be compressed by any suitable means either by increasing the differential of pressure on the opposite sides or faces of the blank or mechanically to squeeze out a large portion of the water held in the blank or carcass. Then the blank may be removed from the molding die in any desired manner and placed in the female die of the present invention, the male die then being brought down into position as shown and the plunger forced inward to effect a displacement of the free rigid bodies to distribute the pressure over the inner face of the blank with or without the intervening yieldable element or elements described above to compress the blank as desired while the heat of the female die drives off the remaining water, the steam, vapors, gases or the like which escape by way of the spaces or voids provided in the yieldable die member, and pass out through the screened outlets mentioned with or without the assistance of a suction as desired. After the blank or carcass is sufficiently dried and compressed, it is then covered as above described, and when it is desired to form a beaded edge the edge of the blank is curved and set in a suitable die means for that purpose, such a means being disclosed in the copending application of William C. Gray, Serial No. 4,868, filed February 4, 1935, entitled Forming die means which issued September 14, 1937, as Patent No. 2,093,167.

While I have herein disclosed a few illustrative embodiments of the invention, it is to be understood that the invention is not limited thereto but comprehends other constructions, forms, details, arrangements of parts, materials, features and the like without departing from the spirit of the invention.

Having thus disclosed the invention, I claim:

1. A drying device for fibrous articles of the character disclosed comprising complementary die members contacting opposite faces of said article and of which one is rigid and has a contoured surface complementary to the contoured portion of said article and of which another is yieldable and conformable to the contour of said article and comprising a mass of free pellet-like bodies above said rigid die and displaceable when pressed to distributively compress the article evenly at all points of contact, a cover for said yieldable die member and provided with drainage outlets and means for applying heat to said rigid die member to dry said article when being compressed, the moisture driven off from said article by said heating means escaping among said bodies.

2. A device for drying an article composed of fibrous material initially accreted, interlaced and integrated into the final given form from suspended fibres in a liquid suspending medium and having a predetermined contour, comprising a

rigid die member having a contoured face portion conforming to a contoured face portion of the article, means for heating said contoured face portion of said die member whereby heat is transmitted to said article when adjacent to said contoured face portion of said die member, a yieldable die member above said heated die and contacting an opposite side of said contoured face portion of said article and comprising a porous fabric so constructed and arranged as to flex and yield in all directions in conformity with the contour of said opposite side of said contoured face portion of said article, and an aggregate comprising a plurality of layers of free firm pellet-like elements above said fabric and having spaces among them for the escape of water, steam, vapors, gases and the like driven off by the heat acting on said article, a cover for said aggregate and provided with drainage outlets and means for applying pressure to said aggregate of firm elements to distributively compress said article over the area of contact between said yieldable die member and said article.

3. A device for drying an article composed of fibrous material initially accreted, interlaced

and integrated into the final given form from suspended fibres in a liquid suspending medium and having a predetermined contour, comprising a rigid die member having a contoured face portion conforming to a contoured face portion of the article, means for heating said contoured face portion of said die member whereby heat is transmitted to said article when adjacent to said contoured face portion of said die member, a yieldable die member above said heated die and contacting an opposite side of said contoured face portion of said article and comprising a flexible fabric of interlinked rigid elements having spaces among them for the escape of water, steam, vapors, gases and the like driven off by the heat acting on said article, said yieldable die member comprising a series of layers of free metal balls above said fabric and having spaces among them for the escape of water, steam, vapors, gases and the like driven off by the heat acting on said article, and means for applying pressure to said balls to distributively compress said article over the area of contact between said yieldable die member and said article.

EDWARD C. SLOAN.