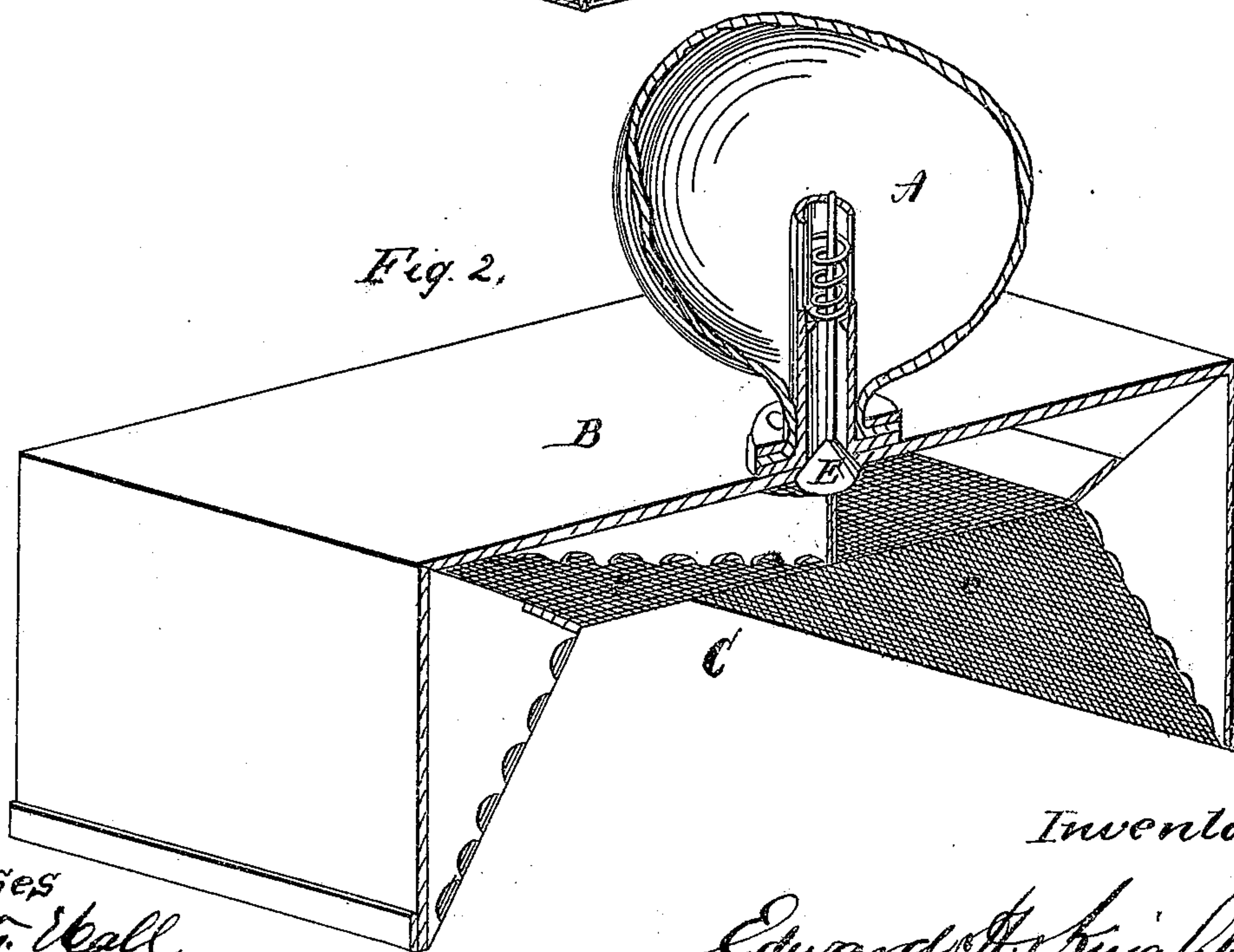
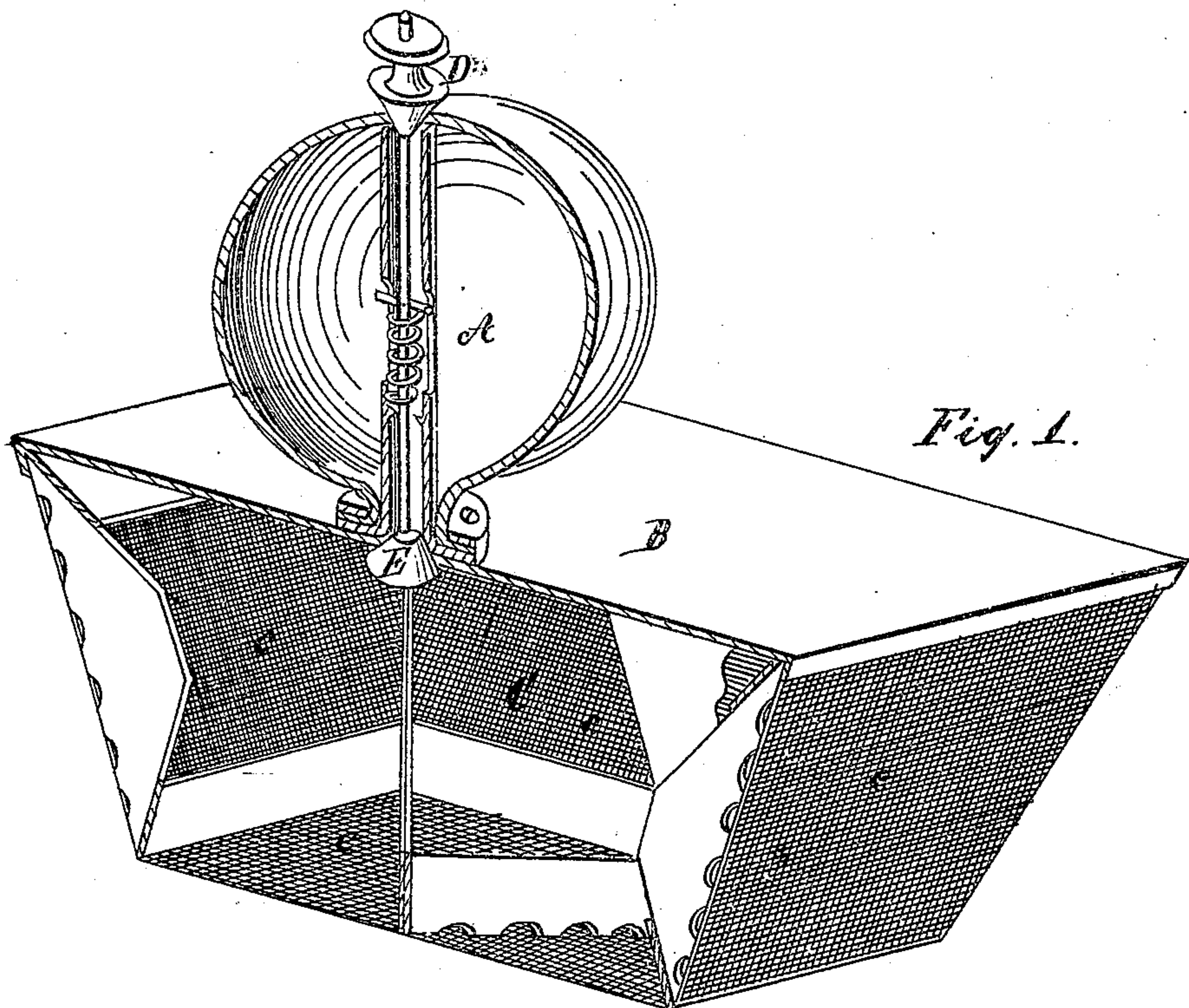


*E. H. Knight. Sheet 1. 2. Sheets.*  
*Paper Molding.*

*N<sup>o</sup> 53,631. Patented Apr. 3, 1866.*

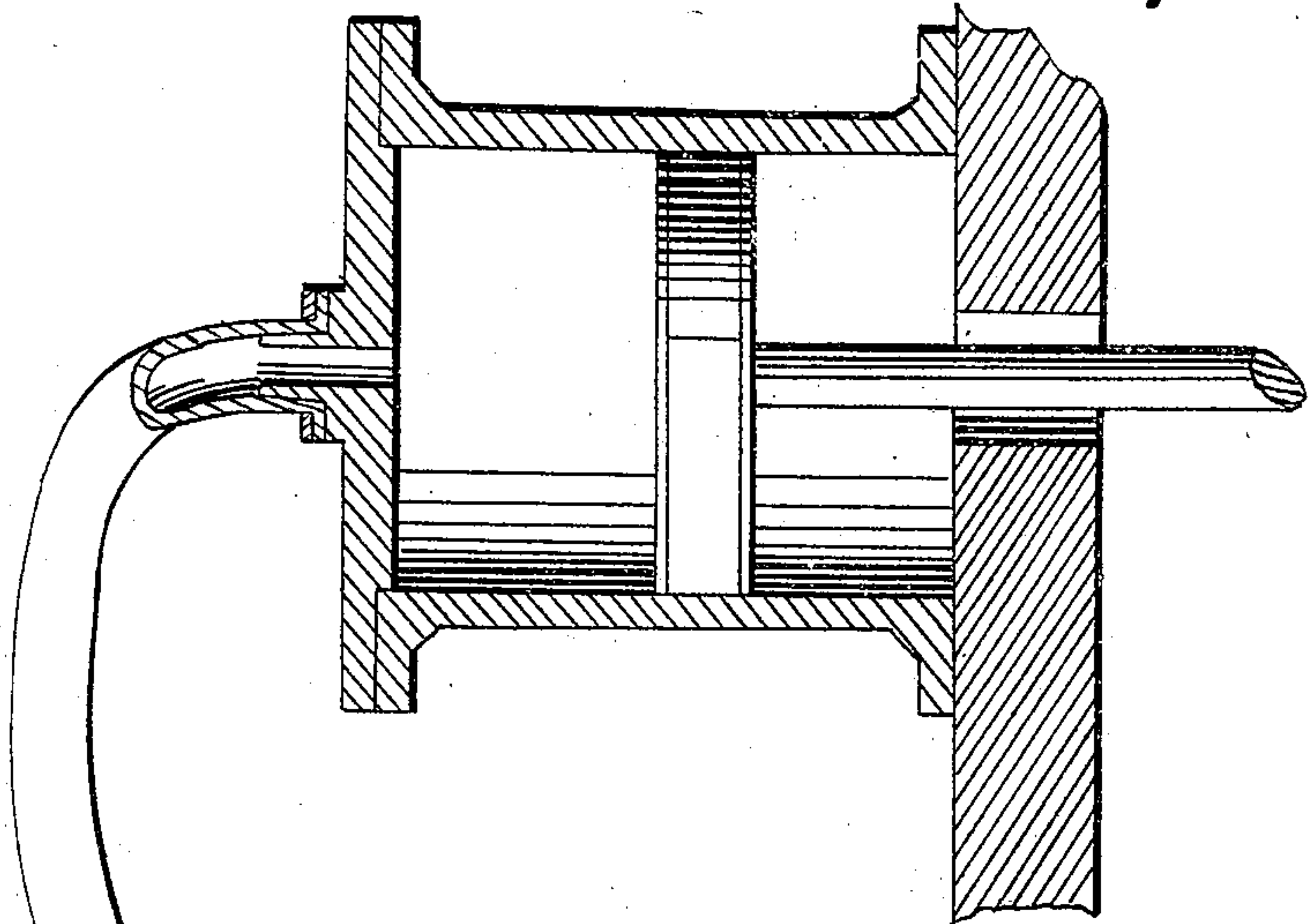


*Witnesses*  
*W. F. Hall*  
*Geo. L. Ewin.*

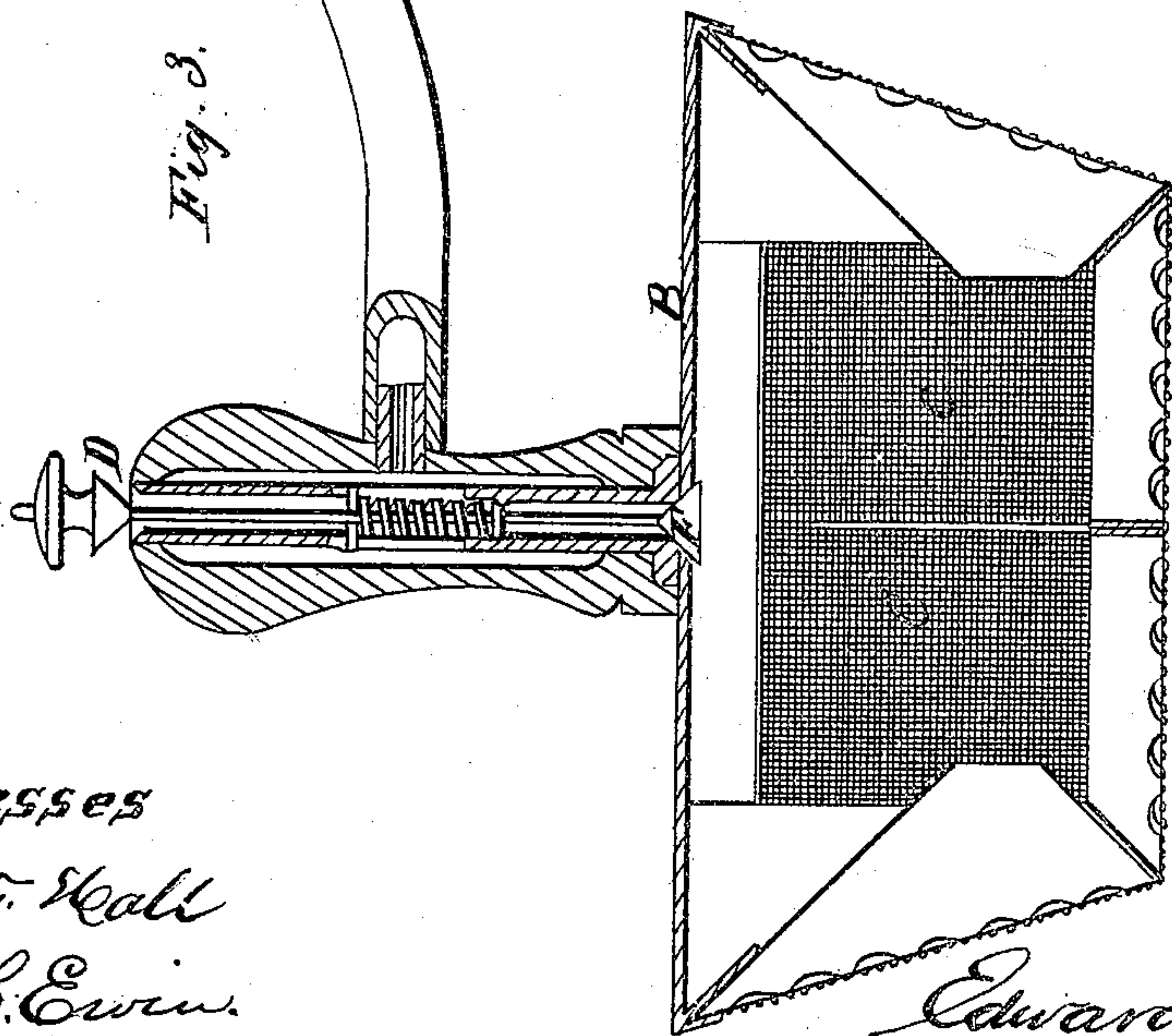
*Inventor*  
*Edward H. Knight*

*E. H. Knight. Sheet 2. 2 Sheets.*  
*Paper Molding.*

*N<sup>o</sup> 53,631. Patented Apr. 3, 1866.*



*Fig. 3.*



*Witnesses*

*W. F. Hall*  
*Geo. L. Ewin.*

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# UNITED STATES PATENT OFFICE.

EDWARD H. KNIGHT, OF WASHINGTON, DISTRICT OF COLUMBIA.

## IMPROVED PROCESS FOR MOLDING ARTICLES FROM PAPER-PULP.

Specification forming part of Letters Patent No. 53,631, dated April 3, 1866.

*To all whom it may concern:*

Be it known that I, EDWARD H. KNIGHT, of the city and county of Washington, District of Columbia, have made new and useful Improvements in the Process of Molding Articles of Fibrous Material; and I do hereby declare the following to be a full, clear, and exact description of the nature, construction, and operation of the same, sufficient to enable one skilled in the art to which it appertains to construct and use the same, reference being had to the accompanying drawings, which are made part of this specification, and in which—

Figure 1 is a sectional view of an apparatus which may be used in carrying out the process described. Fig. 2 is a modification in which the film of pulp is received on a concave or hollow surface. Fig. 3 is a modification in which the former is connected by an elastic pipe to an air-exhausting and forcing apparatus, (the latter not shown.)

The object of the improvement is to make from paper-pulp articles such as boxes, lids, lamp-shades, cases, bags, hats, caps, bonnets, and other articles, with or without a seam, by means of a perforated or reticulated former, which is connected to some air-exhausting device, so that when the said former is plunged into the pulp and the air partially withdrawn from its interior the pulp shall become aggregated upon the surface which is exposed thereto, whether exterior or interior, and by removal from thence constitute a film of fibers capable of being subjected to such other process as may be requisite to give it the required finish, form, or ornamentation.

I cannot attempt to anticipate all the various articles which may be manufactured by the process I have invented, but I will enumerate a few. In the first place it is particularly well adapted for fruit-boxes in which to pack fruit for market, the boxes being made of common material, yet clean and sufficiently lasting for the purpose. The small fruit, such as berries of various kinds, being placed therein and then packed in trays or boxes, are shipped to their destination and sold with the paper box that contains them, the box itself being provided at such a trifling cost that it is not necessary to return it to the packer or producer. The box for this purpose would be of nearly a cubical shape as containing the greatest quantity with a given amount of ma-

terial, due regard being had to the question of economy in packing the said paper boxes in the trays or boxes in which they are shipped to market. The boxes for this purpose may be made of coarse and harsh material, which will answer very well for use but once, and may consist of straw or woody or other vegetable fiber, which might be unsuitable for many of the more delicate uses to which paper is ordinarily applied. It will probably be well to give the fruit-boxes a slight taper, making each a frustum of a pyramid, so that when empty they may readily nest into each other while yet clean and unused and in store, at the factory or plantation, or in transit to the latter for their stated use as required.

I propose also to make paper bags, hats, caps, bonnets, and possibly other articles of clothing in an analogous manner.

Another use of this process is to make boxes for confectionery, bon-bons, or other articles which are usually sold in boxes, such as some kinds of fruit, candy, many articles of stationery, matches, drugs, cosmetics, clothing—such, for instance, as paper collars, gloves, hats, bonnets, &c.—and boxes for temporary use, in which they are soiled and discarded after one service, as is the case in sending out fried oysters or other cooked food therein.

It will also furnish so cheap a means of inclosing articles that it may be expected to form a common means of wrapping up the goods of purchasers to a much greater extent than is now feasible, where boxes are not used for that specific purpose, but only such as become emptied in the ordinary course of selling the contents.

It is not, however, to be supposed that the boxes manufactured by this process are necessarily of a rough and common character, although the facility for manufacturing such is so great as to enable them to be furnished at a price which will render them acceptable for many purposes where no one at present thinks of applying them, where a clean, cheap article is required, as has been more particularly cited above.

When a more expensive article is required it can be made of superior material, bleached or otherwise, or of tinted pulp, or the damp or dried product can be embossed or perforated or covered with ornamental paper or fabric, or otherwise ornamented by painting or overlay-



ing with artistic devices, in any of the well-known methods in use in that department of the arts.

It is also designed that the yet damp film of fiber from the former may be placed upon another former which has only a certain portion of its surface reticulated or perforated, the said portion being in its outline of an ornamental or artistic character. The film, being then upon the second former, is introduced into a second body of pulp, which may or may not be tinted, and is caused to take up a second film, giving that part an additional thickness. This feature is valuable for screens and lamp-shades, where a pretty effect is produced by the varying translucency of the different portions, or by the colored figures thus introduced at a very small cost.

The effect of the overlying additional thicknesses is to give a medallious effect to the screen or shade when placed between the light and the eye of the person.

The product—box, screen, or whatever it may be—may be taken from the former and dried upon blocks, or, what is perhaps better, steam or fire heated hollow metallic blocks, upon a bench placed conveniently to the operator. The after treatment will, however, depend upon the use and the destination, as a mere oven or rack drying may be sufficient for a common article, while another article may be pressed or swaged between polished or embossed surfaces, which will add to its beauty and value.

The main idea is to produce a receptacle, screen, shade, or other article which is not flat without a seam, and thereby avoid the necessity of cutting out a pattern and then bending and joining the parts; but a modification, or rather adaptation, of the idea may be executed by making the formers united in such a manner that a box and lid with a hinge attaching them may be obtained, the point in this case being to make the lid and box continuous at the portion where they are usually united by a separate membrane or hinge of some kind. By a ready arrangement of the parts the box and lid may each have their appropriate shape, so as to fold the latter upon the former with a lapping or meeting joint, as may be required.

There are many descriptions of round or oval boxes, such as match and pill boxes, and scores of other kinds which might be named, which in the present usage are made of a strip rolled into a cylindrical shape around a circular bottom piece. These may readily be made upon or within a cylindrical former.

I have probably said sufficient in regard to the fact that I am not confined to any special form, size, or to a specific pulpy material, or to the purpose, design, or destination of the article produced, or the mode of finishing or ornamenting it, as my invention consists in making the article, of whatever character it may be, upon a reticulated, perforated, or grated former by the adhesion of pulp thereto by the exhaustion of the air therein or the deposition of the pulp thereon by exterior means applied thereto.

In regard to the device I use for this purpose, I refer to the drawings, Fig. 1, in which A is an elastic handle attached to the plate B. C is a chamber or former with open-work sides and bottom *c c c c*, which may consist of wire-gauze or perforated metal, or of a band or grated surface, if sufficiently close to prevent the too ready passage of pulp therethrough; and I wish here to remark that the character of the pulp will have some bearing upon the necessary fineness of the meshes, as a coarse, roughly-ground material may be arrested by a coarser gauze than should be presented to a very fine paper-pulp. The wire-gauze, or whatever the open-work surface may consist of, is supported from the inside by wires or ledges, if necessary. In the drawings these are shown with their edges presented to the gauze, so as not to block up any (or many) of the interstices, the effect of which might be to weaken the article at that point, owing to a lack of fiber accumulated, as it is necessary to afford a passage for the water through the reticulations or interstices to bring the fiber in intimate connection therewith, it being arrested in endeavoring to follow the water through the gauze and making an aggregated fibrous film on the exterior.

Provision is made for the partial exhaustion of the air from the inside of the former C, and I have exhibited one form in Fig. 1. It consists of an elastic handle, A, formed preferably of gum-elastic, though many other equivalents as to material and mechanical functions will readily occur to an expert. An avenue for the passage of the air is provided through the handle as a convenient location, though it may be at some other point. This passage is guarded in Fig. 1 by two valves, D E, which operate as follows: The former is grasped by the elastic handle, which latter is pressed flat, so as to expel the greater part of the air therefrom, which finds its exit through one or other of the valve-openings, it is immaterial which. The thumb being then pressed upon the valve D, and the former C plunged beneath the surface of the pulp, the pressure upon the handle is withdrawn, and the exhaustion of the air from the interior of the former consequent thereupon causes a flow of the pulp against the surface *c c c c*, where it adheres and is withdrawn from the vat adhering thereto. Should a sufficient quantity not adhere by one effort or pulsation, the valve D may be again opened, the handle compressed, and then the valve D being closed, the expansion of the handle will make another draft upon the contents of the vat, causing an additional quantity to adhere to the surface of gauze. The required film being obtained, it is to be removed from the former and dried in any suitable manner. Perhaps the best plan is to put the film like a cap upon a heated block of the shape and size of the former or into a cup of proper shape. If any difficulty occur in getting the film off the former, it may be assisted by pumping air into the interior of the chamber or former, which is ac-



complished by holding the valve D closed while the handle is compressed, which forces the air contained therein into the interior of the former and tends to loosen the film from the gauze as the air seeks an escape. This may be repeated, if necessary, and experience will readily indicate the requisite amount of blast as well as the best mode of applying it—by a sudden puff or a more gentle pressure—in connection with a cap or receiver held on the outside of and ready to receive the detached film.

I have made the principal part of the foregoing remarks as applied to a device like Fig. 1; but it may be varied, as in Fig. 2, where the film is collected upon an interior surface, and may be discharged therefrom upon a heated block, whose temperature may shrink it at once from contact with the gauze. A provision may be made at any suitable place for the discharge of water which reaches the interior of the former.

To increase the translucency at any point, or to make a weak place for breaking, the capacity of the meshes may be lessened, so as to cause a smaller amount of fiber to collect against the said point.

To make an opening hole or slit in the article turned off or out of the former, let an impervious patch or strip be placed at the required point or the meshes be gummed up or stopped at the desired spot.

Fig. 3 gives an indication of a mode of conveying air to and from the former through a flexible tube which leads to a bellows of some kind, which may consist of a piston and cylinder or covered frame, so arranged as by the motions of the foot on a treadle to force the air toward or exhaust it from the former, as occasion may require.

A number of formers may be placed upon a flat surface or a cylinder revolving in a pulp-vat, so as to make several at one operation, either detached or requiring subsequent division.

The edges may be clipped or turned down.

In the latter case the edge will be thickened and strengthened.

The paper-pulp may be made to adhere to a former by centrifugal action, placing it in a revolving vessel with reticulated or absorbent sides; or the film may be obtained by pouring the pulp on a former having reticulated or absorbent sides, or upon a pervious surface, provision being made for the removal of the superfluous water, or by allowing the water to drip or run therefrom.

In place of a metallic reticulated surface to the former, a pervious covering of fabric may be used in some cases.

It may be well to give a certain rotation or motion to the former in the pulp to weave the fibers among each other to a certain extent.

To obtain a thicker, more solid, or rigid result a number of films may be laid together while damp, so as to unite and form a single article composed of several thicknesses.

Having described my invention, what I claim therein as new, and desire to secure by Letters Patent, is—

1. The process of making boxes and other hollow paper articles, substantially as described.
2. In the process of manipulating paper-pulp, and in combination with a former possessing the described functional character, an air forcing or exhausting device, operating substantially as described.
3. In combination with a former constructed to operate substantially as described, an elastic hollow handle provided with valve-guarded opening or openings.
4. A seamless box or other receptacle, lid, lamp-shade, or other hollow paper article made directly from pulp upon a pervious former, in connection with an artificial draft and blast of air or other fluid.

EDWARD H. KNIGHT.

Witnesses:

W. F. HALL,

GUY C. HUMPHRIES.