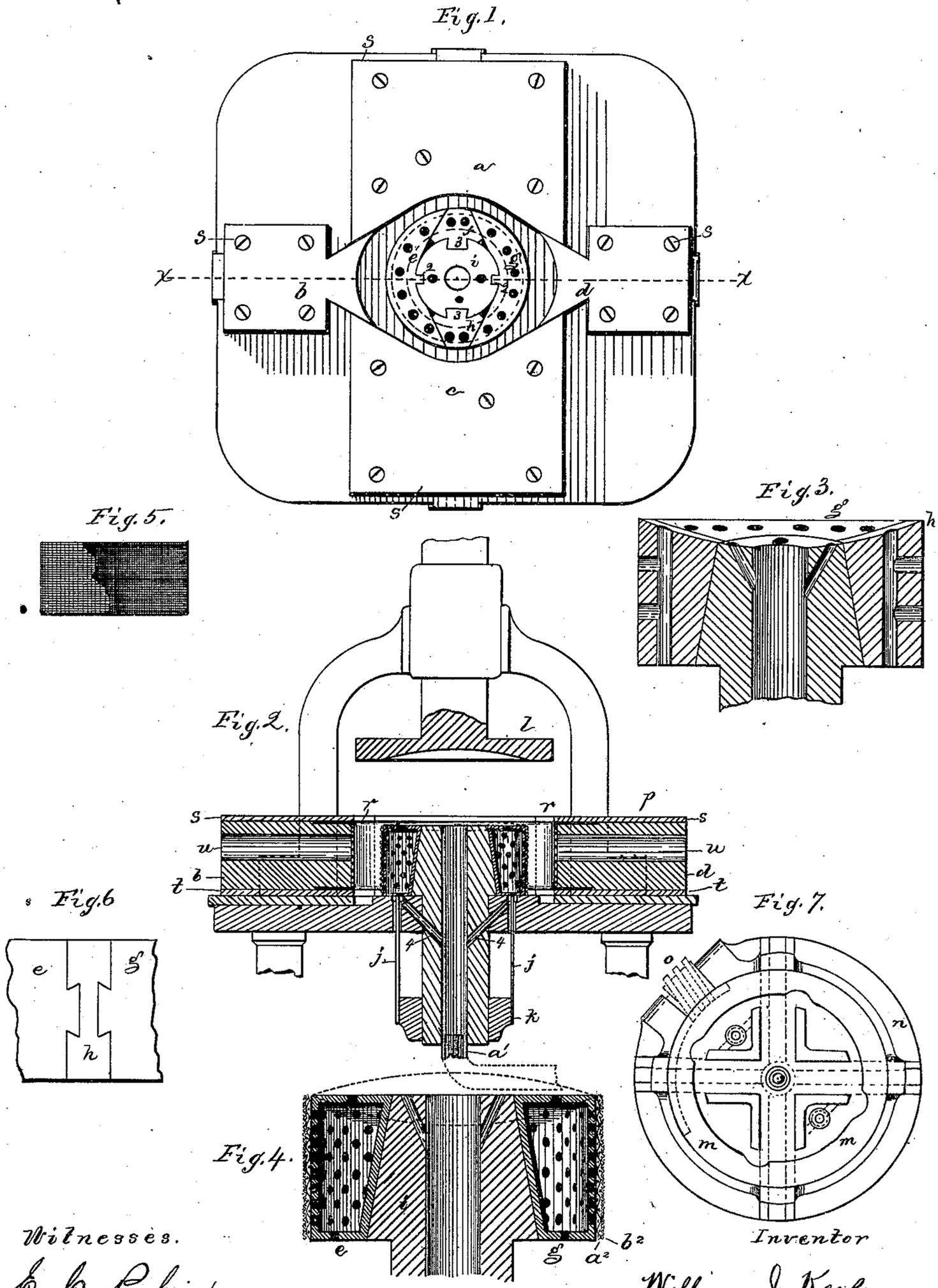


W. J. KEEFE.  
 Machine for the Manufacture of Paper Boxes from Pulp.  
 No. 202,352.      Patented April 16, 1878.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN MACHINES FOR THE MANUFACTURE OF PAPER BOXES FROM PULP.

Specification forming part of Letters Patent No. 202,352, dated April 16, 1878; application filed May 7, 1877.

*To all whom it may concern:*

Be it known that I, WILLIAM J. KEEFE, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improved Machine for the Manufacture of Paper Boxes from Pulp, of which the following is a specification:

This invention relates to mechanism by which to manufacture paper boxes and other hollow articles from pulp.

The invention consists in the combination of a contractile former or holder to sustain the interior of the box with expansible encircling dies to compress and shape the article of pulp, and to permit its easy removal from the former; also, in the combination, with a collapsible former or holder to sustain the paper-pulp article, of an encircling diaphragm, of india-rubber, to press the outside of the paper-pulp article; also, in a former or holder made of pervious sections, fitted together and guided by a wedge-shaped core, the former being adapted to enter and sustain the interior of the box, whereby the diameter of the former or holder may be changed in order to permit the application or removal of a box or other hollow article; also, in the combination, with each other, of four outside dies, having their faces concaved and their edges adapted to come in contact with each other, beveled so that as the dies are contracted or expanded the beveled edges are kept in contact, to prevent the passage of pulp between adjacent dies; also, in the combination, with an interior former or holder, of a set of outside dies, having their concaved faces perforated, the pervious surfaces of the dies being adapted to press directly upon the outside of the article of paper-pulp.

Figure 1 represents a plan view of a paper-box-making machine, with the plunger removed and the outside dies expanded; Fig. 2, a section taken through the former or holder and the dies on the line *x x*, Fig. 1; Fig. 3, an enlarged section of the former or holder and the wedge-shaped core to change the diameter of the former or holder; Fig. 4, a modification thereof, showing, in full lines, the former and core as adapted to make a flat-bottomed box, as usual, and representing, in dotted lines, how the shape of the former and core may be changed to

make a box with a concaved bottom, viewing it from the outside. Fig. 5 represents the face of one section of a former, showing a double wire-gauze covering of two different meshes. Fig. 6 represents the manner of connecting the sections *f h* with those *e g*, as will be hereinafter described. Fig. 7 represents, in plan, a cam-ring, to press the outside dies toward the paper article.

In the manufacture of hollow paper articles I have found that a high column of water containing but little pulp, as described in United States Patent No. 84,835, F. Leclere, operates best to form such articles evenly as to thickness and texture, making them of uniform strength. In the Leclere process the pulp is deposited upon the former, as in the ordinary process of paper-making, and the fibers are interlaced, making a paper article much superior as to strength than if formed by molding or pressing a thick mass of pulp upon a former.

In the practice of this my invention I prefer to employ the method described by Leclere in the formation of the hollow articles; but, instead of employing a former shaped as shown in his patent, I shall use a former as described in this present application.

A series of these pulp-containing cylinders, such as shown by Leclere, will be arranged upon a rotating-table or platform, and be supplied with thin pulp. The formers will be placed within such cylinders, so that the pulp, as the water is caused to pass down through the formers, will coat or cover them with pulp articles corresponding in shape with the formers. After this the formers may be lowered from the cylinders, and the table or former-carrier may then be moved and the former be placed between the outside dies *a b c d*, as shown in Fig. 1; or the partially-formed hollow article may be removed from the former by suitable tongs, and be placed upon another former situated within the outside dies.

In this figure the former or die, which now becomes a holder, is shown as made of pervious sections *e f g h*, adapted to be connected with, and so as to be changed in diameter through the agency of, a wedge-shaped core, *i*, preferably perforated for the flow of water therethrough. Each section *e g* is provided with a projection, 2, to fit a groove in the core

*i*, and each section *f h* is provided with a dovetailed projection, *3*, to fit a correspondingly-shaped groove in such core. The sections *g e* are also dovetailed with each edge of the sections *f h*, as shown in Fig. 6.

In the form of my invention shown in Figs. 1, 2, and 3, the sections *f h* are made movable longitudinally with relation to the core *i* by means of rods *j*, connected with a movable collar, *k*, raised and lowered at proper intervals by any suitable devices. As the sections *f h* are raised, they being connected with sections *e g*, as shown in Fig. 6, they elevate such sections with them; and as the sections *f h* are moved over the wedged core *i* the latter acts to draw such sections toward the smaller diameter of the core, and so contract the holder or former, making it of smaller diameter than when the pulp was deposited thereon, so that at the proper time, this former or holder being contracted, the hollow article may be readily removed.

When the former is brought to the position shown in Fig. 1, the plunger *l*, raised automatically by suitable devices, is lowered until it meets the plane of movement of the top of the outside dies. The plunger, in its descent to such position, presses the bottom of the box on the top of the former, and then the outside dies are moved toward the outside of the box or hollow article, to press its sides or periphery between the former or holder and the dies.

The water expressed from the pulp will flow principally through the perforations in the sections *e f g h*, they being pervious on their convex faces and tops, and through suitable perforations in the core.

The outside dies may be closed by the action of cams *m* on a cam-ring, *n*, (shown in Fig. 7,) or by any other suitable devices. In this Fig. 7 the cam-ring is moved by a worm, *o*. The outside dies and the sections of the former or holder during their movements, both of contraction and expansion, owing to their inclined faces being in contact, keep tight joints, and prevent the passage of pulp between adjacent dies or sections. The angle of the faces will preferably be at about forty-five degrees.

When the box has been pressed upon the holder or former, as just described, the outside dies are expanded and the holder contracted in diameter, and the box or hollow article may then be removed therefrom, preferably by forceps adapted to engage the article to be removed. Forceps suitable for this use will form the subject-matter of another application. If desired, the core *i* may be moved longitudinally to control the sections of the former or holder.

For boxes wherein it is desired to form the periphery without seam, (the latter being formed when the outside dies meet,) I apply to the dies a tubular rubber diaphragm, *r*, it, in this instance, being held between the plates *s t*, that are attached by suitable screws to the top and bottom of the dies *a b c d*. This dia-

phragm will preferably be provided with flanges to enter between these plates and dies. This diaphragm is shown by heavy black lines, Fig. 2. If desired, this diaphragm may be expanded, so as to fit closely against the outside of the box or article, by means of hydraulic pressure. In such case the inclined faces of the dies will be provided with an india-rubber or suitable packing, of a thickness proportionate to the movement of expansion of the diaphragm, and the dies will then be contracted so that their inclined packed faces will be held substantially water-tight, so as to hold water, as would be the case were the dies made in one piece. Water admitted through the passages *u* and the perforations *p* would expand such diaphragm, so that the interior thereof would press closely against the outside of the box.

By employing two thicknesses of wire-gauze of different mesh, the coarser-meshed wire *a*<sup>2</sup>, nearest the former, forms a proper base for the finer wire-gauze *b*<sup>2</sup>, which comes directly against the paper. This gauze is applied in pieces, so as to have joints corresponding with the lines of division between the sections of the former. The gauze, being attached to the former, serves as the foundation upon which the pulp is deposited.

The boxes or the hollow articles made on the machine, as so far described, are removed therefrom, to be dried and finished by inside pressure, substantially as in United States Patent No. 89,433.

In finishing an article by internal pressure its diameter is somewhat enlarged. To permit this enlargement, I propose to so form the bottom of the box that a diametrical line following the bottom will be longer than a diametrical line through the center of the box from side to side, which construction permits the cylindrical portion of the box to expand under pressure, the bottom assuming a position substantially at right angles to the sides of the box without breaking the bottom from the body. This increased diameter of the bottom may be produced by making the former or holder either concaved at top, as shown in Figs. 1 and 3, or it may be convexed, as shown in dotted lines, Fig. 4.

I am aware that collapsible dies are old in many branches of the arts; but I am not aware that a contractile sectional former, holder, or die has ever been used upon which to deposit or form any article directly from paper-pulp, and in which the sections of the former could then be contracted to permit the removal of the box.

When the pulp article is being pressed, and is fully shut into the space between the dies, the water does not all leave the inside of the article being pressed, because there is no opportunity for the admission of air to the interior of the former. Now, to remove the water from the spaces or passages in the former, a pipe, *a*<sup>1</sup>, joined to the lower end of the core, is connected with a suitable suction-pump or vacuum apparatus, not necessary to be shown.

The water-ways 4 lead through the core and intersect with water-passages in communication with the sections of the holder or former.

In some instances the sectional holder may be expanded to compress a box placed therein when collapsed.

The pulp may be made of any pulpable material, and may, if desired, have animal fiber mixed with it.

I claim—

1. A former or holder composed of radially-movable sections adapted to sustain a hollow article made from paper-pulp, in combination with a series of surrounding movable dies, to permit the article of pulp to be compressed and to be removed from the former, substantially as described.

2. A contractile former or holder to sustain a hollow article formed of paper-pulp, in combination with encircling dies and a cylindrical india-rubber diaphragm, to operate substantially as described.

3. The pervious sections *e f g h*, fitted together and to a wedge-shaped core, whereby the diameter of the former or holder may be changed to permit the removal or application of a box or other hollow article, substantially as described.

4. The combination, in a machine for making hollow articles from paper-pulp, of dies having their faces curved and the edges in contact with each other, beveled so that as the

dies are contracted or expanded such beveled edges are kept in contact to prevent the passage of pulp between the adjacent dies.

5. A sectional former or holder and a core to expand and contract it, in combination with a pipe to be connected with a suction-pump or apparatus to withdraw the water from the interior of the holder after compressing the pulp article, substantially as described.

6. A sectional interior perforated die having a pervious covering, in combination with mechanism to expand the die-sections radially to press a hollow article of paper-pulp against an outside surface surrounding the outer portion of the hollow article.

7. An interior die composed of sections having their contiguous faces beveled to maintain contact between the sections as they are moved radially to change the diameter of the die.

8. In the manufacture of paper boxes from pulp, forming the bottom of the box bulging, and subsequently pressing and expanding the same, the bulged bottom permitting the expansion of the sides outward, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM J. KEEFE.

Witnesses:

G. W. GREGORY,  
JNO. D. PATTEN.