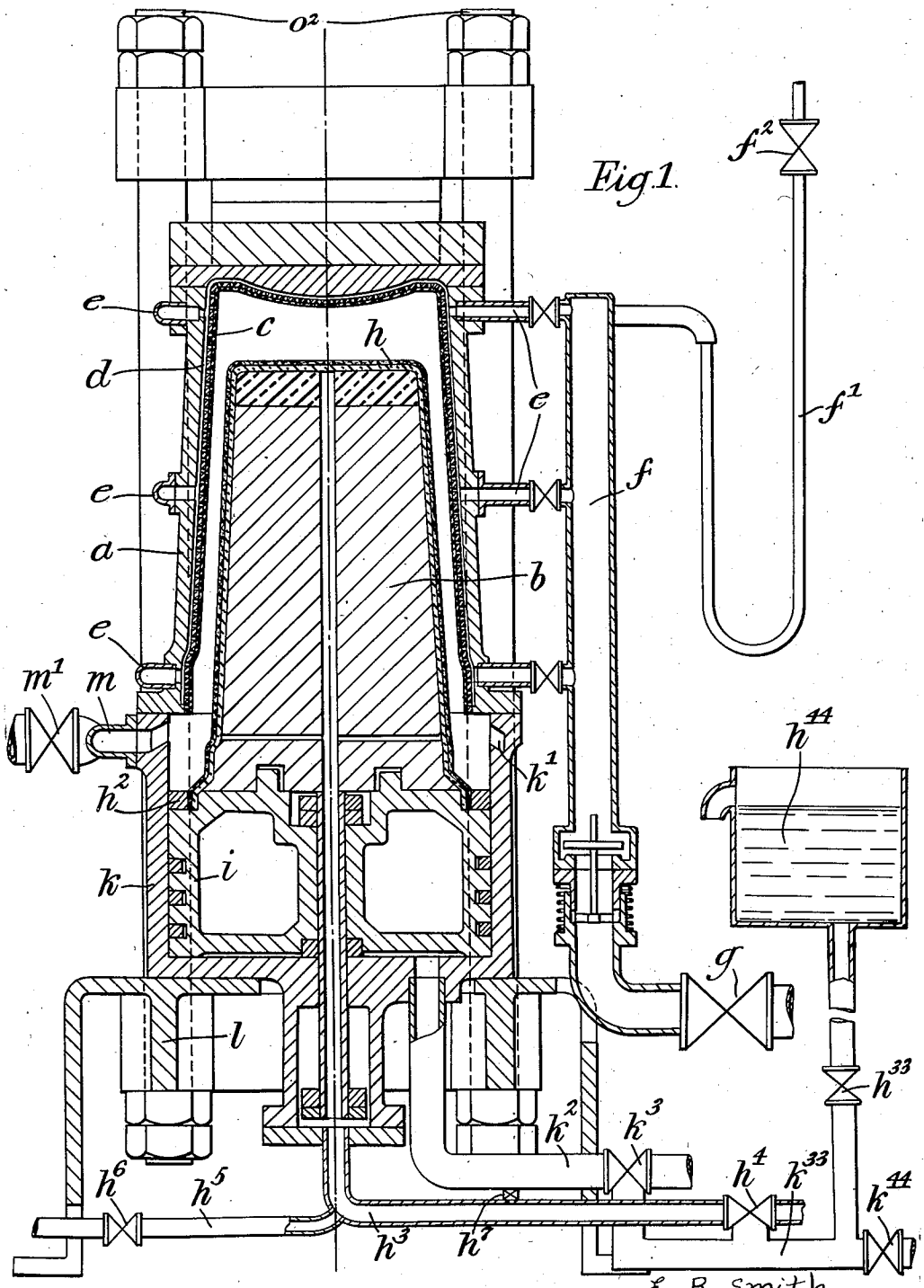
Jan. 25, 1938. E. R. SMITH 2,106,440

APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Original Filed May 3, 1934 6 Sheets-Sheet 1

Fig. 1.



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Original Filed May 3, 1934 6 Sheets-Sheet 2

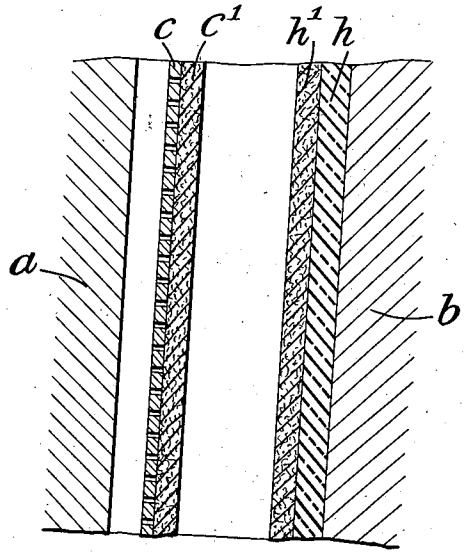


Fig. 2.

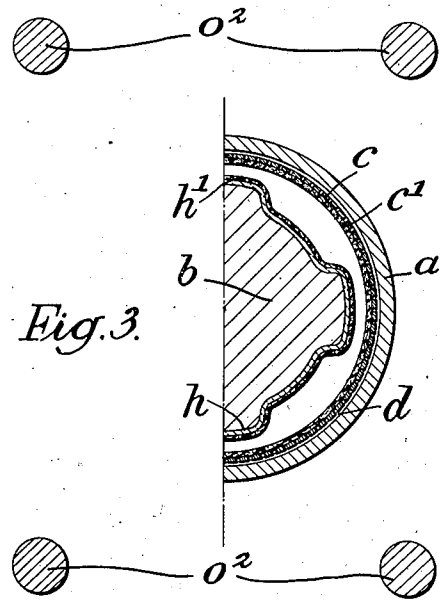


Fig. 3.

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APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Original Filed May 3, 1934 6 Sheets-Sheet 3

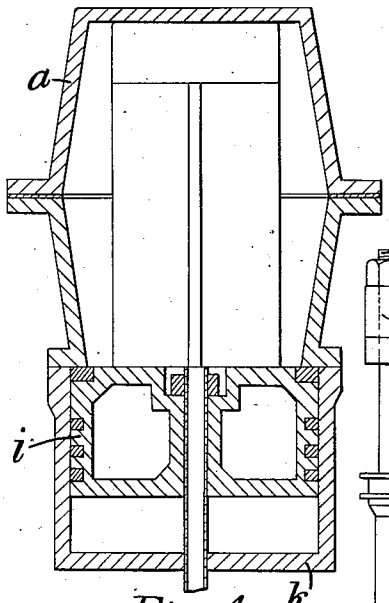


Fig. 4.

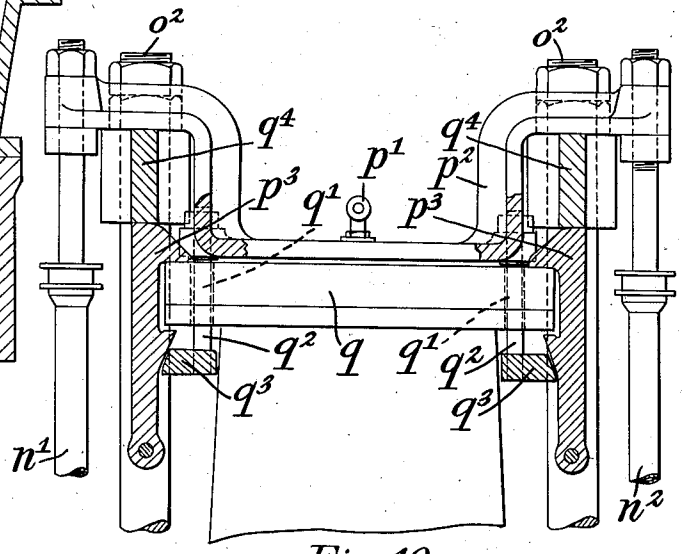


Fig. 10.

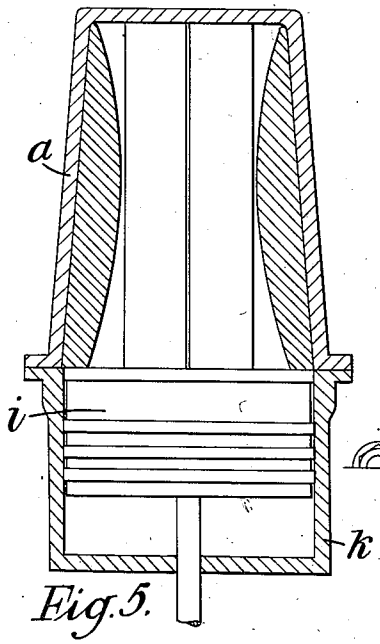


Fig. 5.

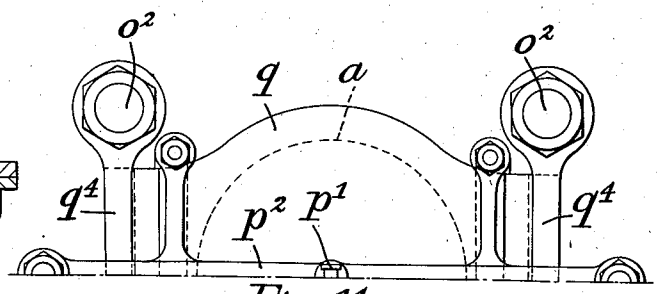


Fig. 11.

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Jan. 25, 1938. E. R. SMITH 2,106,440

APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Original Filed May 3, 1934 6 Sheets-Sheet 4

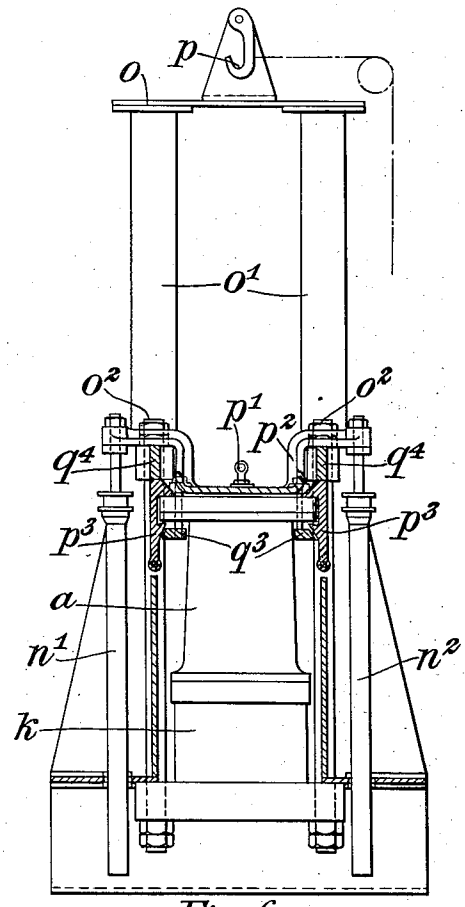


Fig. 6.

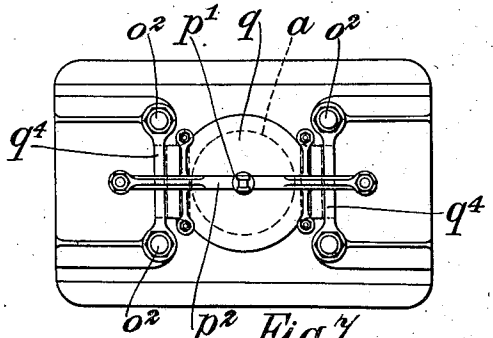


Fig. 7.

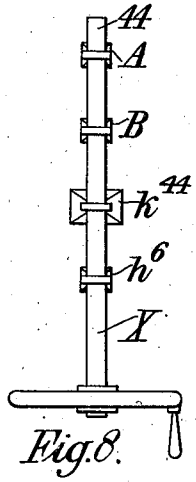


Fig. 8.

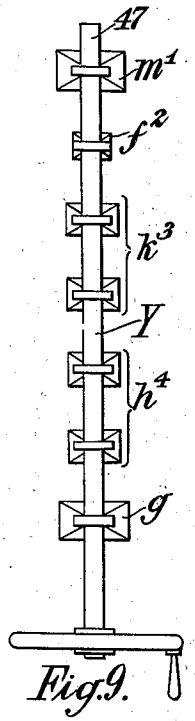


Fig. 9.

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APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Original Filed May 3, 1934 6 Sheets-Sheet 5

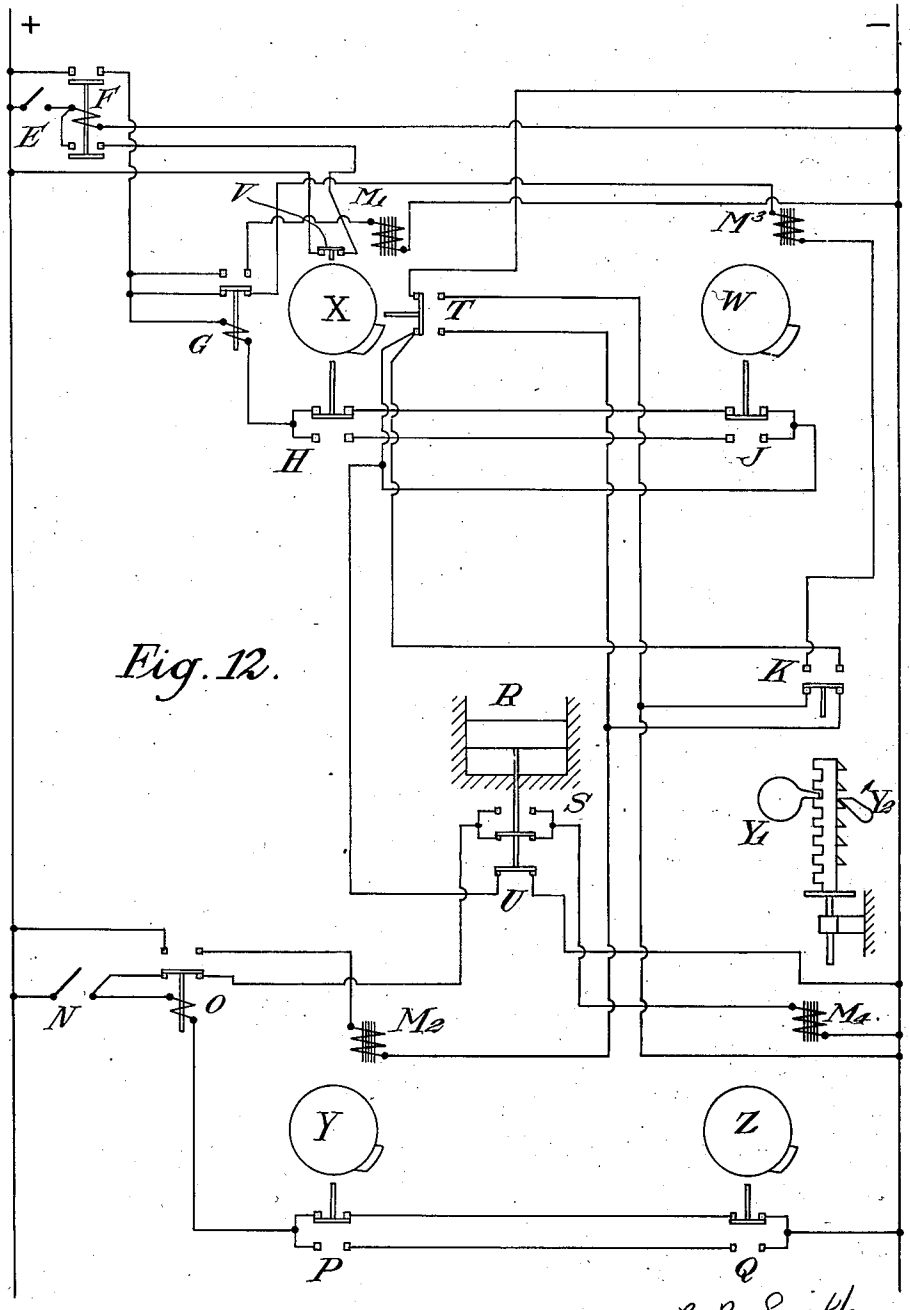


Fig. 12.

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APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Original Filed May 3, 1934 6 Sheets-Sheet 6

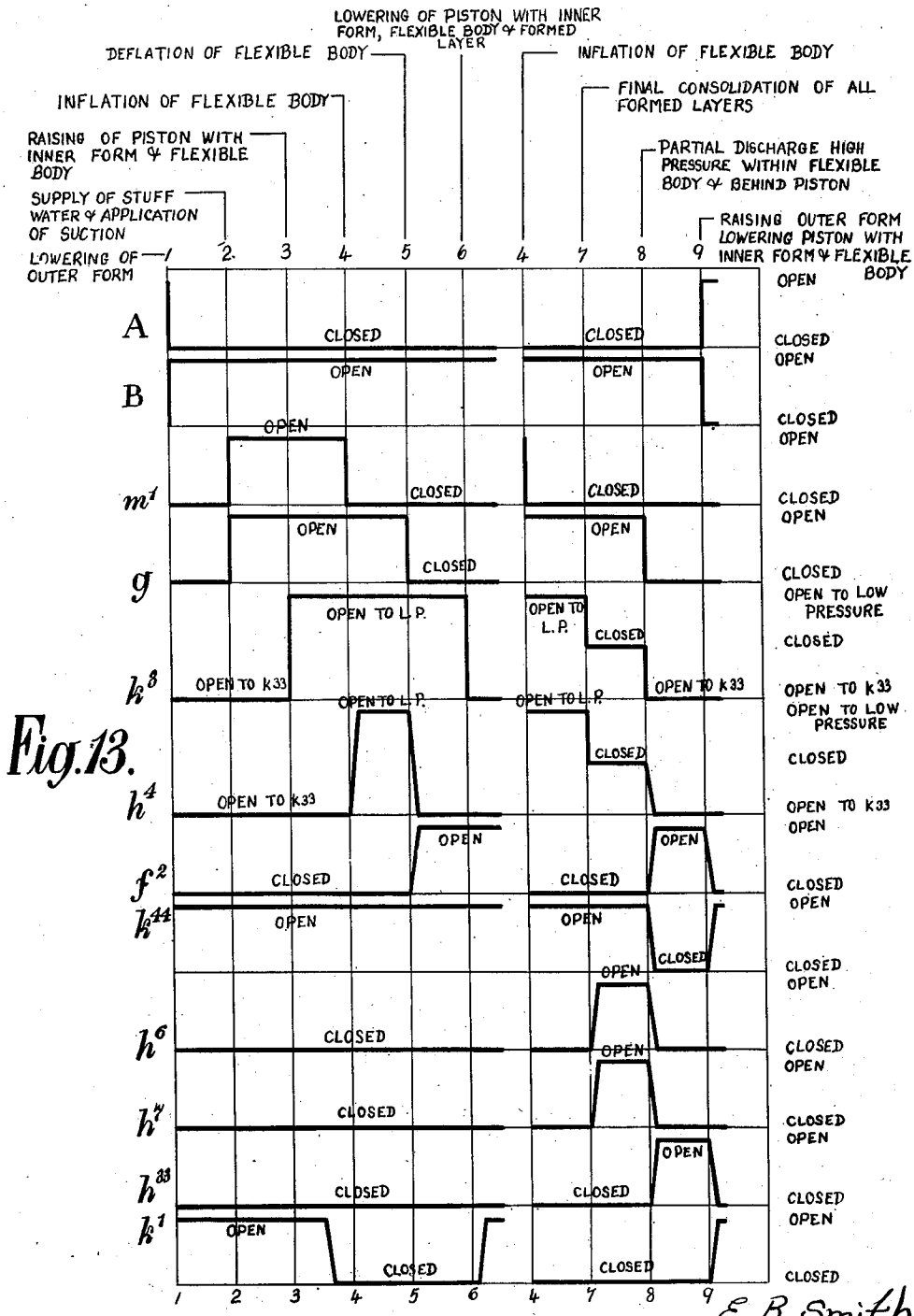


Fig. 13.

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Patented Jan. 25, 1938 2,106,440

UNITED STATES PATENT OFFICE

2,106,440

APPARATUS FOR THE FORMING OF THICK PAPER ARTICLES, SUCH AS BARRELS, TUBS, PLATES, AND THE LIKE

Ewen Ross Smith, Penig in Saxony, Germany

Application May 3, 1934, Serial No. 723,774. Renewed December 18, 1937. In Great Britain May 5, 1933

9 Claims. (Cl. 92—60)

This invention relates to the forming of thick paper articles such as barrels, tubs, plates and the like, and has for its object to devise a simple and efficient method and apparatus by which such articles may be made of the requisite thickness.

The present invention consists in a method of producing articles from paper pulp by sucking a layer of pulp from stuff water on to a sieve and couching, characterized by the feature that the couching is effected by a flexible body to which the formed layer of material is transferred and by which the said layer is removed from the sieve.

The invention also consists in a method according to the preceding paragraph wherein a further layer is formed upon the sieve by suction and couched onto the previously formed layer transferred onto the flexible body, the process being repeated until the last layer required to make up the total desired thickness has been formed, whereupon all the layers are further united by pressing.

The present invention also consists in a method of producing articles from paper pulp comprising forming a felted layer of fibrous material from stuff water by suction onto a sieve having the form of the article to be produced, subjecting the formed layer to pressure by means of a flexible body whereby the formed layer is consolidated and transferred to the flexible body, removing the flexible body and formed layer from the vicinity of the sieve, forming a further felted layer of fibrous material on the sieve, subjecting said further formed layer to pressure by means of said flexible body whereby said layer is consolidated and transferred to the previously formed layer on the flexible body, repeating the process until the last layer required to make up the desired total thickness of the article is formed on the sieve, subjecting said layer to high pressure by means of the flexible body whereby said layer is consolidated and transferred to the last previously formed layer on the flexible body and whereby all said layers are consolidated together, and removing the article from the flexible body.

The invention also consists in apparatus for carrying out the method according to the preceding paragraphs, comprising an outer form having an inner wall of sieve-like construction on to which paper pulp is deposited by suction and an inner form spaced apart from and movable in relation to the outer form and having a flexible body thereon with means for admitting pressure medium between said inner form and said flexible body.

The invention still further consists in apparatus for carrying out the method according to the above paragraphs comprising two spaced forms to the space between which the stuff water is admitted to have the paper pulp withdrawn therefrom by suction, and a flexible body forming a movable wall of said space, wherein the flexible body is connected with a piston movable in a cylinder upon which is mounted the form in or on which the layer of pulp is formed and couched.

The accompanying drawings illustrate one mode of carrying out the invention.

Figure 1 is a sectional elevation of one convenient form of apparatus in accordance with the invention.

Figure 2 is a view of a part of Figure 1 on an enlarged scale.

Figure 3 is a cross sectional view of a part of Figure 1.

Figures 4 and 5 are views illustrating modifications of a part shown in Figure 1.

Figure 6 is a view of the apparatus on a somewhat smaller scale and showing means for raising and lowering the apparatus in operation as hereinafter explained.

Figure 7 is a plan of Figure 6.

Figures 8 and 9 are views showing valve and cam mechanism hereinafter referred to.

Figure 10 is a view on a larger scale of parts shown in Figure 6.

Figure 11 is a half plan of Figure 10.

Figure 12 is a diagram of electrical connections that may be employed for the automatic operation of apparatus in accordance with the invention, and

Figure 13 is a machine operation diagram setting out the disposition of the various valves at successive stages in the cycle of operations of the machine.

In carrying my invention into effect in one convenient manner I form my improved apparatus with outer and inner forms *a*, *b* of a size and shape to suit the size and shape of the article to be formed thereby.

The outer form is provided with an inner wall *c* of wire gauze, felt, perforated metal, or other like material and the outer encasing shell is of sufficient strength to resist the high pressure used while grooves or ridges are formed upon the outer shell, or other suitable arrangements are provided to enable the inner sieve wall *c* to be spaced somewhat apart from the outer

shell, and the space d so formed is connected to a container and suction pump as commonly used in paper-making through the pipes e, f and valve g.

When the nature of the article to be manufactured permits the outer form a may be in one piece as shown in Figure 1 but when necessary or desirable it may be divided in any manner suitable for the removal of the article. Two examples of such divided forms being shown in Figures 4 and 5, the former illustrating a sieve form divided horizontally in which only the upper half a is raised and lowered in regular working, and the latter illustrating a form in which an inner mantle a' is divided vertically and held together by an outer conical mantle a. The core of the inner form b may be of wood or other suitable material approximating to the shape of the article to be manufactured but somewhat smaller in dimensions. It is conveniently formed as shown in Figure 3 with a waved, corrugated, grooved or similar surface and accommodates a water- and air-tight flexible bag h which should be flexible but not elastic and should fit perfectly when inflated against the inner side of the outer form a; for example, the bag h may be made of rubber and canvas insertion and covered upon the outside with wool paper-maker's felt h^1. The inner form is carried upon a piston i, to which the bag h may be jointed by means of a suitable ring h^2 and the piston operates within a cylinder k carried upon a substantial base or foundation l with which the apparatus is provided.

At the upper part of the wall of the cylinder k is an annular passage or chamber k^1 connected through a pipe m and valve m^1 and non-return valve (not shown) with a supply of paper-maker's stuff water which consists of a thin suspension of fibrous, filling, and sizing materials with a consistency of, usually 1 per cent. solids and 99 per cent. water. The cylinder k below the piston i is connected to a low pressure water supply by means of the pipe k^2 and valve k^3, and the space between the bag h and the core of the inner form is similarly connected to a low pressure supply by a pipe h^3 and valve h^4 while the cylinder and space within the bag are connected to a high pressure water supply by the pipe h^5 and valve h^6 and non-return valve h^7. Alternatively, air pressure may be used in place of the low pressure water. The outer form is adapted to be raised for the purpose of withdrawal of the finally manufactured article and such raising and lowering may be effected by means of a winch or by a screw or other mechanical means or by hydraulic means or otherwise.

In the particular form illustrated in the drawings the raising and lowering of the outer form is effected by means of hydraulic rams n^1, n^2 (Figures 6 and 10) and within a frame consisting of a top cross-bar o (Figure 6) and side-pieces or guides o^1 secured to the heavy base member l. The guides o^1 preferably comprise distance pieces disposed about extensions of bolts o^2 (Figure 1).

The form is adapted to be temporarily suspended in its upper position by means of a hook p adapted to be engaged automatically with an eye p^1 secured to a saddle p^2 by means of which the lifting of the form by the hydraulic rams n^1, n^2 is accomplished, and the form in its lowermost position is adapted to be locked by suitable means. Thus in the particular construction illustrated I provide a pair of locking plates p^3 pivotally mounted in the side members of the fixed frame and if necessary controlled by suitable springs not shown. The outer form is bolted to a girder plate q. Four bolts q^2 are suspended from the saddle p^2 and are provided with two lifting plates q^3 one for each locking plate p^3. The arrangement is such that normally when in its lowermost position the form is locked in such a position by means of the locking plates p^3. When the saddle piece p^2 is raised by the lifting rams the lifting plates q^3 first operate as cams to disengage the locking plates p^3 from the girder q by causing them to swing about their pivots and then further upward movement of the saddle p^2 causes the lifting plates q^3 to engage the girder member q by means of which the form is raised and when in its uppermost position is temporarily secured in such position by the hook p and eye p^1 as above referred to.

The locking plates p^3 when in their locking position are held against the heavy hydraulic pressure (which is applied in the final stages of manufacture as hereinafter referred to) by means of the beams q^4 which are fixed to the heavy base l (which carries the cylinder k) by means of four bolts o^2.

The three-way valves k^3 and h^4 are connected to a common outlet pipe k^{33} controlled by a valve k^{44}, and the pipe k^{33} is connected through a non-return valve h^{33} to a constant head tank h^{44}. An air pipe f^1 controlled by a valve f^2 is provided for admitting air to the suction pipe f as hereinafter referred to.

The mode of operation of the apparatus is as follows (it being assumed that the parts are in the position which they occupy when a finished article has been removed from the apparatus, that is, with the outer form suspended from the hook p):— The form is released from the hook and lowered until it is locked to the base by the locking arrangement above described. The stuff water valve m^1 and the suction valve g are opened so that the stuff water enters through the passage k^1 and fills the space between the inner and outer forms and is drawn through the sieve c leaving on the sieve a layer of felted fibrous material. If the fibrous material has been sufficiently beaten and prepared so that the fibres are exceedingly flexible and the cellulose partly hydrated the layer is so dense that a thin layer is practically watertight allowing little more water through and thus limiting the thickness of the layer which it is possible to form, it being the object of the process to obtain such a density with its resulting strength while at the same time forming a wall of the desired total thickness by building the necessary number of layers.

On the formation of the layer (shown at c^1 in Figure 2) which is regulated in practice by varying the time for which the stuff is admitted and which varies according to the consistency and condition of the stuff but is constant for any particular stuff, water at a pressure of 4 to 5 atmospheres is admitted by the valve k^3 to the under side of the piston i so raising the inner form to the position shown in the right-hand part of Figure 1 and cutting off the inflow of stuff water from the channel k^1. Water is then admitted through the valve h^4 to the inside of the bag h thus inflating it and pressing the bag against the formed layer c^1 to express part of the remaining water therefrom and consolidate the layer. The suction valve g is then closed

and air is admitted to the suction pipe f by operation of the inlet valve f^2. The water is then exhausted, first, from the bag through the valve h^4 and valve k^{44} causing the bag to collapse against the core of the inner form and bringing with it the formed layer c^1. Thereafter water is exhausted from beneath the piston i through the valve k^3 and the common valve k^{44} causing the piston, bag, core and formed layer to sink to the position shown in the left-hand part of Figure 1. The transfer of a formed layer of felted fibrous material from a sieve to another surface by pressure is known as "couching" and is so referred to in the claims. The air valve f^2 is now closed and the suction valve g is opened so that stuff water again flows through the channel k^1 and a second layer is formed as before and is subsequently removed upon the inner form, the process being repeated until the last layer required to make up the total desired thickness has been formed.

The piston with the core and bag and the previously formed layers is then raised as before and the bag inflated with the low pressure water. Thereupon the valve h^6 is opened to admit high pressure water to the bag and also to the underside of the piston via non-return valve h^7 and the pressure is maintained for sufficient time to consolidate the material and the layers together and to express as much as possible of the remaining water therefrom. When the manufactured article is sufficiently pressed the high pressure valve h^6 and the suction valve g are closed and at the same time the valve k^{44} on the common outlet pipe k^{33} is closed and the valves k^3 and h^4 are closed against the pressure supply and opened to the common exhaust pipe k^{33} whereby the cylinder and bag are exhausted through the non-return valve h^{33} to the constant head tank h^{44}. The pressure in the cylinder and bag maintained by the constant head is just sufficient to maintain the piston i in its upper position and the bag inflated. The inlet valve f^2 is opened to release the manufactured article from the sieve and the outer form is unlocked and raised until it engages in the hook p. As soon as the outer form is clear of the inner form the valve k^{44} is opened so that the bag deflates and the piston sinks whereupon the manufactured article can be removed.

It will be clear that the operation of the various valves may be effected separately by hand or the valves may be operated in their proper sequence by means of cams, or the operation may be performed entirely automatically and either electrically, mechanically or pneumatically. For example, Figures 8 and 9 show an arrangement of cam-operating gear which may be employed in accordance with the invention. For this purpose the various valves are brought together in one or more rows associated with appropriate cams mounted upon shafts which may be hand-operated or power-operated as desired, the valves being so located and the cams so designed that the valves are operated in the proper sequence. Thus, Figure 8 shows the valves h^6 and r^{44} and inlet valve A and outlet B for the hydraulic rams n^1, n^2.

At the commencement of an operation when the hook p is released (the release being effected by hand or automatically) the shaft X is turned by means of the hand-wheel to its first position where the inlet valve A closes and the outlet valve B opens. The outlet valve is retained open during a complete turn of the shaft X until it again reaches the zero position when the outlet valve closes and the inlet valve is opened.

When the outer form has been locked to the cylinder k the shaft Y is then turned through its successive positions to operate the various valves in the required sequence and for the required time until the last layer has been sieved and pressed. Thereupon the cam shaft X is turned to its second position to open the high pressure valve h^6, and at the end of the pressing period the shaft X is turned to a third position allowing the high pressure valve h^6 to close and the common exhaust valve k^{44} to close.

The shaft Y is then turned to successive positions to effect the operations subsequent to the pressing of the manufactured article, and finally the shaft X is turned to a fourth or zero position closing the outlet valve B and opening the inlet valve A and common exhaust valve k^{44}.

For the automatic working the hand-wheels upon the cam shafts may be replaced by electromagnetically operated ratchet wheels and pawls or clutches driven through suitable reduction gearing by a variable speed electric motor and Figure 12 illustrates a convenient form of electrical circuit which may be employed. In this figure X and Y are the cam shafts and W and Z are timing shafts, W being associated with X and Z with Y, and the respective shafts being rotated when the electromagnets M^1, M^2, M^3 and M^4 are energized. The releasing of the hook p closes a switch E which closes the magnetic switch F which remains closed (whether the switch E is subsequently open or not) so long as its magnetic circuit is not interrupted and which operates a relay G through the two switches H and J (which are both in the upper position) and through switch S or T. The relay G sets the shaft X in motion through the electromagnet M^1 but the timing shaft W remains stationary since the electromagnet M^3 is cut out by the relay G.

In the first position of the shaft X the switch H is depressed opening the upper and closing the lower shunt in the circuit controlling the relay G which thus returns to the lower position, de-energizing the electromagnet M^1 and bringing shaft X to rest while at the same time the circuit of electromagnet M^3 is prepared by the relay G but is interrupted at the switch K which is closed at a later stage by a counting device hereinafter described.

The outer form a having been released from the hook p and the shaft X being in its first position the form is lowered until it is locked to the cylinder k and the locking device closes the switch N operating the relay O through switch P so that the circuit for the electromagnet M^2 is closed and that operating M^4 is broken. The cam shaft Y is thus set in motion until it reaches its first position when the switch P is moved so as to break, through the relay O, the connection through M^2 and so as to close the circuit of M^4 thus setting in motion the timing shaft Z, the speed of rotation of which is adjustable and is set to a suitable speed so that it will rotate for part of a revolution until sufficient time has elapsed for the formation of the layer when it depresses the switch Q breaking contact in the upper shunt and closing the lower shunt which has already been closed at P by the shaft Y. The relay O again operates to set the shaft Y again in motion and when the shaft reaches its second position the switch P again operates to switch out M^2 and stop the shaft.

The cylinder *k* and piston *l* of Figure 1 are represented diagrammatically at R in Figure 12 and the movements of the piston are arranged to control a switch S so that on the piston commencing to rise the operating circuit through M^4 is broken when otherwise it is closed by the relay O and both shafts Y and Z remain at rest until the contact switch S is brought to the upper position when the circuit through M^4 is again closed and the shaft Z turns so as to raise the switch Q, re-establishing the current through O and thus stopping Z and turning Y to the third position.

It is thought that the operation of the automatic control for the valves will be sufficiently clear from the foregoing without going into detail for each position of the valve controlling shafts but it remains to describe the counting device above referred to and which operates the switch K.

The counting device consists of a ratchet bar resting upon an adjustable stop and so disposed that each time the shaft Y makes a complete revolution a tooth or finger Y^1 raises the bar one tooth, the bar being retained in its new position by the pawl Y^2.

The adjustable stop supporting the bar is raised or lowered according to the number of layers required so that when the necessary number of turns of the shaft Y has been made the switch K is raised. The shaft X on its return to the zero position trips the pawl Y^2 and allows the ratchet to drop to the stop and the switch K to fall. When the final layer has been formed the tooth or finger Y^1 of the timing device is so set in relation to the shaft Y that the switch K is raised with the arrival of shaft Y in the third position. The timing shaft W now rotates until the switch J is depressed completing the circuit through H of the relay G which stops the timing shaft W and turns X through the electromagnet M^1 to the second position. When the shaft X turns to the third position the switch H remains in the upper position and the switch T is raised by the shaft X closing the controlling circuit to M^2 previously opened by the switch K. The switches P and Q are in the lower position when T is raised, and shaft Y now turns to the fourth position in which pressure is released from the cylinder allowing the piston to fall and the switch S interrupts the current through M^4 until the piston reaches its lowest position when the current is again re-established causing Z to turn further and raise the switch Q whereupon Y turns to the zero position. At the same time that the contact is remade at S the switch U is also closed and re-establishes the circuit operating M^1 and M^3 so that X moves to the zero position, both switches H and J remaining in the upper position and T falling to the lower position. When X moves to the zero position the contact V is opened momentarily and reclosed thus interrupting the current through the magnetic switch F and, E being open, F interrupts all circuits controlling X and W which remain at rest in the zero position. It also unlocks and raises the outer form as above described and opens the switch N cutting off the current from Y and Z so that they also remain in the zero position. At the same time the pawl Y^2 upon the counting device is tripped allowing the ratchet to fall to its stop and the switch K to the lower position ready for the next cycle.

The shafts W and Z are timing shafts, W determining the pressing time and Z the sieving time, the former being, say, from 20 to 60 seconds and the latter from 5 to 20 seconds, while the dewatering time for a single layer may be from 2 to 10 seconds, it being understood however that these times are given only by way of example and may be varied for different articles and each of which may be separately adjustable.

W and Z are mechanically adjustable through separate variable speed gear, where a rotor drive is employed, and the contacts on the drums may also be adjustable as to their spacing.

Moreover the speed of the motor may be adjusted at the commencement of each time operation.

It will be understood that the invention extends broadly to the method of operation pointed out in the appended claims and is therefore not to be limited to the details of construction hereinbefore given by way of illustration and which may be varied to suit the particular type or shape of article that is being formed, the nature of the material from which it is formed, or any practical requirements that may have to be fulfilled.

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

1. A method of producing articles from paper pulp comprising forming a felted layer of fibrous material from stuff water by suction on to a sieve having the form of the article to be produced, subjecting the formed layer to pressure by means of a flexible and inflatable couching body whereby the formed layer is consolidated and transferred to the flexible body, removing the flexible body and formed layer from the vicinity of the sieve, forming a further felted layer of fibrous material on the sieve, subjecting said further formed layer to pressure by means of said flexible body whereby said layer is consolidated and transferred to the previously formed layer on the flexible body, repeating the process until the last layer required to make up the desired total thickness of the article is formed on the sieve and couched, subjecting said layer to high pressure by inflating the flexible body whereby all said layers are consolidated together, and removing the article from the flexible body.

2. A method of producing articles from paper pulp by sucking a layer of pulp from stuff water on to a sieve and couching, wherein the couching is effected by a flexible and inflatable couch body to which the formed layer of material is transferred and by which the said layer is removed from the vicinity of the sieve, whereupon a further layer is formed upon the sieve by suction and couched on to the previously formed layer transferred on to the flexible body, the process being repeated if necessary until the last layer required to make up the total desired thickness has been formed, whereupon the layers are further united by pressing.

3. Apparatus for carrying out the herein described method, comprising in combination an outer form having an inner wall of sieve-like construction, an inner spaced form carried upon a piston working within a cylinder, valve controlled means for reciprocating said piston within said cylinder, valve controlled means for supplying stuff water to the space between said forms, valve controlled means for applying suction to said space during the time the stuff water is passing therethrough, a flexible body upon said inner form with valve controlled means for admitting pressure media between said inner form

and said flexible body, valve controlled means for moving the outer form to permit the removal of the manufactured article, and means for operating said valves first to move said outer form into operative relation with respect to the cylinder; then to supply stuff water to the space between the forms and at the same time to supply suction to the outside of the sieve wall; then, after a predetermined period of time, to admit pressure medium behind the piston to bring the forms into closer relationship; then to admit pressure medium between the flexible body and the inner form to cause the flexible body to bear against the formed layer on the sieve whereby the formed layer is consolidated and transferred to the flexible body; then to remove the suction from the outside of the sieve wall; then to discharge the pressure from between the flexible body and the inner form whereby the flexible body resumes its position on the inner form bringing with it the formed layer, then to discharge the pressure from behind the piston, whereby the latter returns to its previous position bringing with it the inner form, the flexible body and the formed layer; then to supply stuff water again to the space between the forms, and so on until the last layer required to make up the desired total thickness of the article is formed on the sieve and pressed by the flexible body; then to admit high pressure medium behind the piston and between the flexible body and the inner form whereby the last layer on the sieve is consolidated and transferred to the flexible body and whereby all the layers are consolidated together; then to partially discharge the high pressure between the flexible body and inner form and behind the piston to a predetermined value; then to remove the suction from the outside of the sieve wall; then to raise the outer form to permit the removal of the article; then to discharge the partial pressure between the flexible body and the inner form and behind the piston whereby the apparatus is restored to an initial condition.

4. Apparatus for carrying out the herein described method comprising in combination an outer form having an inner wall of sieve-like construction on to which paper pulp is deposited by suction, an inner form having a grooved surface spaced apart from and movable in relation to the outer form and having a flexible and inextensible, inflatable couching body thereon having exterior superficial dimensions corresponding with the superficial dimensions of the interior of the sieve wall, means for bringing the inner form and couching body into close proximity with the sieve wall and means for admitting pressure medium between the inner form and the couching body.

5. Apparatus for carrying out the herein described method comprising, in combination, an outer form having an inner wall of sieve-like construction, an inner spaced form carried upon a piston working within a cylinder, means including an annular channel in the wall of the cylinder for continuously supplying stuff water for a predetermined period to the space between the forms, means for applying suction to said space during the time the stuff water is passing therethrough, a flexible and inextensible, inflatable couching body upon the inner form and having exterior superficial dimensions corresponding with the superficial dimensions of the interior of the sieve wall, and means for admitting pressure medium between the inner form and the couching body.

6. Apparatus for carrying out the herein described method comprising, in combination, a base member, a hollow cylinder carried by said base member and having an annular channel in the interior wall thereof towards the upper end and communicating with the exterior of the cylinder, an upper mould member mounted upon the cylinder but adapted to be raised therefrom to permit of the removal of the manufactured article, means for securing the upper mould member to the cylinder and for securing both members to the base member, said upper mould member having an inner spaced wall of sieve-like construction; a piston operating within said cylinder, an inner form carried upon said piston and extending into said upper mould member, a flexible and inextensible, inflatable couching body enveloping said inner form and being secured to said piston, said couching body having exterior superficial dimensions corresponding with the superficial dimensions of the interior of the sieve wall, means for supplying stuff water via said annular channel to the space between the couching body and the sieve wall, means for applying suction to the space between the sieve wall and the upper mould member, means for raising the piston in the cylinder to move the inner form and couching body further into the upper form, the piston in its upward movement closing the annular channel and cutting off the supply of stuff water, and means for supplying fluid pressure between the inner form and the couching body to inflate the latter.

7. Apparatus as claimed in claim 6 wherein the inner form has a grooved surface to accommodate the folds of the couching body when deflated.

8. Apparatus as claimed in claim 6 comprising means for admitting a high pressure medium between the inner form and the couching body and behind the piston for the purpose of applying a consolidating pressure to the article being formed.

9. Apparatus as claim in claim 6 comprising means for admitting a high pressure medium between the inner form and the couching body and behind the piston for the purpose of applying a consolidating pressure to the article being formed, and means for partially discharging the high pressure from behind the piston and from between the inner form and the couching body when the upper mould is to be raised to permit the removal of the manufactured article.

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