H. L. GANTT.

PROCESSING APPARATUS.

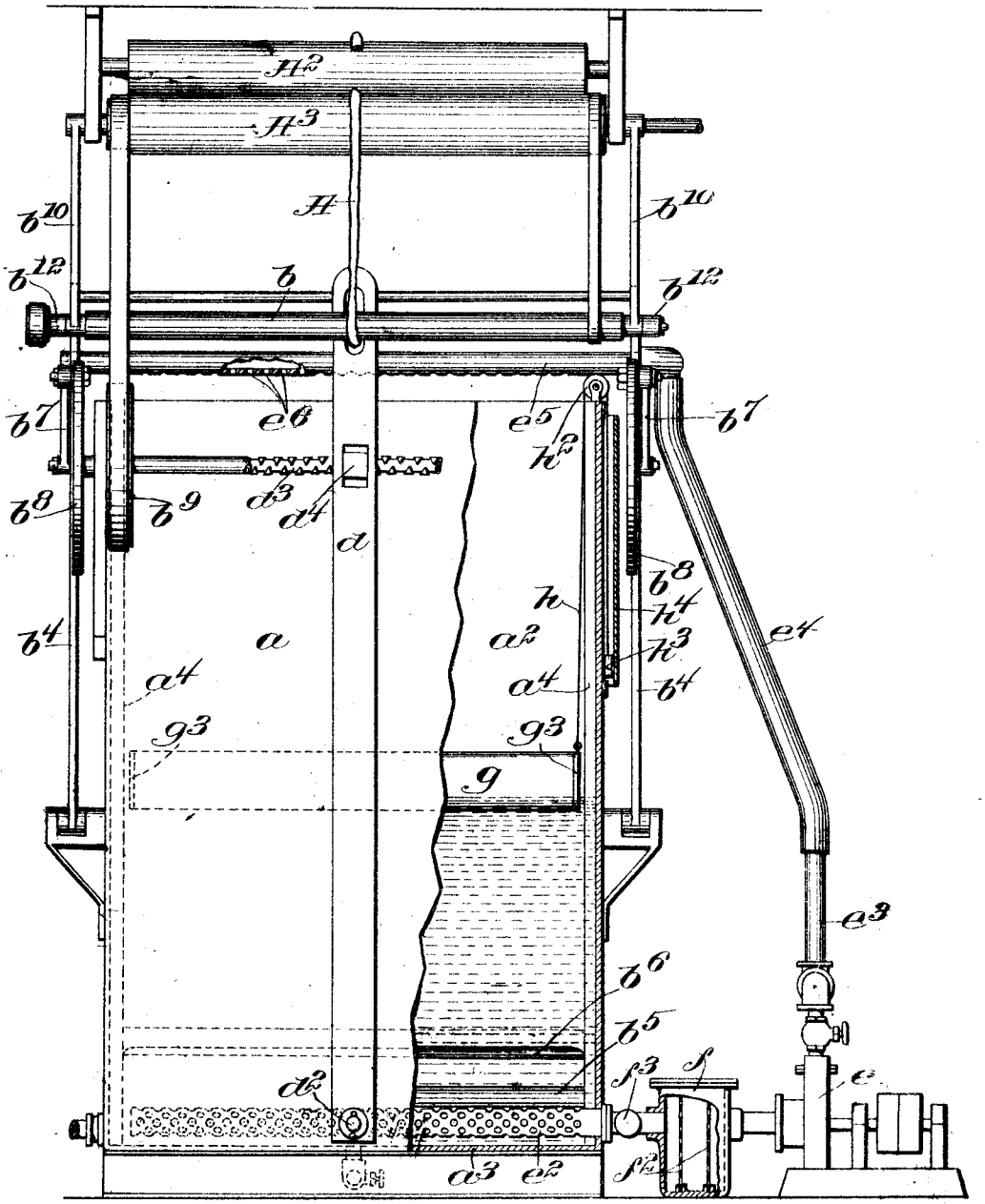
APPLICATION FILED JULY 20, 1909.

1,074,568.

Patented Sept. 30, 1913.

6 SHEETS—SHEET 1.

Fig. 1.



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PROCESSING APPARATUS.

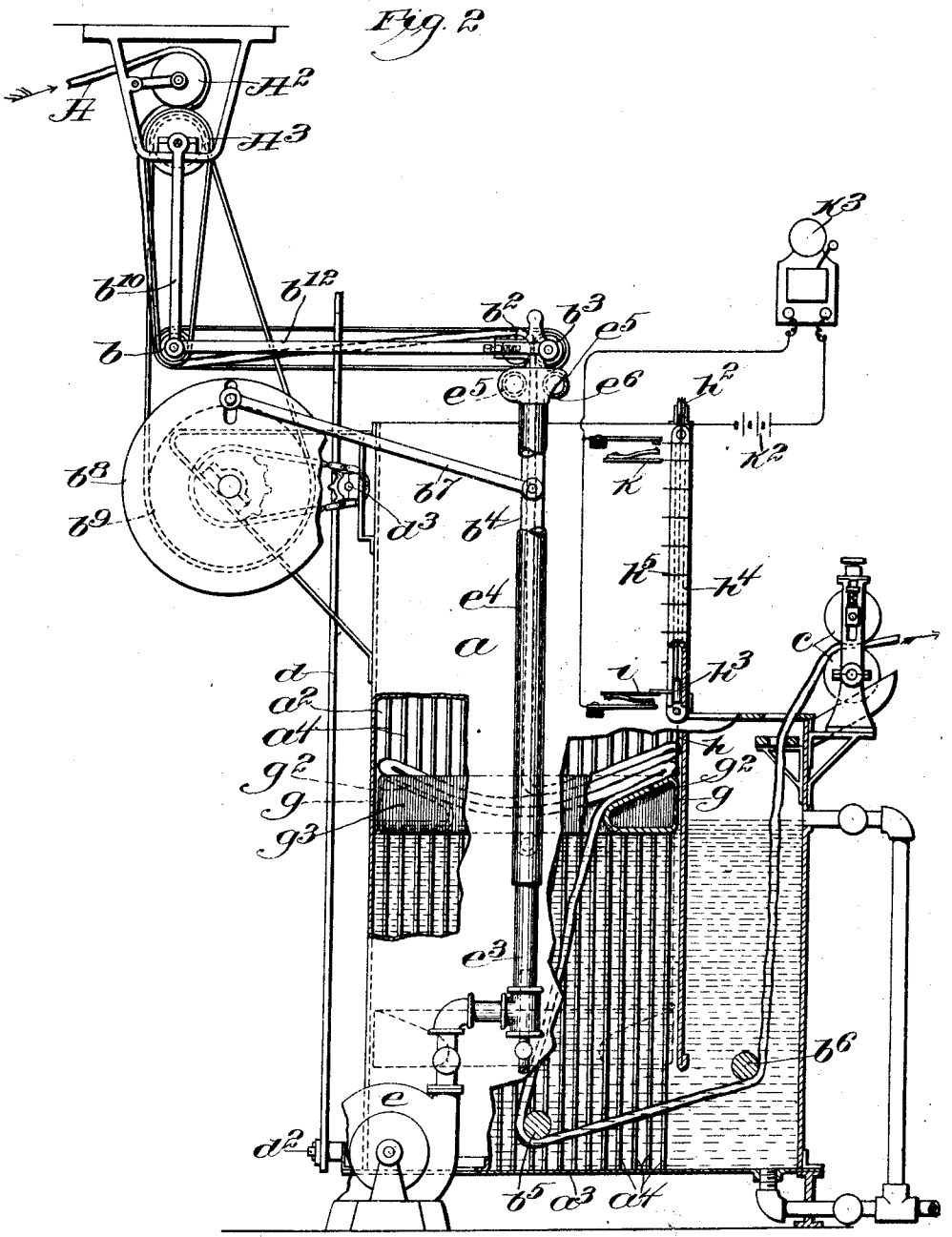
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6 SHEETS—SHEET 2.

Fig. 2.



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PROCESSING APPARATUS.

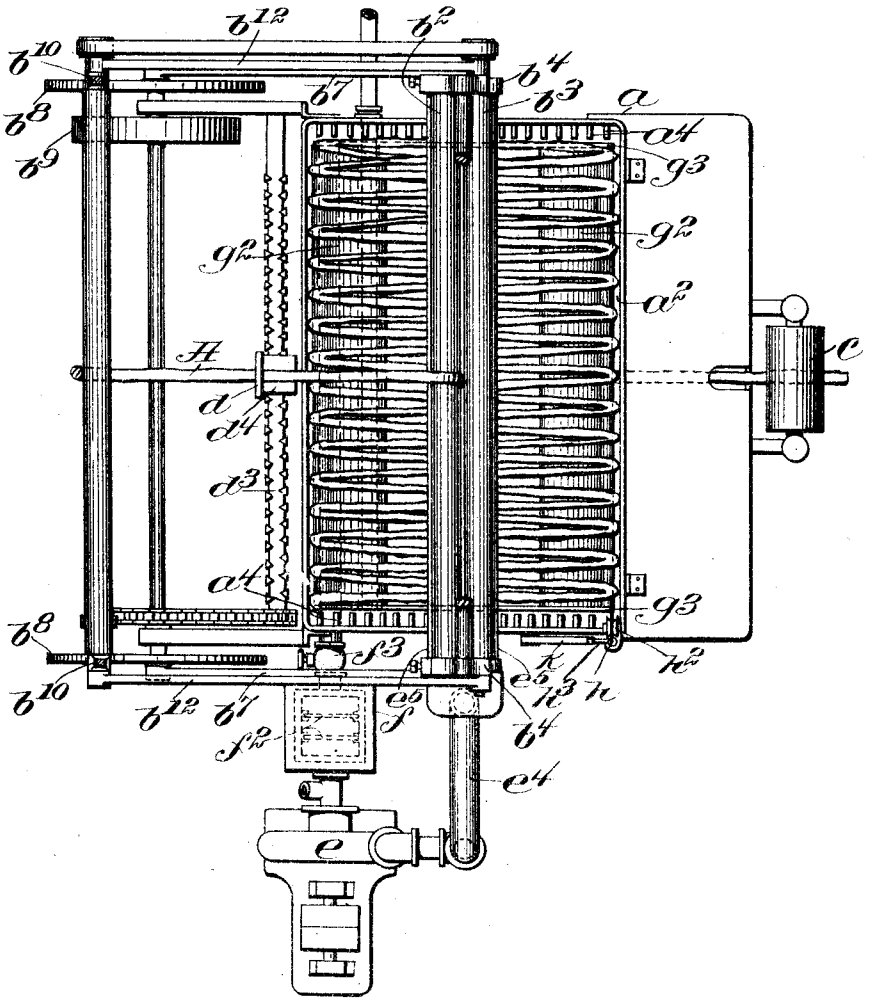
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Patented Sept. 30, 1913.

6 SHEETS—SHEET 3.

Fig. 3.



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PROCESSING APPARATUS.

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6 SHEETS—SHEET 4.

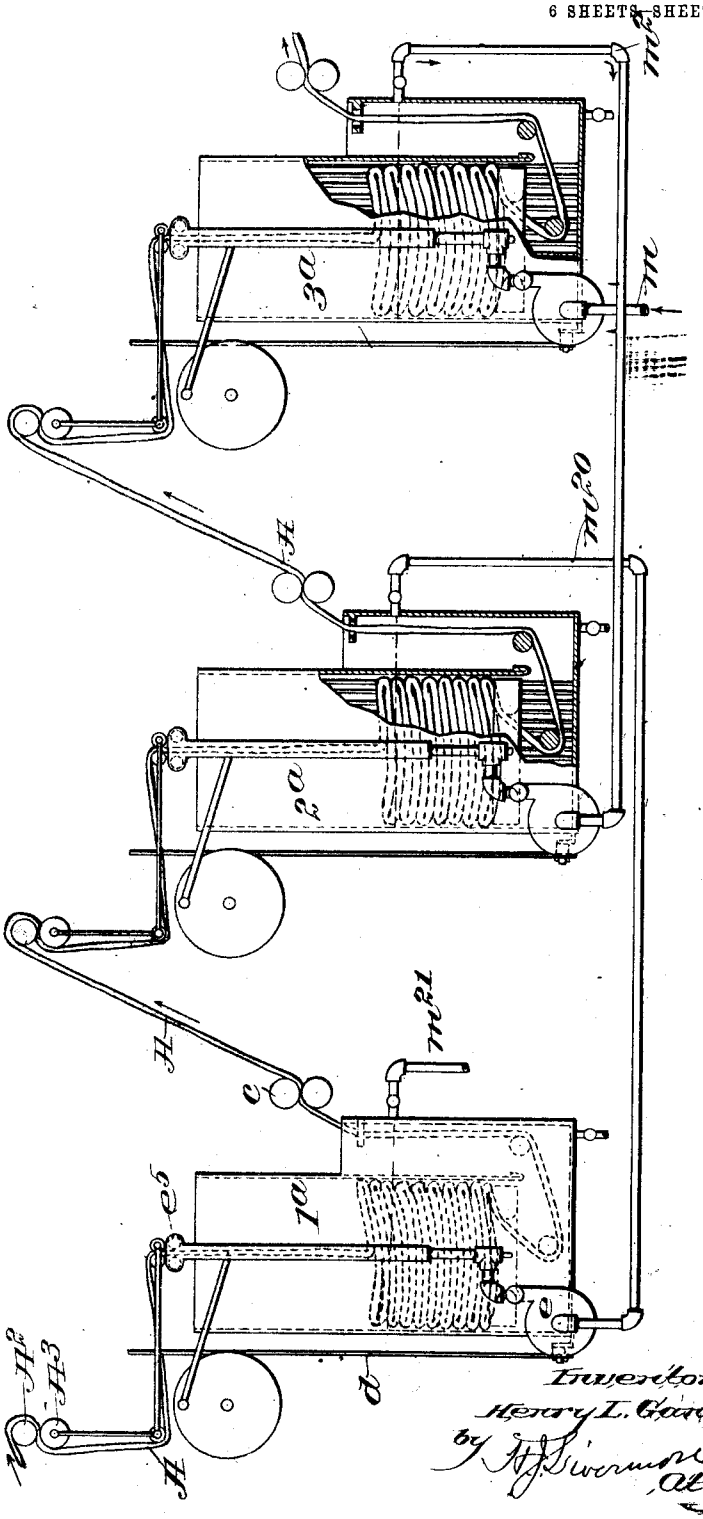


Fig. 4.

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PROCESSING APPARATUS.

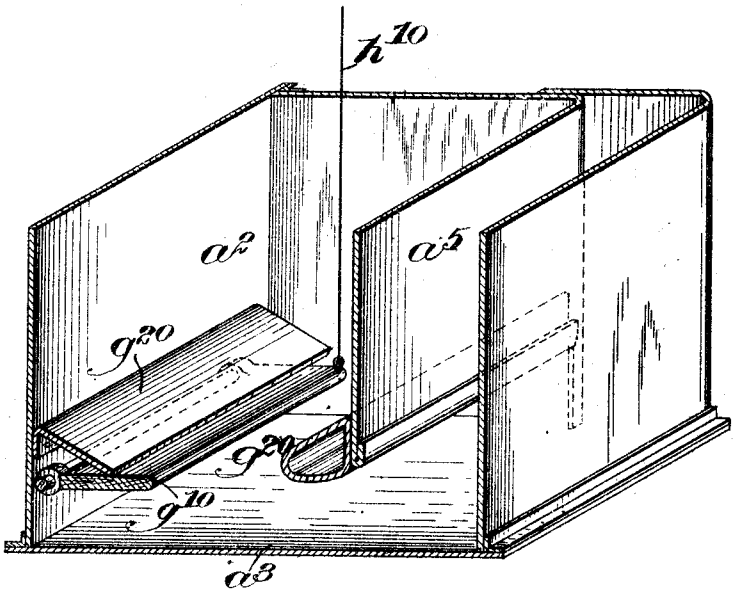
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6 SHEETS—SHEET 5.

Fig. 5,



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PROCESSING APPARATUS.

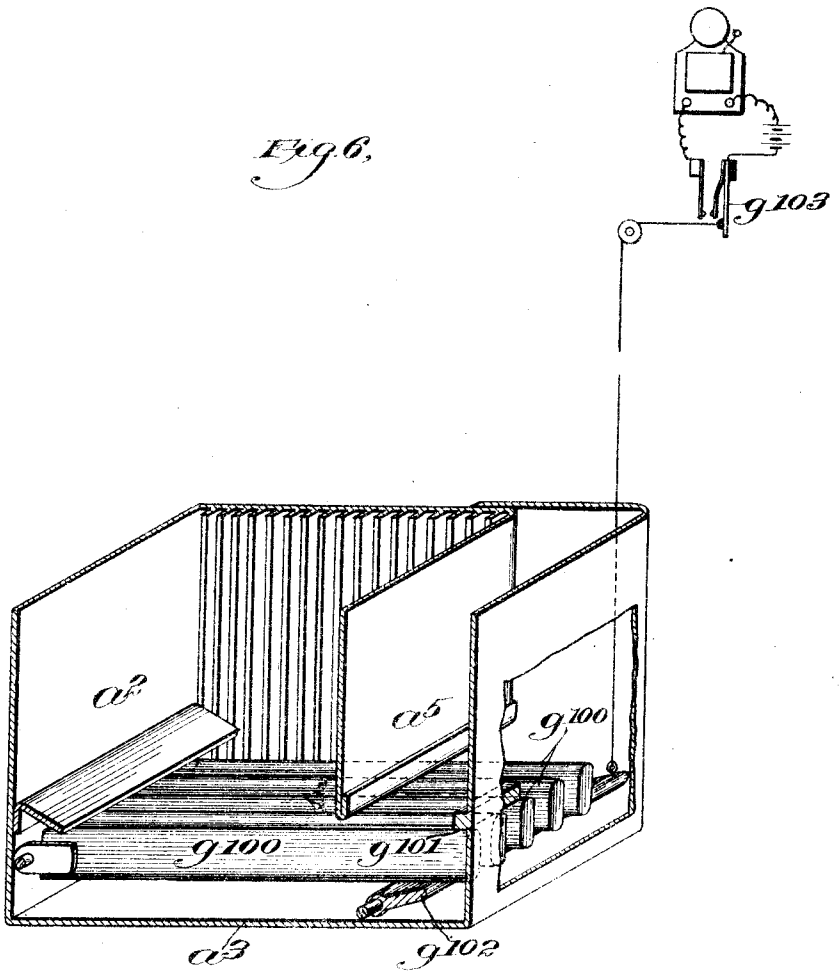
APPLICATION FILED JULY 20, 1909.

1,074,568.

Patented Sept. 30, 1913.

6 SHEETS—SHEET 6.

Fig. 6.



Witnesses:
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UNITED STATES PATENT OFFICE.

HENRY L. GANTT, OF PAWTUCKET, RHODE ISLAND.

PROCESSING APPARATUS.

1,074,568. Specification of Letters Patent. Patented Sept. 30, 1913.

Application filed July 20, 1908. Serial No. 444,622.

To all whom it may concern:

Be it known that I, HENRY L. GANTT, of Pawtucket, in the county of Providence and State of Rhode Island, have invented an Improvement in Processing Apparatus of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The present invention relates to a processing apparatus in which material is subjected to a process involving the use of a liquid, such for example, as a boiling or dyeing, or chemicking process, the apparatus being especially designed for use in one of the steps of the usual process of bleaching fabric.

The apparatus embodying the invention is designed to carry on the process continuously, that is to say, to operate on a web or rope of fabric, which is continuously fed into a keir or vat in which liquid is circulated, and continuously withdrawn therefrom, and to accumulate enough of the fabric between the entering and the leaving points to allow the same to be subjected to the action of the liquid for a sufficient length of time.

It is one purpose of the present invention to provide the apparatus with means for causing the liquid to which the fabric is subjected to permeate the fabric as it enters the keir, it being practicable in this way to reduce the length of time during which it is necessary to subject the fabric to the action of the liquid. To attain this result, the apparatus embodying the invention is provided with means for delivering a plurality of powerful streams of liquid upon the top of the pile as the fabric is piled into the keir, the streams being arranged to travel back and forth so that they impinge upon and thoroughly permeate every part of the top layer as it is formed, and even penetrate, to a greater or less extent, the layers below. This result can be practically obtained by using the same liquid over and over, the liquid being pumped from the bottom of the keir and forced up to the delivery ducts above. As a practicable expedient, the delivery mechanism for the fabric may be employed as a conveyer for the delivery ducts for the liquid, the said ducts being, for example, in the form of pipes which extend along substantially and parallel to the reciprocating draw rolls by which the layers of fabric are formed, while the liquid is directly delivered in streams issuing from openings or nozzles in the under side of the pipes.

The boiling process, to which this invention is especially adapted, is mainly a cleansing process, and the object is to remove the impurities thoroughly and rapidly,—all parts of the fabric being equally subjected to the action of the liquid. To facilitate and improve the operation, a series of keirs may be employed, having a circulating system, in which the liquid, while being circulated in each keir, also passes from one keir to another, the fabric being introduced at one end of the series and the fresh liquid at the other, so that as the fabric becomes cleaner it enters cleaner liquid.

The invention relates further to certain novel features of construction and arrangement of the feeding apparatus.

Figure 1 is an elevation of an apparatus embodying the invention shown partly in section; Fig. 2 is a section of the same on a plane at a right angle to Fig. 1, with parts in elevation; Fig. 3 is a plan view of the apparatus; Fig. 4 is a view, partly in section and partly in elevation, of a series of keirs arranged in accordance with the invention; Fig. 5 is a perspective view, partly in section, showing a modification; and Fig. 6 is a view similar to Fig. 5 showing a further modification.

In the apparatus embodying the invention, the keir a is shown as provided with a fabric-containing portion a^2 which terminates above the bottom a^3 of the keir a, and is provided with a support for a pile of fabric which is adapted to be continuously delivered at the top and withdrawn from the bottom of the said fabric-containing portion.

In carrying out a boiling process in connection with bleaching, for example, it is customary to gather a web of fabric into a rope form, and to pile the fabric thus formed by hand into an empty keir, and the heated liquid is put in afterward and circulated. This hand piling is irregular, and the liquid which is introduced after the pile is formed does not uniformly penetrate the fabric in the pile, but acts more thoroughly on those parts of the fabric which are more loosely associated than on those parts which are closely packed together. The circulation of the liquid naturally follows the parts of

least density, and parts where the density is greatest may not be subjected to the flowing action of the liquid at all. In the apparatus embodying the present invention, the piling mechanism is automatically controlled so that the pile is substantially uniform, and of approximately equal density throughout, and the lower end of the rope of fabric is pulled out from the fabric containing portion lengthwise and carried upward over the level of the liquid in the keir so as to be withdrawn continuously while the process is being carried on.

In starting the machine, the rope of fabric A is led in between rolls A^2 and A^3, thence over a guide roll b to a pair of draw rolls b^2, b^3, which are mounted on a swinging frame consisting of the vertical arms b^4 pivotally supported at opposite sides of the keir. From these draw rolls the rope of fabric A is delivered to the fabric-containing portion a^2 of the keir in a systematic pile, from the bottom of which the rope is pulled out over guide rolls b^5 and b^6. It is then carried upward through a pair of squeeze rolls c and drawn away from the machine. In order to pile the fabric in substantially uniform layers, the draw-rolls b^2, b^3 are arranged to be swung back and forth over the fabric-containing portion a^2 of the keir, the arms b^4 being herein shown as connected by means of pitmen b^7, with disks b^8, which are shown as provided with a pulley b^9 belted to a pulley on the roll A^3, which constitutes the driving member. This carries the fabric A back and forth, and, in order that the fabric may also be spread laterally so as to make a uniform pile, the strand A is arranged to be acted upon by a transversely movable member d which is shown as an arm pivoted at d^2 and arranged to be moved back and forth by means of a rotating screw threaded shaft d^3, the threads of which engage with a block d^4 having a swivel connection with the arm d. The said shaft d^3 is shown as provided with a sprocket and chain connection with the shaft which carries the pulley b^9 (see Fig. 2). There are two sets of threads on the shaft d^3 cut in opposite directions and crossing each other, and means are provided whereby the swivel block d^4 is shifted from one set of threads to the other, so that the said block is caused to reciprocate through the rotation of the shaft. This construction is not novel, and is not, therefore, specifically described herein.

In order to provide for the delivery of the fabric during the movement of the draw rolls b^2 and b^3 in either direction, the guide roll b is mounted at the ends of arms b^{10} which are pivotally connected at a point concentric with the roll A^3, the said arms b^{10} being connected by means of links b^{12} with the arms b^4. As the arms b^4 swing back and forth to lay in the fabric, the length of the line of fabric under tension between the draw rolls b^2, b^3, and the rolls A^2, A^3, is not varied, and inasmuch as the speed of the delivery rolls b^2 and b^3 is constant, the fabric is drawn from the source of supply and through the transversely movable member d at a constant speed, and not by jerks, as would be the case if it were drawn directly from the source of supply through the member d by the draw rolls. This expedient is adopted because it is detrimental to locate any more of the delivery mechanism than is absolutely necessary directly over the keir.

The delivering device, constructed as above described, piles the rope of fabric in layers, each of which, as shown in Fig. 3, has a series of substantially V-shaped loop formations, so that in pulling out the fabric from the bottom, the direction of pull is substantially lengthwise, so that the loops pull out endwise, with the least liability of tangling.

In order to carry on the process to the best advantage, and with the least expenditure of time, it is necessary that the liquid should thoroughly and evenly permeate the fabric, and it is desirable that such permeation should take place when the material is first acted on by the liquid. If such action is caused to take place at the beginning, the length of time during which the material must remain immersed in the liquid may be diminished, as also the size of the keir, and the fabric can be put through the process at a greater speed. If, therefore, the fabric, as it is piled into the receptacle is subjected to the scouring action of streams of liquid, so directed that the liquid is forced into and through the fabric, the action is much more rapid than is the case if the fabric is merely immersed in the liquid and subjected to such action as may result from ebullition or slow and uneven circulation. In accordance with this invention, the apparatus is provided with means whereby streams of liquid are forcibly directed against every part of the fabric with equal effect throughout, these streams being caused to permeate the fabric before it sinks beneath the surface of the more inert liquid in the keir. The arrangement is such, however, that circulation is maintained in the keir, so that even after the fabric has been subjected to the preliminary action, the liquid in the keir is not wholly inert. For this purpose, the lower portion of the keir is shown as provided with a pump e which draws the liquid from the bottom of the keir through a suction pipe e^2, which extends completely across the bottom of the keir below the fabric support, the suction of the pump producing the downward current while the liquid drawn out by the pump is forced up and delivered into the top of the keir, from a point above the fab-

ric piled therein. The lower circulating pipe may be provided with a trap or strainer to catch lint, etc., the said strainer being herein shown as a chamber f provided with vertical perforated partitions f^2, there being a cock f^3 between the strainer and the keir, so that the strainer can be cleaned without discharging the contents of the keir. The liquid thus drawn upward is delivered in streams directed downward upon the top of the pile, and the streams are arranged to travel back and forth, it being practicable to locate the delivery ducts adjacent to the draw rolls b^2 and b^3, and to cause them to travel therewith, so that the liquid is distributed over the entire upper surface of the pile instead of being concentrated at one or more stationary points. In the construction shown, the outlet pipe e^3 from the pump e is connected by means of a flexible tube e^4 with two horizontal delivery ducts e^5 which are mounted on the arms b^4 below the draw rolls b^2 and b^3, and provided along the under side with perforations e^6 which constitute the nozzles.

In arranging for the delivery of the fabric, the rotating movement of the draw-rolls may be so timed with relation to the reciprocating movements which carry the cloth back and forth, as to deliver more cloth during each reciprocation than would extend from one wall of the keir to the other. This increases the amount of cloth in each layer, and causes the pile to be porous which enables the circulating liquid to penetrate it more thoroughly than if the cloth were laid in a solid pile.

It is very important that the streams of liquid should impinge directly on the fabric at the beginning, and that the top layer should be exposed to the direct action of the streams before it is submerged. In order, therefore, to prevent the liquid from accumulating on top of the pile, it is desirable to afford a free space through which a portion of the liquid can flow without having to penetrate the mass of fabric. For this purpose, I have shown the fabric-containing portion a^2 of the keir as provided at opposite sides with vertical strips a^4 projecting inward and adapted to keep the sides of the pile out of actual contact with the walls.

In order that the lower strand of the pile of fabric can be most readily pulled from the bottom of the pile without tangling, it is desirable in some cases to provide a supplemental support for the pile above the bottom of the keir, and in Figs. 1 and 2 the said supplemental support is shown as arranged to be yielding and may consist of a buoyant frame which is light enough to float to the top of the liquid when there is no fabric piled therein. As shown in Fig. 2, the said support consists of a frame having hollow side members g with sloping upper surfaces g^2 which afford supports for the closed ends of the loops of fabric, the rope of fabric being pulled lengthwise from under the pile over the sloping surfaces g^2 of the side members g. In order to render the pull uniform, the guide roll b^5 previously described is shown as located directly below the middle of the support, that is, midway between the two members g which are connected together by means of transverse frame pieces g^3 to hold them in proper position. By this construction the yielding support will rest against the bottom of the pile at all times, whether the pile be large or small, and will thus tend to prevent any possibility of tangling at the beginning of the operation.

While the yielding support above described is a practicable device and may in some cases be utilized to advantage, it forms no part of the present invention, and is not essential to the practical operation of the apparatus, since the pile of fabric is mainly supported by its own buoyancy and tends to retain its original layer arrangement. It may be desirable, however, if the yielding support g is dispensed with, to utilize a stationary support at the bottom of the keir, modified forms of the supplemental support being shown in Figs. 5 and 6. In Fig. 5, the sloping surfaces g^{20} are shown as projecting from the walls of the fabric containing portion, and sloped downward from opposite sides toward the middle, thus supporting the pile, leaving an open space between the sloping surfaces through which the strand of fabric may be easily drawn. In Fig. 6, the support consists of a series of parallel fingers g^{100} arranged to lie in line with the looped strands of fabric, the said fingers being independently mounted and separated from each other so as to afford space for the circulating liquid. These fingers may be buoyant, or otherwise caused to remain in the position shown in Fig. 6, which position is determined by means of a latch or shoulder g^{101} which holds the fingers slightly below the wall a^5 of the fabric-containing portion.

A further feature of the invention consists in providing the apparatus with an indicator which will show the operator how large a pile of fabric is in the apparatus at any given time, and the indicator may be operated by any yielding element which is subjected to the pressure of the pile of fabric in the keir. In the construction shown in Fig. 1, the yielding support g is connected, by means of a cord h which runs upward over a pulley h^2, with an indicator finger h^3 adapted to move up and down in the guide h^4 which is provided with a calibrated scale h^5. The same indicator may also be utilized to operate a tell-tale signal,

and, in the construction shown, Figs. 1 and 2, the said signal is arranged to be operated when the indicator member h^3 is in either of its extreme positions. For this purpose the apparatus is provided with electrical switches i and k, either of which is adapted to close a circuit from a battery k^2 through an audible signal such as a bell k^3. In the construction shown in Figs. 5 and 6, in which the supplemental support is mainly stationary, a yielding portion can be added for the purpose of operating the signal, Fig. 5 showing a projecting member g^{10} which projects beyond the surface g^{20} so as to be subjected to the pressure of the pile, the said member being connected with a signal controlling device by means of a cord h^{10}. In Fig. 6, the yielding fingers g^{100} are shown as adapted to act either individually or collectively upon a pivotally supported member g^{102} which may be connected with the switch g^{103} adapted to close an electric circuit through the bell.

A further feature of the invention consists in a multiple apparatus which is embodied in a series of keirs which are arranged to receive the same fabric consecutively, each keir having the piling apparatus above described, together with the means for circulating and distributing the liquid. While each keir is provided with its own circulating apparatus which is adapted to produce a rapid circulation of the liquid contained in the keir, the overflow from one keir supplies liquid to the next, and so on, there being fresh liquid supplied at one end, and the surplus liquid drawn off at the opposite end. The fabric first enters the keir at the end where the surplus liquid is drawn off, and passes from there through the series, it being obvious, therefore, that as the fabric becomes cleaner, it will enter cleaner liquid, thus making the cleansing process more thorough. Such a construction is shown in Fig. 4, in which the keirs are indicated by the reference letters a, 2^a, and 3^a, the fabric A being first piled in the keir 1^a, and upon its withdrawal therefrom, being piled into the keir 2^a and then into the keir 3^a, from which it is finally carried away. While the liquid in each keir is used over and over again, the circulation produced by the circulating pump being rapid, a small amount of liquid is continuously supplied, the keir being provided with an overflow to carry off the liquid and maintain the level thereof the same. As shown in Fig. 4, the fresh liquid is supplied through a pipe m to the keir 3^a, and the overflow from the keir 3^a is through a pipe m^2 which communicates with the keir 2^a, so that the liquid passes from the keir 3^a to the keir 2^a. Similarly the keir 2^a communicates through a pipe m^{20} with the keir 1^a, and the superfluous liquid escapes from the keir 1^a, through the overflow pipe m^{21}. By this construction it will be seen that the fabric A is first acted upon by the liquid which has been used to the greatest extent, this liquid, however, serving to thoroughly loosen the impurities, and, to a considerable extent, remove them, the fabric then being subjected successively to two or more other treatments in liquid which is cleaner, the result being that the fabric finally has received a very thorough cleansing upon leaving the apparatus.

What I claim is:

1. An apparatus for subjecting fabric to the action of a liquid comprising a keir; delivery devices located over the keir for laying or piling layers of the fabric in said keir in regular formation; spray nozzles located adjacent to said delivery devices adapted to eject liquid and distribute the same over the surface of the pile as it is formed by the said delivery devices; and means for reciprocating said delivery devices and said spray nozzles whereby they travel together across the top surface of the pile of fabric.

2. An apparatus for subjecting fabric to the action of liquid comprising a keir; means located over the keir for piling layers of fabric in said keir in regular formation; spray nozzles also located over the keir; means for causing said spray nozzles to travel above the top surface of the pile of fabric while the fabric is being added thereto, and spray on all parts of the top layer; and means for supplying said spray nozzles with liquid under pressure.

3. The combination with a keir; of delivery ducts for liquid located over the keir and provided with downwardly directed outlets; draw rolls for the fabric adjacent to said ducts, but out of the path of the liquid issuing from said outlets; means for supplying said ducts with liquid under pressure; and reciprocating mechanism common to said delivery ducts and said draw rolls, whereby said draw rolls and ducts coöperate in piling the fabric in circular layers and in causing the liquid to impinge on all parts of the top layer.

4. The combination with a keir; of delivery ducts located over the keir and provided with downwardly directed outlets; draw rolls for the fabric adjacent to said ducts, but out of the path of the liquid issuing from said outlets; a pump having a suction pipe projecting into the keir; a flexible connecting tube leading from the outlet of the pump to said delivery ducts; and reciprocating mechanism to cause said ducts and draw rolls to travel together across the top of the keir.

5. The combination with a keir; of delivery ducts located over the keir and provided with downwardly directed outlets;

draw rolls for the fabric adjacent to said ducts, but out of the path of the liquid issuing from said outlets; a pump having a suction pipe projecting into the keir; a flexible connecting tube leading from the outlet of the pump to said delivery ducts; means for reciprocating said ducts and said draw rolls; and a strainer between the outlet of the pump and said delivery ducts.

6. The combination with a keir; of a reciprocating delivery device consisting of draw rolls movable in a direction transverse to their own axes, said draw rolls being located over said keir and adapted to pile fabric therein; ducts parallel to and located at opposite sides of said draw rolls and provided with downwardly directed outlets; said ducts being connected with said delivery device and adapted to reciprocate therewith; and means for supplying said ducts with liquid.

7. The combination with a receptacle, of means for piling a rope or strand of fabric in layers therein, and means for withdrawing the bottom layer; means for retaining the strands of the bottom layer in their original relative positions, in order that they may be withdrawn without tangling; a liquid ejecting device located over the receptacle to deliver streams of liquid downward on the fabric; and means for causing said ejecting device to travel over the surface of the pile and thereby deliver the streams on all parts thereof.

8. The combination with a keir having a fabric-containing portion, provided with a fabric support at its bottom; of transversely movable reciprocating members adapted to fill said fabric-containing portion with a regularly arranged pile of fabric; means for withdrawing the fabric from the bottom of the pile; and a traveling device for continuously ejecting liquid on the fabric as it enters the keir, the said traveling device following the movement of the said reciprocating members.

9. The combination with a container for liquid, of means for continuously adding fabric to the top and simultaneously withdrawing fabric from the bottom of a vertical pile of fabric suspended in the liquid in said container; and of a traveling device adapted to eject streams of liquid upon the top of the pile of fabric before the fabric at the top becomes submerged in the liquid.

10. The combination with the keir; of means for continuously adding fabric to the top and simultaneously withdrawing fabric from the bottom of a vertical pile of fabric suspended in the liquid contained in the keir; means for circulating the liquid in the keir; and a traveling device for ejecting the circulating liquid uniformly over all parts of the top of the pile before the fabric at the top of the pile becomes submerged in the liquid.

11. A keir having a fabric-containing portion provided at its bottom with a series of parallel members to support the pile of fabric, combined with piling mechanism adapted to lay the fabric in loops, the strands of which extend generally lengthwise of said parallel members; and a traveling device adapted to eject streams of liquid upon the top of the pile and to distribute the ejected liquid over the entire surface thereof.

12. A keir having a fabric containing portion provided at its bottom with a series of separate members to support the pile of fabric, said members having spaces between them for free circulation of liquid; means for circulating the liquid by drawing the same from the bottom of the keir below the pile, and returning it to the keir at the top; and a traveling ejecting device to distribute the liquid thus returned.

13. The combination with the keir having a fabric-containing portion provided with a yielding member adapted to press against the lower layer of fabric without sustaining the weight of the pile; of means for systematically piling the fabric in the keir; means for withdrawing the fabric from the bottom of the pile; and an indicating device operating in response to the movement of said yielding portion due to variations in pressure of the fabric piled thereon.

14. The combination with the keir; of reciprocating draw rolls located over said keir; stationary draw-rolls; a guide roll bearing in an arm pivotally supported on an axis concentric with said stationary draw rolls and connected with the reciprocating draw rolls whereby said guide roll is caused to reciprocate with said draw rolls to maintain a constant length of material between the stationary and reciprocating draw rolls.

15. The combination with the keir; of reciprocating draw rolls located over said keir; stationary draw rolls; a guide roll bearing in an arm pivotally supported on an axis concentric with said stationary draw rolls and connected with the reciprocating draw rolls whereby said guide roll and said reciprocating draw rolls are caused to reciprocate together and maintain a constant length of material between the stationary and reciprocating draw rolls; a traveling guide eye located between said guide-roll and the reciprocating draw rolls; and means for causing said traveling guide eye to reciprocate in a direction parallel to the axes of the draw rolls.

16. The combination with reciprocating draw rolls and a guide roll adapted to reciprocate with said draw rolls; of a guide eye located between said draw rolls and said

guide roll, and adapted to reciprocate in a direction transverse to that of the draw rolls and the tension roll.

17. In an apparatus for carrying on a continuous process of subjecting fabric to the action of a liquid, a plurality of keirs and piling devices for each keir; means whereby the fabric is continuously withdrawn from the bottom of one keir and continuously delivered to the top of the next keir; means for producing a local circulation of the liquid in each keir by withdrawing liquid from the bottom thereof and delivering it in streams at the top; and means whereby the surplus liquid of one keir is delivered to the adjacent keir, the general travel of the liquid thus delivered being in the opposite direction to the general travel of the fabric.

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

HENRY L. GANTT.

Witnesses:
JAS. J. MALONEY,
W. E. COVENEN.