

J. M. PAYNE & G. G. WALLACE.

DYEING MACHINE.

APPLICATION FILED FEB. 20, 1911.

Patented Mar. 25, 1913.

5 SHEETS—SHEET 1.

1,057,265.

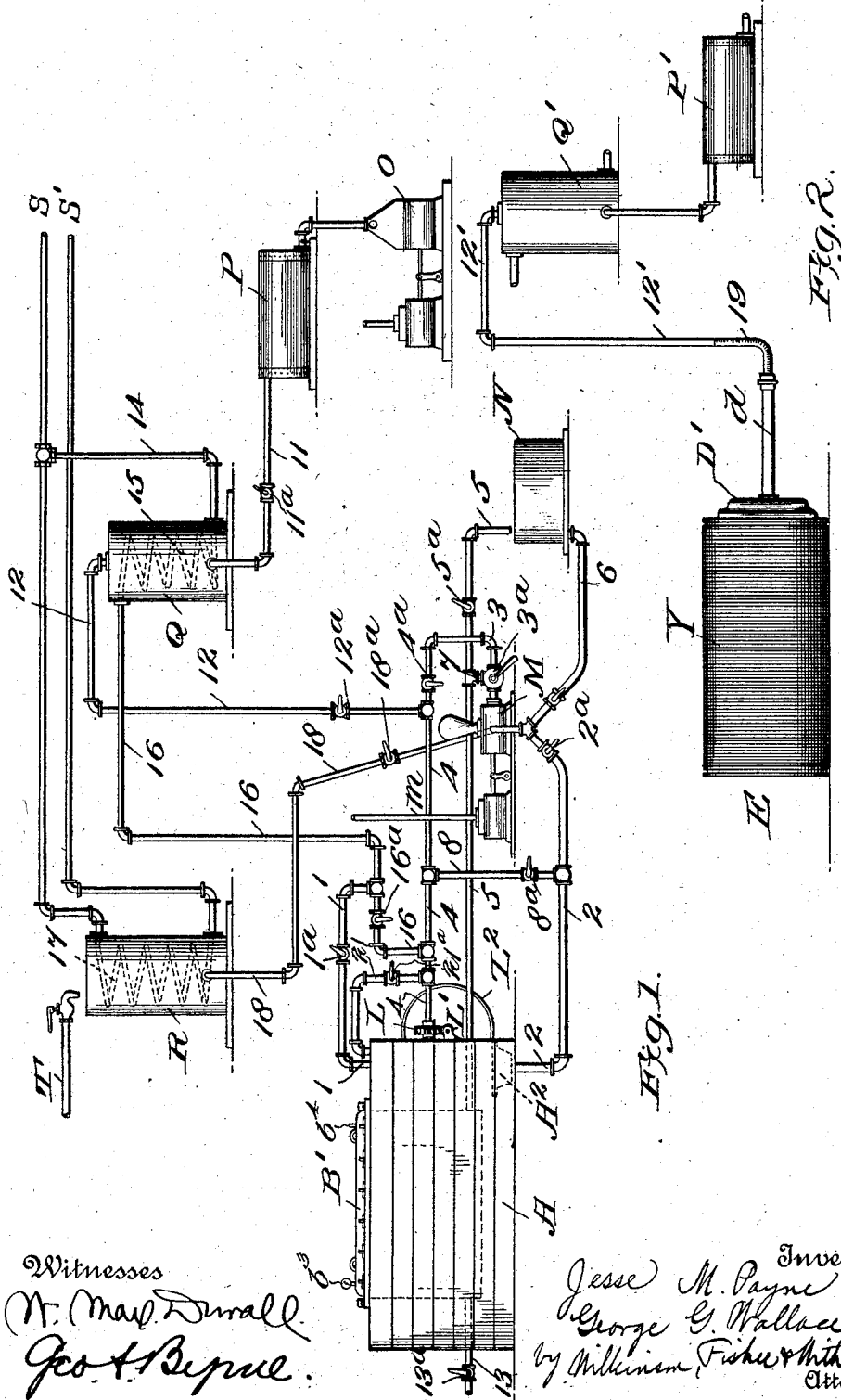


Fig. 2.

Fig. 1.

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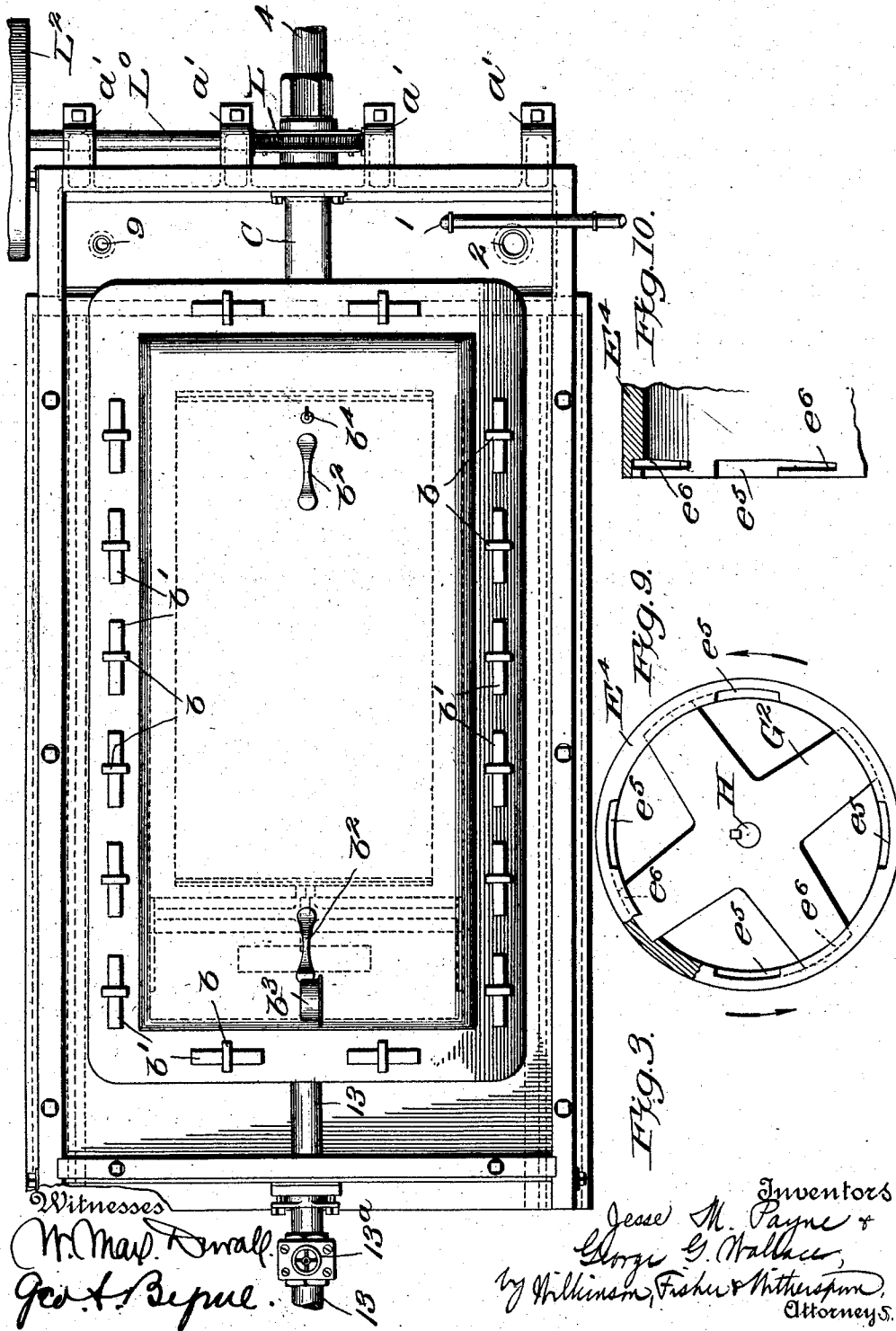
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5 SHEETS—SHEET 2.



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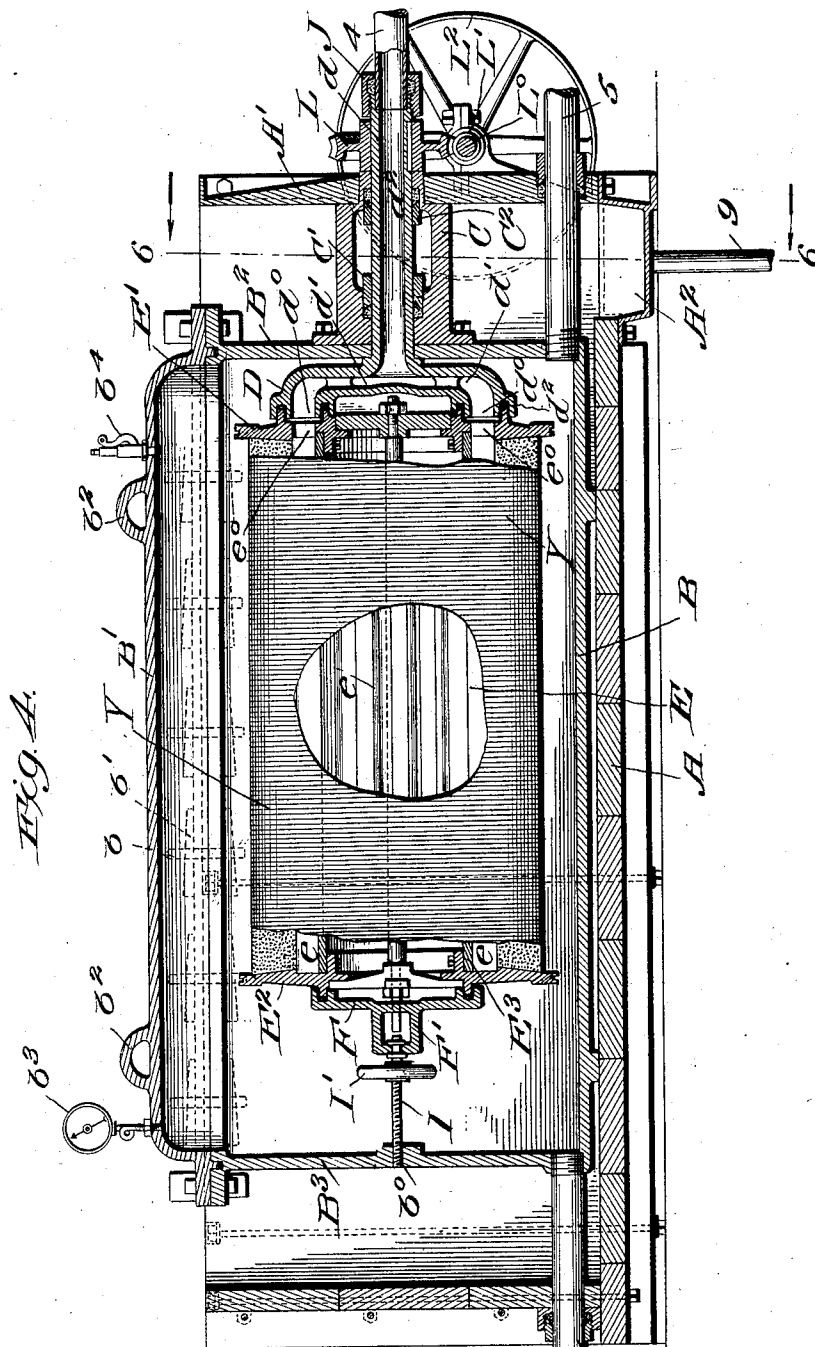
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Fig. 5.

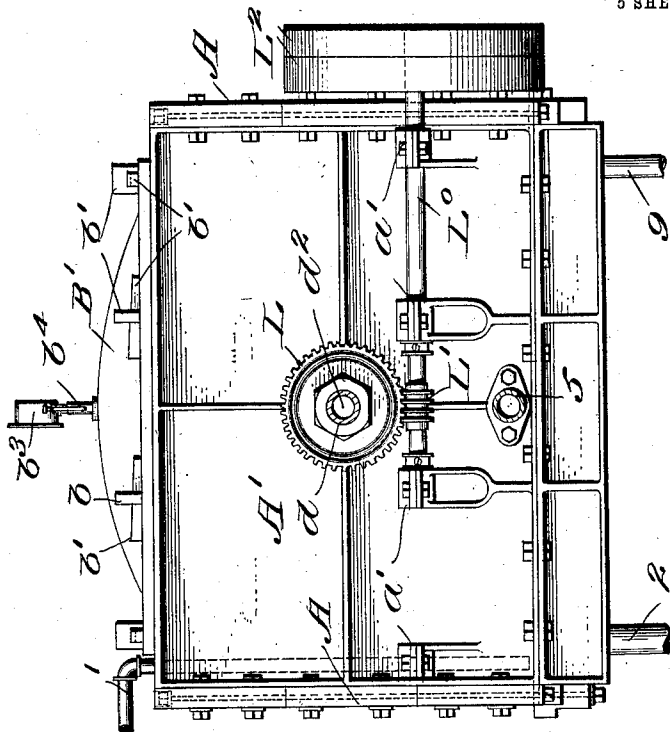
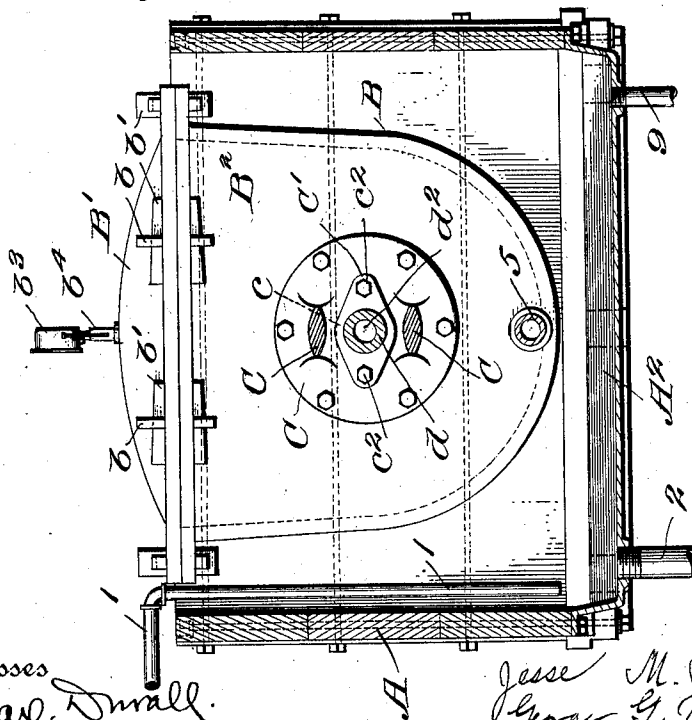


Fig. 6.



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5 SHEETS-SHEET 5.

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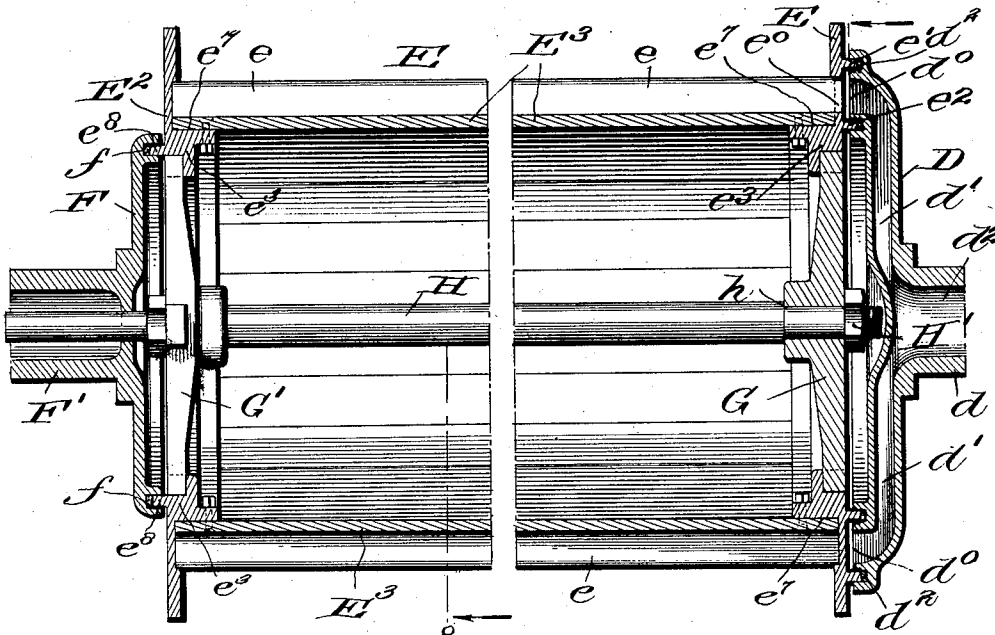


Fig. 7.

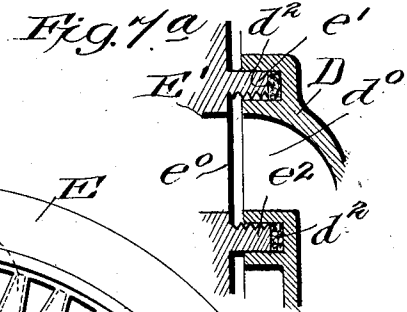
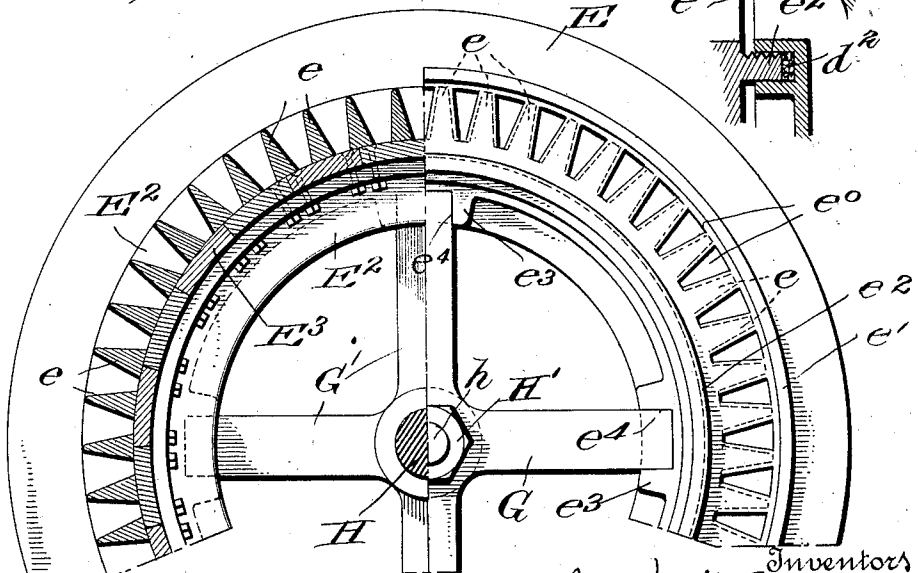


Fig. 7a.

Fig. 8.



Witnesses

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UNITED STATES PATENT OFFICE.

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A CORPORATION OF GEORGIA.

DYEING-MACHINE.

1,057,265.

Specification of Letters Patent.

Patented Mar. 25, 1913.

Application filed February 20, 1911. Serial No. 609,794.

To all whom it may concern:

Be it known that we, JESSE M. PAYNE and GEORGE G. WALLACE, citizens of the United States, residing at Phoenix city, in the county of Lee, State of Alabama, and at Girard, county of Russell, State of Alabama, respectively, have invented certain new and useful Improvements in Dyeing-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in apparatus for dyeing and drying yarns of cotton or other textile material, wherein the entire operation is effected without removing the textile material from the supporting body upon which it is wound.

Under the old process, known as the long chain system, the yarn was carried from the warpers to ball warps and thence to the boiling machine; thence to the doubling machine; thence to the dyeing tub; thence to the splitting machine; thence to the drying machines, which consist of large cans filled with hot air; thence to the long chain beaming machines, and finally to the slashers for sizing, the entire process requiring from four to six days.

According to the herein described invention, the yarn goes from the warpers to the warper beams, on which it is wound, and the warper beams are placed in the dyeing apparatus, where the dyeing is effected and also the drying, and thence the warper beam is taken direct to the slashers for sizing. This obviates the necessity for unwinding the yarn from the warper beam for the purpose of drying same, and saves an enormous amount of expense in the operation, and reduces the time for the complete operation from four to six days down to about three hours.

Our invention will be understood by reference to the accompanying drawings, in which the same parts are indicated by the same letters and numerals throughout the several views.

Figure 1 is a diagram showing the complete apparatus for dyeing and drying the yarn. Fig. 2 shows a modification in which

the drying is effected outside of the dye tank. Fig. 3 is a plan view of the dye tank and the inclosing vat. Fig. 4 shows a central vertical section through the apparatus shown in Fig. 3. Fig. 5 is an end view of the apparatus shown in Fig. 3, as seen from the right of said figure. Fig. 6 shows a section of the apparatus shown in Figs. 3 to 5 along the line 6-6 of Fig. 4. Fig. 7 is a detail view, on a larger scale, of the warper beam and the heads therefor, the parts being shown in central vertical section. Fig. 7^a is a detail, showing the mode of packing the end of the warper beam. Fig. 8 shows a section along the broken line 8-8 of Fig. 7, and looking in the direction of the arrows. Fig. 9 shows a means for detachably connecting the spider to the hollow warper beam, and Fig. 10 is a detail showing the interior of the hollow warper beam, with grooves adapted to engage the spokes of the spider.

A represents a vat, preferably of wood, which is mounted the dye tank B, preferably of cast iron or steel. The vat A is provided with a trough-shaped well A² at one end thereof, and with a metallic head A', perforated to permit the passage therethrough of the apparatus for rotating the warper beam.

B represents a metallic tank, having the cap B' tightly secured thereto in any convenient way, as by means of eyes b and wedges b'. For convenience in removal, the top B' of this tank is provided with eyes b² to engage the hooks of slings, not shown.

b³ is a pressure gage, and b⁴ a safety valve to indicate when the pressure in the closed tank B exceeds a predetermined limit.

C represents a journal bearing, secured between the head A' of the vat A and the adjacent head B² of the tank B. This bearing has stuffing sleeves C' and C², as shown in Figs. 4 and 6, thus compressing packing about the hollow shaft d of the head D of the warper beam E. This hollow shaft d has a passage d², connected with the passages d' and d^o, which open into the corresponding passages e^o between the slats e of the warper beam.

The warper beam, shown in detail in Figs. 4 to 8, is provided with two heads E' and

E^2 , each shouldered as at e^7 to receive a hollow shell E^3 , preferably of wood, on which shell are secured the slats e , also preferably of wood. The head E' has the ribs e' and e^2 , which are preferably screw-threaded, as shown in Fig. 7^a, for reasons hereinafter to be described, and these ribs project freely into packing grooves d^2 in the head D , which contain packing, as shown in Fig. 7^a, and this head E' is provided with a series of perforations e^o (see Fig. 8) to permit the passage of the liquid between the slats e .

By having the shell E^3 of large diameter with the slats e of comparatively slight depth, the zone for the yarn comprises a circle of large diameter, as shown in Fig. 8, and therefore the thickness of the layers of yarn will be comparatively small, while the passages for the liquid will be constricted. By this construction, the liquid and air as well may be caused to flow freely through the comparatively thin layers of yarn in either direction, and a great saving in liquor is accomplished. It will be noted that the hollow shell E^3 contains merely atmospheric air, and being preferably of wood, would keep tight when wet, so that by this arrangement an extremely light warper beam is secured, which is especially adapted for use with the process as described.

Both heads E' and E^2 are provided with lugs e^3 , and with sockets e^4 for the arms of the spiders G and G' , which are mounted on the shaft H ; one end of said shaft being reduced, as at h , and having screwed thereon a nut H' , holding in place the spider G . The other end of the shaft projects beyond the spider G' into the cap F , which is provided with packing grooves f , into which projects the ring e^8 of the head E^2 (see Figs. 4 and 7). This cap F is provided with a loop F' , in which is revolvably mounted the end of the shaft I , which shaft is screw-threaded to engage in screw-threads b^o in the head B^3 , and is turned by means of the hand wheel I' . By screwing down on this hand wheel, the cap F forces the warper beam to the right, causing the ribs e' and e^2 to engage in the packing grooves d^2 , and causing the ring e^8 to engage in the packing grooves f , thus forming a tight packing for the cap F and the head D , and at the same time the motion of the hand wheel I' in the reverse direction will permit the warper beam to be readily disengaged from the head D and the cap F , and to be removed from the tank B ; the top B' of said tank, of course, having been previously taken off.

After the warper beam has been removed from the tank B , the shaft H may be removed by taking off the nut H' , withdrawing the shaft H in one direction, and pulling out the spider G in the other direction.

For quickly connecting and disconnecting

the shaft H to the warper beam, a bayonet joint arrangement, such as shown in Figs. 9 and 10, may be provided, in which the arms of the spider G^2 project into slots e^5 , terminating in branch slots e^6 . The shaft H is turned so that the arms of the spider G^2 will project into the slots e^5 and then be slipped into the warper beam, and the spider is turned to the left, as shown in Fig. 9, causing the arms of the spider to engage in the tapered grooves e^6 , the shaft H being driven, when in use, in the direction of the arrows, as shown in Fig. 9. By reversing the operation, it will be noted that the shaft may be readily detached from the warper beam.

The warper beam when mounted in the dye tank is rotated by means of suitable gearing, such as the worm wheel L , fast to the hollow spindle d of the head D , which worm wheel is driven by the worm L' on the shaft L^o , carrying the fast and loose pulleys L^2 .

Journal bearings a' are provided on the head A' , and are preferably so arranged (as seen in Fig. 5) that the shaft L^o may project beyond either side of the vat A , so that the fast and loose pulleys L^2 may be placed on either side of said vat, if desired.

The complete apparatus is shown in diagram in Fig. 1, in which M represents a pump, adapted for use either with hot or cold water or dye liquor. N represents a tank for receiving the dye liquor drained off; O represents an air compressor; P a storage tank for compressed air; Q represents a tank in which the compressed air is or may be heated; R represents a hot water heater; S represents a steam pipe, S' a return pipe for steam; and T represents a source of water supply.

The various connecting pipes and valves are indicated by numerals, and will be referred to in connection with the operation of the device.

The yarn Y is wound over the slats e , preferably in helical coils crossing each other, so as to facilitate the passage of the liquor therethrough.

The operation of the apparatus is as follows:—The dye liquor is put into the well A^2 in the vat A , and is heated by steam from the pipe 1, which pipe is connected by the pipe 16, the heating coil 15, and the pipe 14 to the steam pipe S . Of course, this steam pipe 1 might be directly connected with the steam pipe S , if desired. The dye liquor is drawn from the well A^2 through the pipe 2, past the valve 2^a to the pump M , whence it is forced through the pipe 3 past the valves 3^a and 4^a , into the pipe 4, all as shown in Fig. 1, and thence through the hollow spindle d and passages d' and d^o in the head D , to the openings e^o between the slats e , on which the yarn Y is wound. The yarn is

preferably wound in helical coils, the different layers crossing each other, and the dye liquor entering the passages between the slats *e* is forced outward through the yarn and falls into the bottom of the tank B, whence it may be withdrawn by means of the drain pipe 5, past the valve 5^a and into the tank N; or the dye liquor, after passing through the yarn from in out, may be allowed to remain in the tank B. After the desired amount of dye liquor has been pumped through the layers of yarn from in out, the operation is reversed by pumping the dye liquor from the tank N through the pipe 6, through the three-way valve 3^a and the pipe 7, back to the pipe 5, the valve 5^a being closed. The tank B having its top B' secured in place with a water-tight joint, the dye liquor will rise in said tank until it submerges the warper beam. At the same time, the pressure will rise, owing to the compression of air in the upper part of the tank, the amount of pressure being limited by the safety valve 6^a, and the dye liquor will be forced back through the yarn from out in, returning through the pipe 4 and the pipe 21 past the valve 21^a back to the well A² in the vat A. After the dye liquor has been pumped in this direction, from out in, through the yarn the desired length of time, the dye liquor is drawn off through the drain pipe 9 from the well A² of the vat A, and is allowed to drain through the pipe 5 from the bottom of the tank B to the tank N; or it may be drained off through the drain pipe 13 at the opposite end of the tank B, this drain pipe being controlled by the valve 13^a. After the dye liquor has been passed in reverse directions through the yarn, hot or cold water is pumped in from the tank R through the pipe 18 by the pump M, and thence delivered past the three-way valve 3^a to the pipe 3, and past the valve 4^a through the pipe 4 to the passages between the slats *e*. This hot or cold water going outward through the yarn washes the same, and is drawn off through the pipe 13. It will be evident that the hot or cold water may be pumped through the yarn in the reverse direction in the same manner as the dye liquor, if this be desired; but in practice, it is not found necessary to pump the hot or cold water through in more than one direction. During the dyeing and washing processes the warper beam is slowly rotated. After the washing process is completed, the yarn is dried by compressed air from the reservoir P, which air may be directly led to the pipe 4 and forced through the yarn from in out like the dye liquor and hot or cold water, as before mentioned; but it may be preferable to heat said air. For this purpose, we show a reducing valve 11^a, which delivers the air from the reservoir P to the heating tank Q, where it is heated by the steam coil

15, and passing from the top of said tank enters the pipe 12, and passing the valve 12^a it enters the pipe 4, and passes through the hollow spindle *d* to the spaces between the slats *e*. This compressed air passing through the yarn, drives part of the moisture out of same, at the same time evaporating a large portion of said moisture, while at the same time, the oxygen in the air tends to oxidize and fix the coloring matter of the dye. During the drying operation, the waste air may be allowed to escape through the pipe 13, or during this part of the operation, the cap B' may be removed from the tank B.

By forcing compressed air through the yarn as above noted, the necessity for "aging" or "seasoning" by long continued exposure to the atmosphere, which is found necessary in dyeing raw stock, is entirely obviated.

Since the drying operation requires a longer time than the dyeing operation, it may be more convenient and economical to use the apparatus for the successive steps of dyeing and to remove the warper beam from the tank B and insert a fresh warper beam in its place, and perform the drying operation as a separate step. In this case, the cap F is drawn backward, and by turning the hand wheel I' the warper beam is disengaged from said cap and from the head D, and hooks being attached to the ends of the shaft H, the warper beam is hoisted out, as by means of a sling, not shown, and placed upon a suitable truck. The shaft H and the spiders on the same are then removed from the warper beam, as already described, and are used in connection with the fresh warper beam to be inserted in the dyeing apparatus. The whole warper beam is then carried to the head D', which is then screwed into the screw-threads on the annular ribs *e'* and *e''* (see Fig. 7^a) to form an air-tight joint, and the stem *d* is connected by any suitable flexible connection, such as 19, to the pipe 12', which is supplied with compressed air from the reservoir P', preferably through a suitable heater Q', which may be generally similar to the air heater Q, already described. By having the well A² below the bottom of the vat A, a sufficient amount of dye liquor may be heated and used without excessive waste, as occurred where the dye liquor was drawn from the flat bottom of the tank. Furthermore, by having the shell E³ of the warper beam at some distance from the axis thereof, and having the passages between the slats *e* of comparatively small depth radially, it will not be necessary to fill up the interior of the hollow warper beam with dye liquor, but the dye liquor may be supplied at a distance from the axis of the warper beam and through comparatively small passages, thereby effecting a great saving in the

amount of dye liquor required to dye the material. Furthermore, by having the warper beam of greater diameter, the same length of yarn may be wound on, but in much fewer layers than in the old form of warper beam, and the easier passage of the liquor therethrough may be secured, so that with the herein described apparatus, a greater amount of yarn may be dyed with less dye liquor than with any apparatus heretofore known in the art. It will be obvious, however, that if it be desired, the shell E^3 may be omitted, and the slats e secured on rings spaced apart, as described in our Patent No. 887,511, granted May 12, 1908, and entitled Improvements in dyeing machines.

By using the wooden shell E^2 and wooden slats e , the dye liquor, which ordinarily has a strong chemical effect upon metals, is not affected, and moreover the yarn is not stained at the points where it comes in contact with the slats. Wood, therefore, is preferable for this purpose, but if desired any suitable metal may be used either for the shell, or for the slats, or for both.

It will be obvious that with the herein described apparatus, air may be exhausted from either side of the layers of yarn, causing the atmospheric pressure to force the air through the layers of yarn in either direction, and this might be augmented by having air pressure on one side and a partial vacuum on the other side of the layers of yarn.

We do not mean to limit our invention to the precise form of apparatus, or to the precise details of construction, or the combinations and arrangements of parts herein described, as these might be readily varied within wide limits, but

What we claim and desire to secure by Letters Patent of the United States is:

1. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof, a closed tank mounted in said vat, a hollow warper beam adapted to have yarn wound thereover, means for detachably mounting said warper beam in said tank, and means for forcing dye liquor from said well through the yarn on said warper beam, substantially as described.

2. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof, a closed tank mounted in said vat, a hollow warper beam provided with a closed shell, with slats secured on said shell adapted to have yarn wound thereover, means for detachably mounting said warper beam in said tank, and means for forcing liquid into the passages between said slats and through the yarn on said warper beam, substantially as described.

3. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the

yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, substantially as described.

4. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with a shaft detachably mounted in said inner shell, substantially as described.

5. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with means for rotating said warper beam and cap, substantially as described.

6. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with a shaft detachably mounted in said inner shell, and means for rotating said warper beam and cap, substantially as described.

7. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof, a closed tank mounted in said vat, a hollow warper beam adapted to have yarn wound thereover, and means for forcing dye liquor from said well through the yarn on said warper beam, substantially as described.

8. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof, a closed tank mounted in said vat, a hollow warper beam adapted to have yarn wound thereover, means for forcing dye liquor from said well through the yarn on said warper beam, and means for forcing compressed air through the yarn on said warper beam, substantially as described.

9. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof, a closed tank mounted in said vat, a hollow warper beam provided with a closed shell, with slats secured on said shell adapted to have yarn wound thereover, and means for forcing liquid into the passages between said slats and through the yarn on said warper beam, substantially as described.

10. A dyeing apparatus, comprising a vat having a well or sink in the bottom thereof,

a closed tank mounted in said vat, a hollow warper beam provided with a closed shell, with slats secured on said shell adapted to have yarn wound thereover, means for detachably mounting said warper beam in said tank, and means for forcing liquid into the passages between said slats and through the yarn on said warper beam, substantially as described.

11. A dyeing apparatus, comprising a closed tank, a hollow warper beam having a closed inner shell with slats secured thereon, said slats being adapted to have yarn wound thereover, means for detachably mounting said warper beam in said tank, means for forcing liquid through the passages between the slats and through the yarn on said warper beam in reverse directions, and means for simultaneously rotating said warper beam, substantially as described.

12. A dyeing apparatus, comprising a vat provided with a well projecting below the inner bottom thereof and means for drawing off the dye liquor from said well, means for heating the dye liquor in said well, a closed tank provided with a removable top mounted in said vat, a hollow warper beam for the yarn detachably mounted in said tank, means for rotating said warper beam while mounted in said tank, and means for forcing dye liquor in reverse directions through said warper beam, and for forcing washing fluid through the yarn on said beam, substantially as and for the purpose described.

13. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the

spaces between said slats, substantially as described.

14. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with a shaft detachably mounted in said inner shell, substantially as described.

15. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed hollow inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with means for rotating said warper beam and cap, substantially as described.

16. A warper beam provided with annular heads, one head being imperforate and the other perforated, a closed inner shell, slats secured on said shell on which the yarn is to be wound, in combination with a hollow cap secured over said perforated head and adapted to permit the passage through said cap of fluid into the spaces between said slats, with a shaft detachably mounted in said inner shell, and means for rotating said warper beam and cap, substantially as described.

In testimony whereof, we affix our signatures, in presence of two witnesses.

JESSE M. PAYNE.
GEORGE G. WALLACE.

Witnesses:

CHAS. HECKMAN,
A. S. BRADLEY.