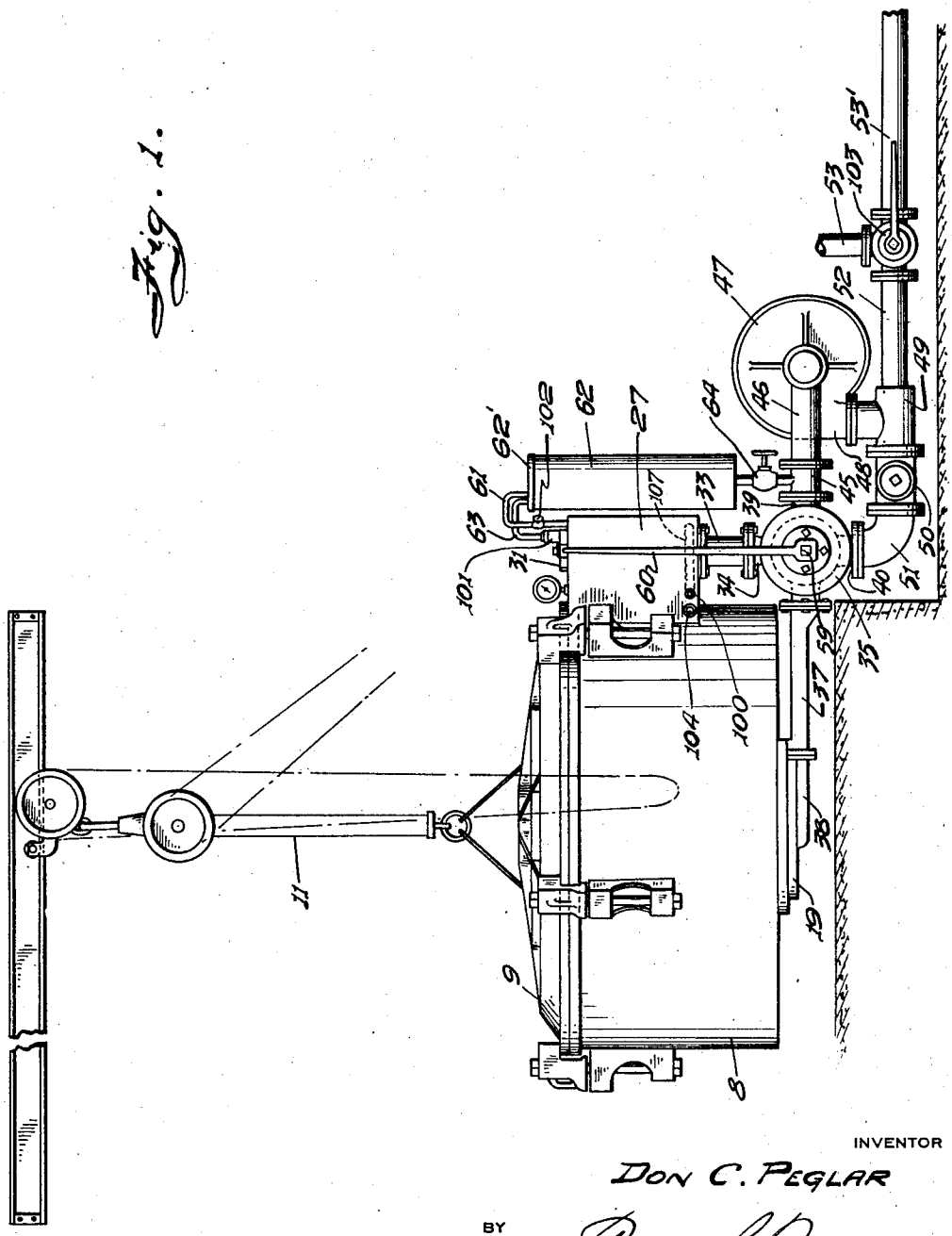
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DYEING MACHINE

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Fig. 1.



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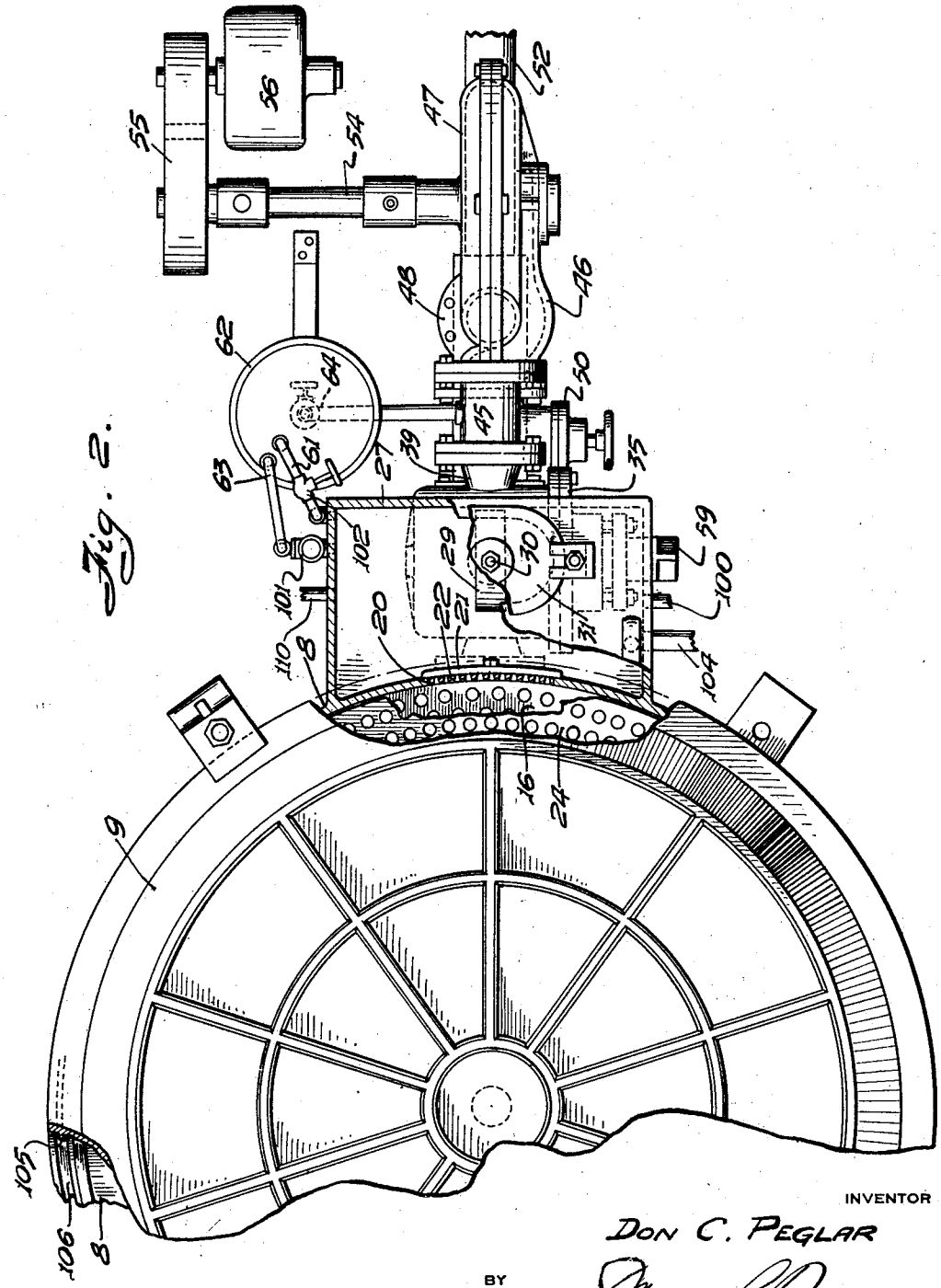


Fig. 2.

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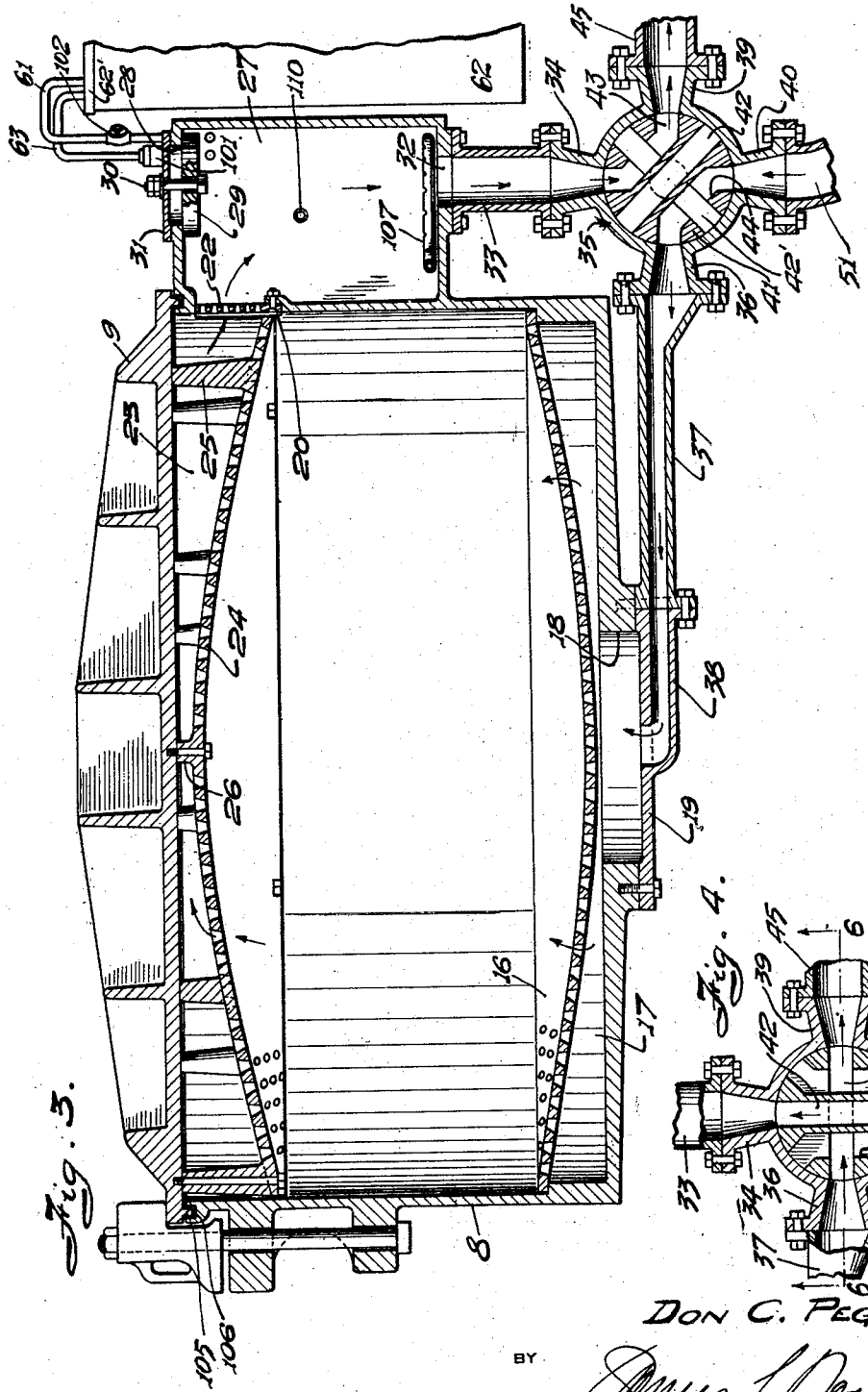


Fig. 3.

Fig. 4.

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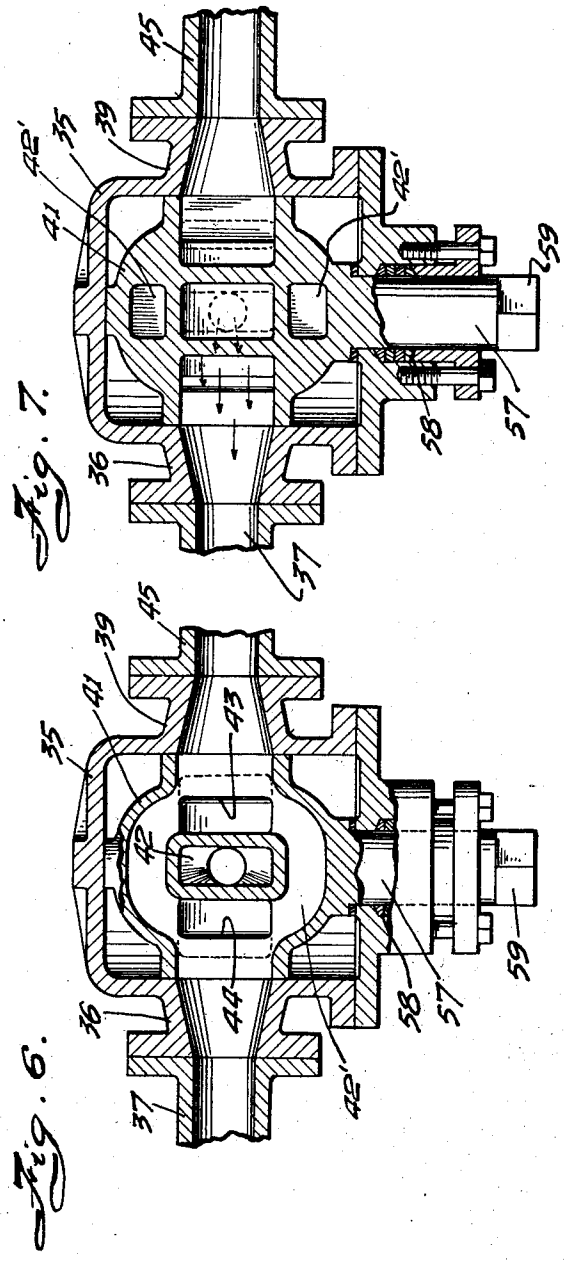


Fig. 7.

Fig. 6.

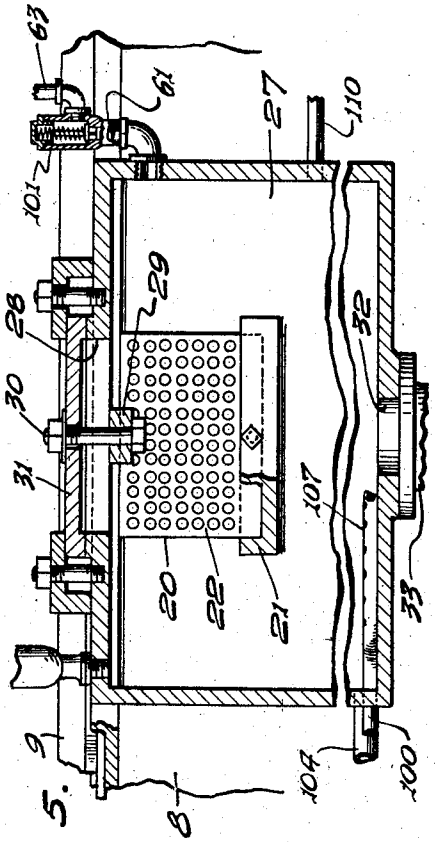


Fig. 5.

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UNITED STATES PATENT OFFICE

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DYEING MACHINE

Application filed November 13, 1929. Serial No. 406,937.

This invention relates to dyeing apparatus and is particularly designed for the dyeing of masses of raw fiber such as cotton or wool. The invention is an improvement of that type of apparatus set forth in the United States Patent 723,795.

One of the objects of the invention is the provision of a circulation system for the dye-liquor by which the flow of said liquor through the mass to be dyed may be reversed at the will of the operator.

Another object of the invention is to provide, in a system of the type described, a tank for the reception of the mass of fibers, the walls of which are so disposed as to exert a compression upon the mass, somewhat greater near the peripheral portions thereof than elsewhere, whereby the mass is somewhat compacted against the sides of the tank in order to prevent channeling of the dye-liquor, that is, the choosing by said dye-liquor of the path of least resistance, which in the older device was between the mass of fibers and the side wall of the tank, instead of through said mass.

Still another object of the invention is to provide a system in which the circulation is maintained by a pump, uni-directional in its operation, with a valve in said system by means of which the direction of circulation of the dye-liquor through said tank may be reversed without interrupting the operation of the pump.

A more specific object of the invention is the construction of a tank for receiving the mass of fibers to be dyed in which upper and lower dished plates are provided with their concave faces disposed toward the space to be occupied by the mass to be dyed, said plates being perforate and defining respectively above and below them, chambers in the tank from which the mass to be dyed is excluded, said chambers and the perforations in said plates promoting the distribution and circulation of the dye-liquor through the mass.

Another specific object of the invention is the provision, in such a system as has been above described, of a steam chest in which steam is brought into open contact with the dye-liquor for heating the same and maintaining it heated during the period of its circulation, said steam chest being in communication with the said upper chamber of the tank and also, by way of a reverse valve, with the lower chamber, so that the circulating liquor regardless of its direction of flow, will pass through the steam chest to be heated.

Another object of the invention is to provide an expansion tank into which steam and dye-liquor may pass from the steam chest, at times and upon occasions as will hereinafter be explained, said expansion tank being connected into this system so that any accumulation of dye-liquor in said tank may be discharged into said system when desired.

The invention further contemplates the provision of means by which the dye-liquor may be pumped selectively out of the system into a storage tank for future use, or into the sewer.

Other objects of the invention which include also the specific form of reverse valve, will be disclosed as the following description of a preferred embodiment of the invention proceeds.

In the drawings:—

Fig. 1 is a side elevation of apparatus embodying the system of the present invention.

Fig. 2 is in the main, a plan view of the apparatus, a part being broken away, and part being shown in section.

Fig. 3 is a vertical section through the tank and its appurtenant connections.

Fig. 4 is a transverse section through the reverse valve, showing it in a different position from that shown in Fig. 3.

Fig. 5 is a vertical section through the steam chest.

Figs. 6 and 7 are sections, through the reverse valve taken at right angles to one another in planes embracing the axis of said valve.

Referring now in detail to the several figures and first adverting to the complete system shown in Fig. 1, the numeral 8 represents the tank in which the dyeing operation is carried out. This tank has a massive cover 9 which fits in sealing relation to said tank and is conveniently lifted by the hoist 11 when it

is desired to open the tank for the purpose of filling it or removing its contents.

A steam chest 27 is mounted adjacent one side of the tank 8 to which steam is admitted through a suitable pipe 100, from any source.

The steam chest communicates with the tank 8 through a grating 22 which can be observed in Fig. 3.

The bottom of the tank and the lower part of the steam chest are connected respectively by means including the conduits 37 and 33 and reverse valve 35 with a pump 47. The shaft 54 of this pump is driven by any suitable source of power, for instance the motor 56 through gearing 55, as shown in Fig. 2. The induction and eduction sides of the pump are connected, respectively, to the valve 35 by conduits 46 and 51. The reverse valve 35, which will be described in detail later, is of such form that it may be positioned to place the conduit 33 in communication with the conduit 46 and the conduit 37 in communication with the conduit 51, as shown in Figure 3, or to place the conduit 33 in communication with the conduit 51 and the conduit 37 in communication with the conduit 46, as shown in Figure 4. So that in one position of the said valve the conduit 33 communicates with the induction side of the pump while in another position of said valve the conduit 37 is connected to the pump intake. In this manner reversal of the direction of flow through steam chest and tank is effected. A valve 50 is interposed between the outlet 48 of the pump and the conduit 51 for a purpose to appear later.

An expansion tank 62, shown as closed by a cover 62′ but which may be open at the top, is provided, and pipes 61 and 63 lead from the upper part of the steam chest 27 into said expansion tank. These pipes perform functions which might be performed by a single pipe but the use of two pipes is preferable. One pipe, for instance the pipe 63, is provided, as shown best in Figures 1, 2 and 5, with a relief valve 101 which opens only when a predetermined safety limit of pressure has developed in the tank 8 and steam chest, as will be explained later. The pipe 61 is controlled by a pressure bleed valve 102 which is normally open sufficiently to relieve pressure incident to the normal working of the apparatus.

Fig. 1 shows also a pipe 52 having one end connected by a T-coupling 49 to the outlet 48 of the pump 47 and its other end connected to a two-way valve 103 which has two branches 53 and 53′ the former leading to a storage tank, not shown, and the other leading to the sewer or similar outlet.

When the pump 47 is to discharge into storage tank or sewer, the valve 50 in the conduit 51 is closed so as to interrupt the circulation of the liquor through the tank 8. Whether the dye-liquor shall be stored or discharged into the sewer depends upon whether the valve 103 is positioned to connect the pipe 52 with the branch 53 or with the branch 53′.

Fig. 1 shows a valve 64 connecting the expansion tank 62 to a coupling 45 which extends between the discharge side of the pump 47 and the valve 35 and this figure also indicates clamping means, for holding down the cover 9 in steam tight relation.

It will presently be explained that it is desirable at times to use compressed air to evacuate the dye-liquor from the mass in the tank 8. For this purpose a pipe 110 is provided for admitting compressed air to the steam chest.

The general lay-out of the apparatus and the purpose of its principal units having now been briefly touched upon, the detailed construction will be seen in the other figures.

For instance, in Fig. 3 the tank 8 is shown as provided with removable bottom plate 16 resting upon a shoulder extending around the tank 8 a short distance from the bottom. The plate 16 is dished and has its concave side directed toward the space which is to be occupied by the mass to be dyed, said plate being perforated substantially over its whole extent. This plate defines between itself and the bottom wall of the tank a lower chamber 17 from which the fibrous mass is excluded. This chamber communicates by way of a drainage sump 18 and a fitting 19 with the conduit 37 included in one side of the circulation system. The cover 9 supports, in spaced relation by means, such as the bosses 25, a plate 24 similar to the plate 16 which has its concave side also directed toward the space to be occupied by the fibrous mass. The cover 9 and the plate 24 define an upper chamber 23, from which the fibrous mass is likewise excluded. Said cover presses down upon the mass to be dyed and, on account of the concave shape of the upper and lower plates, the fibrous mass is compacted slightly more at its sides than at its center, effectively preventing the formation, between the side walls of the tank and the mass to be dyed, channels through which the dye-liquor might by-pass.

The cover 9 has a depending annular flange 105, which, when the cover is in place, rests within a packing groove 106 formed at the top peripheral portion of the tank 8.

The steam chest 27 is preferably integral with the tank 8 but this is not an essential relation. The steam chest communicates with the upper chamber 23 by means of the grid 22. Steam is admitted to the steam chest, as has been stated, through the pipe 100 and a perforated coil 107 disposed in the lower part of said chest and passes upwardly through the dye liquor in the steam chest.

The reverse valve includes a casing 35 having four nipples 34, 39, 40 and 36, the nipples 34 and 36 being connected respec-

tively to the upper chamber 23 of the tank through the steam chest and conduit 33, and to the lower chamber of the tank through the conduit 37 and the nipples 39 and 40 being connected respectively with the induction and eduction sides of the pump. The valve has a barrel 41 rotatable by means of a shaft 59 and handle 60 within the casing. This barrel is of somewhat peculiar construction, since it has a diametrical passage 42 rotatable in a plane embracing the four nipples of the casing and another diametrical passage 42′ the ends of which are in the same plane as the ends of the passage 42 and having intermediate parts bent out of said plane in a general U-shape so as to avoid intersecting the passage 42. The passage 42′ is therefore trident shaped on opposite sides of the valve barrel for the purpose of making the necessary simultaneous connections with the several limbs of the circulation system. It will suffice, for the purpose of explaining this invention to state that, when the valve is in the position shown in Fig. 3, the flow of dye-liquor induced by the operation of the pump passes by way of the conduit 51, into the nipple 40, valve passage 44, out of the nipple 36, into the conduit 37, into the lower chamber 17 of the tank 8, through the perforations in the plate 16, through the mass of material to be dyed, through the perforations in the upper plate 24, through the upper chamber 23, through the grid 22, into the steam chest 27, through the conduit 33, and nipple 34, through the passage 43, out of the nipple 39, and through the conduit 45 to the induction side of the pump.

In this case the flow of dye-liquor through the mass in the tank 8 is in an upward direction.

When the valve is in the position shown in Fig. 4, the circulation of the dye-liquor is from the conduit 51, through the nipple 40, passage 42, nipple 34, through the conduit 33, steam chest 27, (grid 22, upper chamber 23, perforations in the plate 24, downward through the mass to be dyed, and back through the perforations in the plate 16, into the chamber 17, returning by way of the sump 18, the conduit 37, through the nipple 36, the passage 42′, the nipple 39, and the pipe 45 back to the inlet of the pump.

It will be noted that the reversal in the direction of flow is accomplished solely by manipulation of the valve 35 without disturbing the continuous uni-directional operation of the pump.

It will be readily understood that the upper and lower chambers 23 and 17 provide for a uniform distribution of the dye-liquor both above and below the mass to be dyed, and that the perforations in the plates 16 and 24 permit uniform percolation of the fiber by the dye-liquor irrespective of the direction in which the dye-liquor moves. It is clear also that a more even dyeing effect throughout the whole mass is produced by reversing the flow of dye-liquor than can be produced in the apparatus disclosed in the patent hereinbefore referred to, wherein the dye-liquor circulates in only one direction.

The steam which enters the dye-liquor in the steam chest for heating purposes charges the liquor with steam, some of which escapes and would accumulate in the upper portion of the steam chest and in the upper chamber 23 of the tank, thus building up a back pressure and lowering the level of dye-liquor in said tank if means were not provided for its escape. The means shown for this purpose consists of the pipe 61 controlled by the valve 102, which valve is normally open just enough to permit the proper amount of steam to escape. This could be permitted to discharge into the open air, but since there is a certain amount of ebullition in the steam tank some of the dye-liquor is frequently discharged with the steam, so that the provision of the expansion tank 62 is found advantageous. It will be readily understood that when the flow of dye-liquor from the steam chest is downward, the steam with which it becomes charged in the steam chest generally condenses while the dye-liquor is passing upward through the mass in the tank 8 so that provision for the normal escape of steam is not so important. But when the flow of dye liquor is upward through the steam chest there is opportunity for the steam to escape from the dye-liquor before the latter has begun to percolate the mass in the tank 8 so that provision must be made for the relief of such steam in this phase of operation of the apparatus. Furthermore, when the steam chest is connected to the eduction side of the pump there is a building up of liquid pressure in the steam chest and upper chamber 23 of tank 8, which pressure is relieved by the discharge of some of the dye-liquor through the pipe 61 into the expansion tank 62.

As a measure of safety, to prevent an excessive static pressure in the tank 8 which might occur through excessive speed of rotation of the pump, the admission of steam at too high a pressure, undue compactness in the mass to be dyed, or from other causes, the pipe 63 is provided with a relief valve 101 which can be set to open automatically at any desired pressure, for instance 10 pounds, and discharge steam or dye-liquor into the expansion tank. As has already been noted, the expansion tank can be emptied into the system by opening the valve 64.

The expansion tank is also useful as a receptacle for concentrated dye solution which may be admitted from time to time into the circulation system to renew the strength of the circulating liquor, the main body of which

is normally admitted by the pipe 104, directly into the steam chest.

Fig. 3 shows that access may be had to the interior of the steam chest by means of a cover plate 31 held in place by a bolt 30 reacting against an underlying spider 29.

When the dyeing operation has been completed the dye liquor, if it is to be used again, is pumped through the pipe 52, valve 103 and branch 53 into the storage tank, or if spent is pumped through the pipe 52, valve 103 and branch 53′ into the sewer in the manner heretofore described. This of course leaves the mass of material within the tank 8 in saturated condition. This material may then be brought to a state of comparative dryness by admitting compressed air through the pipe 110 into the steam chest and upper chamber 23 and at the same time leaving the lower chamber 17 vented to the sewer. The compressed air descends through the mass of fibers in the manner of a fluid piston, driving before it the greater proportion of the retained dye-liquor so that the mass is reduced to a merely moist condition.

While I have in the above disclosure described what I believe to be a preferred practical form of the invention, it is to be understood that the details of construction are merely by way of example and not limitative and that the scope of the invention is to be measured by a fair interpretation of the terms of the appended claims.

1. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a removable cover for said tank, upper and lower perforate plates within said tank dividing the interior of said tank into upper, lower and middle chambers the latter being for receiving the mass to be dyed in compressed relation by the said plates, said upper plate being carried by said cover in spaced relation thereto, a pump, conduits connecting said pump with said upper and lower chambers, means for reversing the flow of dye-liquor through said tank, said upper conduit including a steam chest to which steam is admitted into contact with said dye-liquor for heating the same and an expansion tank connected at the top with said steam chest and at the bottom with said system on the induction side of the pump.

2. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a steam chest forming part of said circulation system and communicating with said tank, an expansion tank, a conduit leading from said steam chest to said expansion tank and a safety valve in said conduit.

3. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a steam chest forming part of said circulation system and communicating with said tank, an expansion tank, means for admitting steam to said steam chest and means putting said steam chest in communication with said expansion tank, said means including a normally open bleed valve and a normally closed safety valve.

4. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a steam chest forming part of said circulation system, communicating with said tank, a pump connected with said tank on one side through said steam chest, a valve for reversing the direction of flow of dye-liquor through said steam chest and tank, an expansion tank, means affording valve controlled communication between said steam chest and expansion tank, the latter being in valve controlled communication with said circulation system between said reverse valve and pump.

5. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a steam chest forming part of said circulation system, communicating with said tank, a pump connected with said tank on one side through said steam chest, a valve for reversing the direction of flow of dye-liquor through said steam chest and tank, an expansion tank, means affording valve controlled communication between said steam chest and expansion tank, the latter being in valve controlled communication with said circulation system between said reverse valve and pump, a discharge conduit on the eduction side of said pump and a valve in said discharge conduit selectively diverting the discharged dye-liquor to a storage tank or to a waste outlet.

6. Dyeing apparatus comprising a circulation system for dye-liquor including a tank, a steam chest forming part of said circulation system communicating with the upper part of said tank, a pump for promoting circulation through said system, an expansion tank, means for admitting steam to said steam chest, valve controlled means of communication between said steam chest and expansion tank, a valve for reversing the direction of circulation of dye-liquor through said tank, a valve controlled waste conduit and means for driving the dye-liquor from the mass to be dyed which is in said tank, comprising a conduit for admitting compressed air to said steam chest.

In testimony whereof I have hereunto set my hand.

DON C. PEGLAR.