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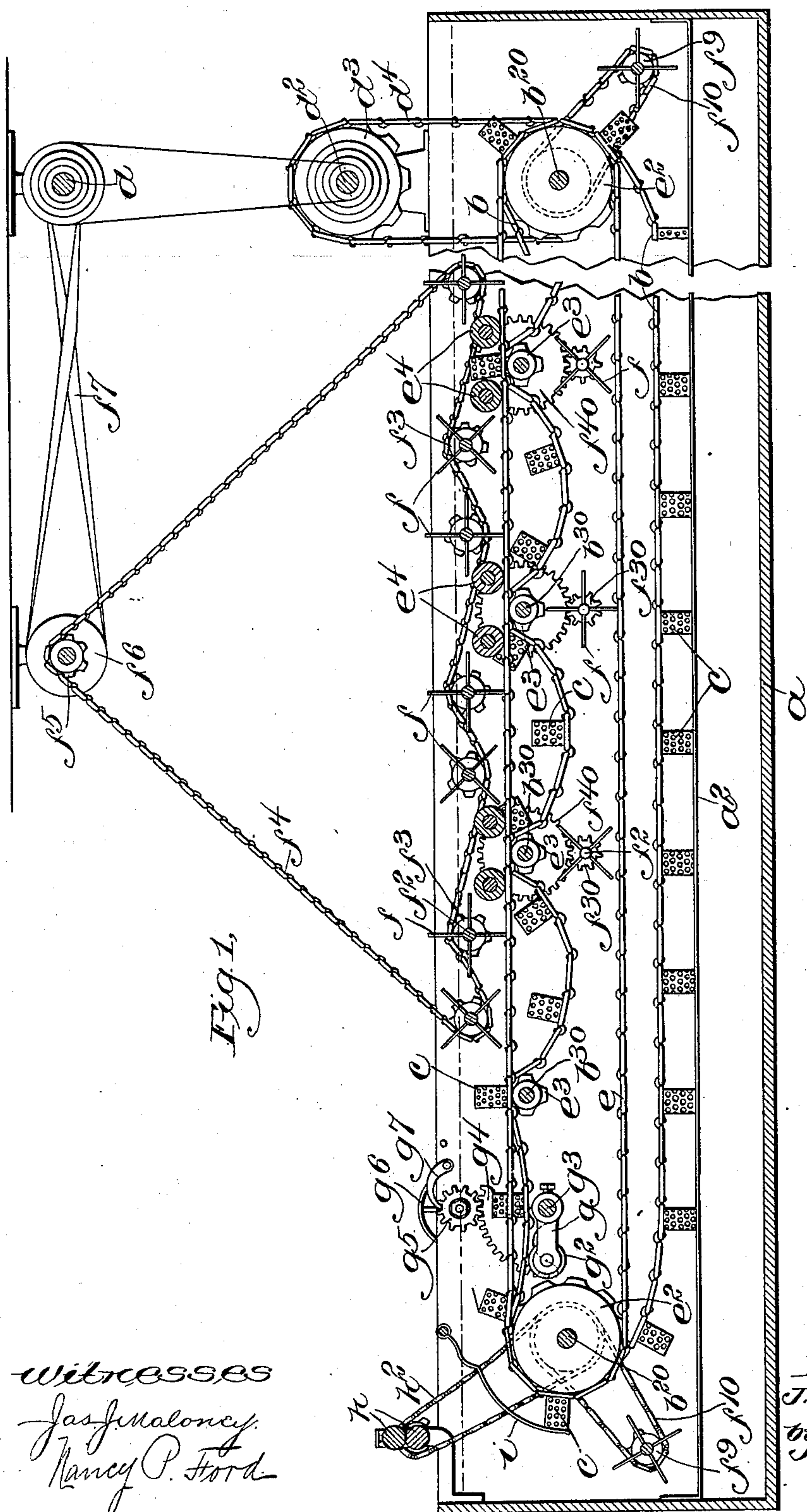
Patented Sept. 4, 1900.

J. C. THICKINS.
APPARATUS FOR DYEING.

(Application filed Jan. 8, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
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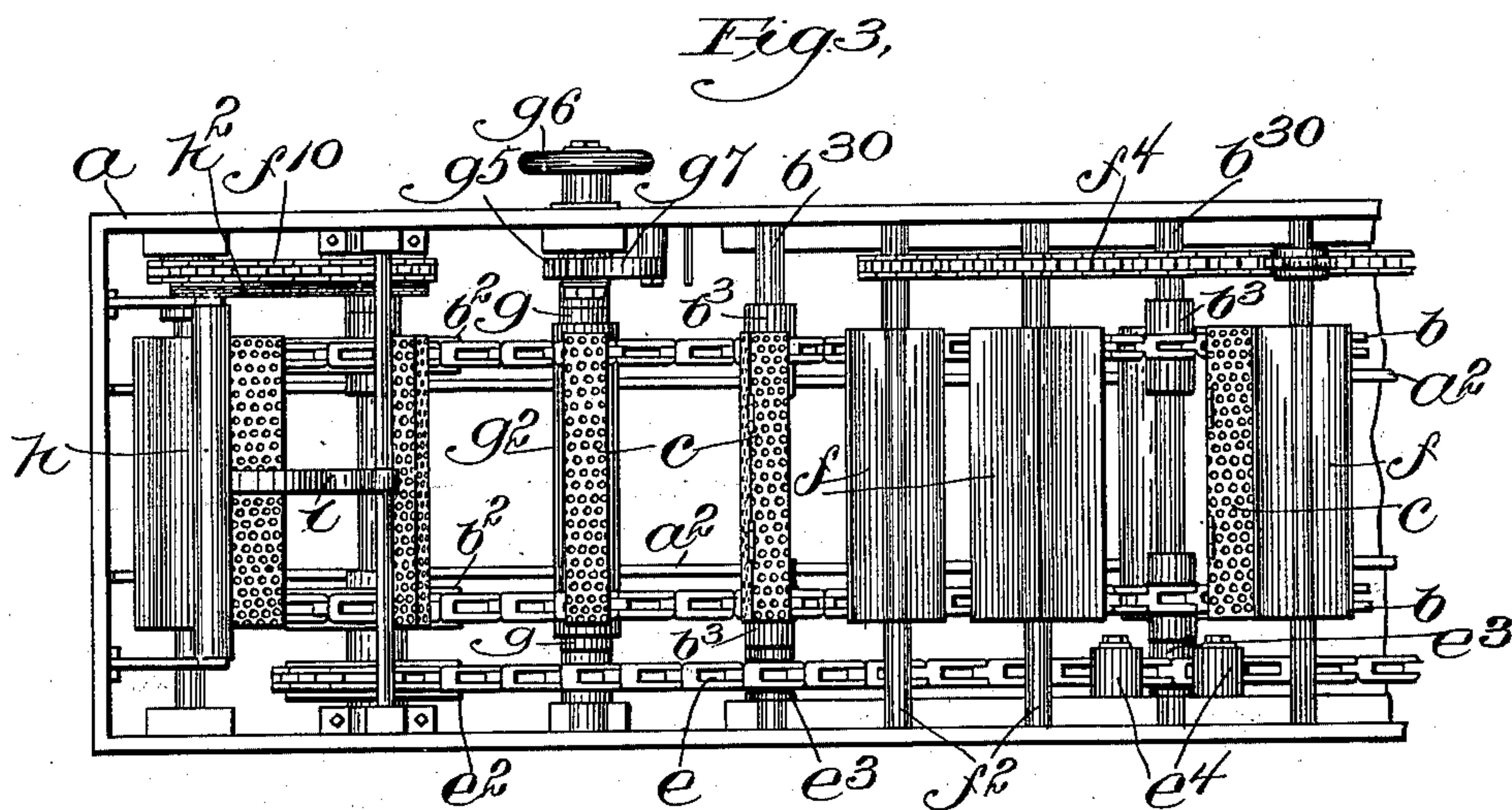
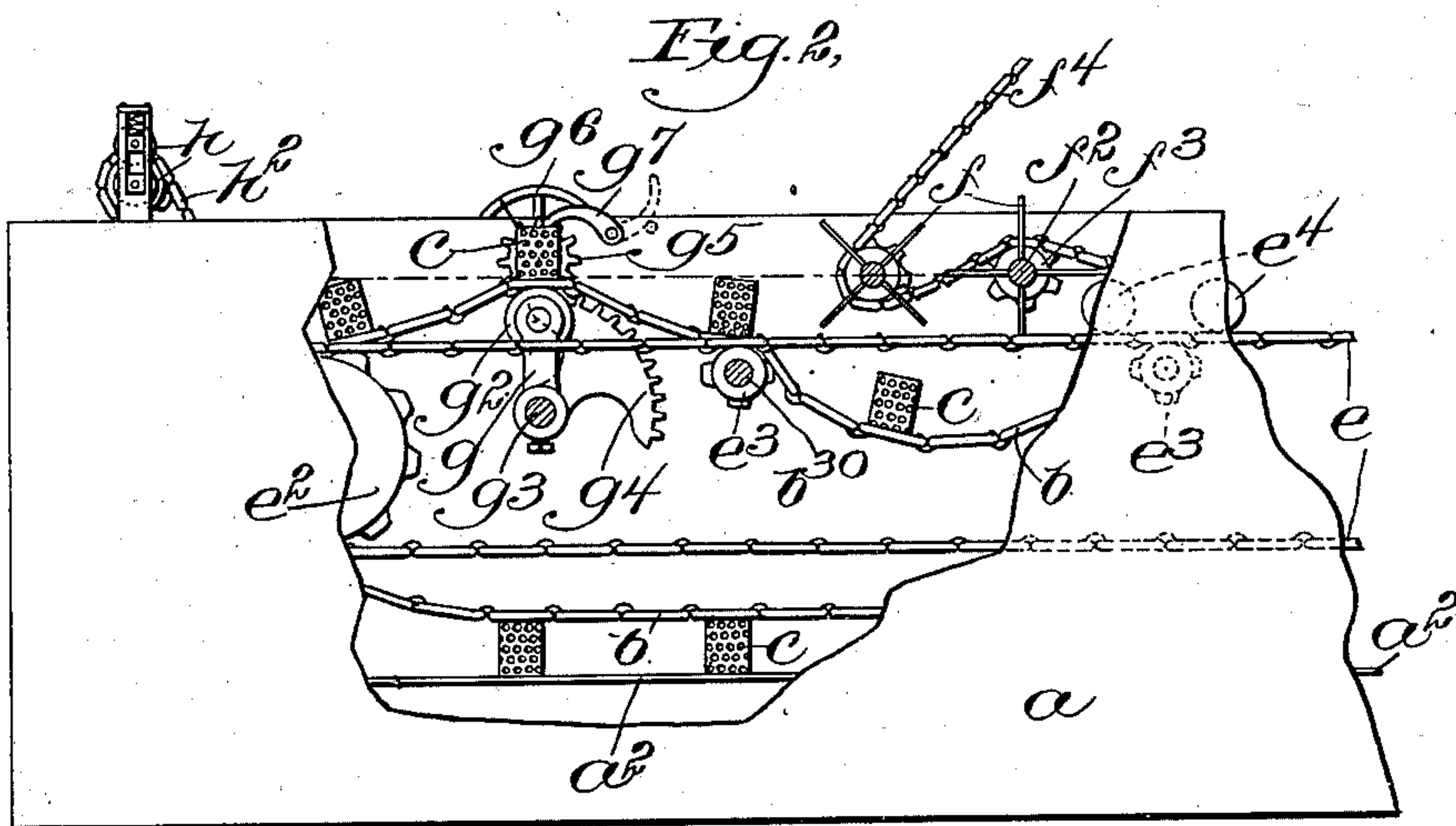
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2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

JOHN C. THICKINS, OF PITTSFIELD, MASSACHUSETTS.

APPARATUS FOR DYEING.

SPECIFICATION forming part of Letters Patent No. 657,323, dated September 4, 1900.

Application filed January 8, 1900. Serial No. 717. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. THICKINS, of Pittsfield, county of Berkshire, and State of Massachusetts, have invented an Improvement in Dyeing Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

10 The present invention relates to an apparatus for dyeing wool, yarn, or other material, the object being to obtain uniformity in the dyeing process and also to save time and manual labor.

15 In the use of many of the dyeing materials, indigo especially, it is necessary that the material to be dyed should be wholly submerged in the liquid for a certain length of time and the whole piece or lot of material taken out
20 of the liquid at once, since the rapid oxidation of the dye causes a variation in shade if part is exposed to the air while another part is still submerged. If every skein of yarn or other lot of material or fabric to be dyed
25 is not kept in the liquid during the same length of time, there will be variations in the shade of color in the different lots, so that there will be a lack of uniformity, which is detrimental. Furthermore, if the material
30 to be dyed is taken out of the liquid during the dyeing process and again submerged or a part of a certain lot exposed to the air while the rest of the same lot remains submerged there are likely to be variations in the shade
35 of color owing to the rapid oxidation of the dye. When, therefore, the judgment of the operative is relied upon, as in the hand dipping process, it is practically impossible to secure absolute uniformity in shade.

40 To accomplish the results desired, the apparatus embodying the present invention is provided with a conveyer for the material to be dyed, the said conveyer being normally wholly submerged in the dyeing liquid and
45 so arranged as to receive a number of skeins of yarn or lots of material, each of which at a predetermined point in the travel of the conveyer can be rapidly lifted out of the liquid, so that the whole skein is exposed to the
50 air at substantially the same time and can be removed from the conveyer and subjected

without delay to the squeezing process to express the excess of liquid.

A further feature of the invention is embodied in means for causing the retaining devices or receptacles for the material to have
55 an oscillating or rocking movement as they are carried along through the dyeing liquid, this being preferably accomplished by so arranging the conveyer-chain that it will hang
60 slack between adjacent supports throughout the vat, so that as the said conveyer travels over the said supports each retaining device will be tipped first in one direction and then
65 in the other owing to the curved path followed by the chain.

The supports for the conveyer are preferably sprockets, and in order to keep the said conveyer slack between adjacent supports
70 the said sprockets may be driven by an independent drive-chain which has no corresponding slack, but is adapted to engage with each of the said sprockets, so that they will all travel at the same rate of speed, thus maintaining the uniformity of slack or sag in the
75 conveyer or chain.

For the purpose of obtaining a better distribution of the fluid through the material carried by the conveyer the vat is provided
80 along the upper portion thereof with a series of paddles, which are preferably so arranged that there are three paddles triangularly arranged with relation to each support, the said
85 paddles having driving mechanism which causes them to travel in such a way as to set up currents of liquid toward the receptacles or retaining devices as the same travel over the supports.

Near the bottom of the tank or vat there are supporting bars or tracks along which the
90 conveyer or the receptacles connected therewith travel, the said tracks preventing the receptacles from sagging too far and maintaining the same at a uniform level above the bottom of the tank. By this device the said
95 receptacles are always kept at too high a level to pass through the sediment which collects at the bottom of the tank, so that the material to be dyed is always subjected to the action of the clear liquid. Since the articles are fed at the top, they are first subjected
100 to the action of the paddles, which are high

enough in the vat to avoid disturbing any sediment at the bottom, the liquid thus being caused to thoroughly permeate the material as the same is traveling from one end of the tank to the other, and in traveling back below the said material is still subjected to the action of the liquid but without any additional current set up by the paddles, so that while it is still undergoing the dyeing process there is no danger of unevenness, as would be the case if the sediment were stirred up.

To supply material to be dyed and to remove such material after the process is finished, the conveyer is arranged to be bodily lifted at a certain point or points in its travel so as to expose one lot only of the material while the other lots remain submerged, so that the said lot of material can be removed from the conveyer and a new lot placed therein without interrupting the travel of the conveyer. The result is therefore that if the conveyer travels at a uniform rate of speed each lot of material subjected to the process will receive the same treatment as every other lot, so that substantial uniformity is assured.

Figure 1 is a longitudinal vertical section of an apparatus embodying the invention, the said apparatus being shown as broken in order that the essential parts may be shown on a larger scale. Fig. 2 is a partial side elevation with a part of the wall of the vat broken away to show the conveyer, &c., the lifting mechanism being shown in operation; and Fig. 3 is a partial top plan view.

The material to be dyed is adapted to be carried along submerged in dyeing liquid contained in a vat *a* of considerable length, the said vat being normally filled with dyeing liquid up to the level of the dotted line, Figs. 1 and 2. To carry the material through the liquid, the apparatus is provided with a conveyer *b*, herein shown as an endless chain traveling over a sprocket *b*² and a similar sprocket at the opposite end (not shown) and supported at intervals by intermediate sprockets, the hubs of which are indicated by the reference-letter *b*³, Fig. 3. The said conveyer is provided with retaining devices or receptacles *c*, herein shown as perforated boxes connected at intervals with said conveyer, the preferred construction being such that there are two endless chains *b*, one near each side of the vat, as shown in Fig. 3, while the receptacles *c* extend from one chain to the other, certain of the links being provided with wings which afford supports for the receptacles. The sprockets *b*² and the intermediate sprockets *b*³ are similarly duplicated and mounted on transverse shafts *b*²⁰ and *b*³⁰, respectively, which have suitable bearings supported by the walls of the vat.

The conveyer is arranged to be driven from a shaft *d*, which is shown as belted to a counter-shaft *d*², provided with a sprocket-wheel *d*³, having a sprocket-chain *d*⁴, which also runs over a sprocket mounted on one of the

shafts *b*²⁰, which carries the mate to the sprocket-wheel *b*². In order, however, to give the retaining devices or receptacles an oscillating or rocking movement as they travel along through the liquid, the conveyer *b* is arranged to hang slack between the adjacent supporting-sprockets therefor, and in order that the amount of slack may be uniform throughout the device is provided with an independent drive-chain *e*, which connects the shafts *b*²⁰ by means of sprockets *e*² and meshes with suitable sprockets *e*³ along the several shafts which carry the intermeshing sprockets, so that the said shafts will be kept in uniform rotation, thereby maintaining the same amount of slack in the conveyer-chain between adjacent sprockets.

In order to prevent the drive-chain *e* from slipping over the teeth on the sprockets *e*³, as might occur if the conveyer-chain were unbalanced, so as to pull one way or the other upon any of the supporting-sprockets concentric therewith, the apparatus is provided with retaining devices *e*⁴, which are shown as consisting of rollers mounted on suitable bearings along the wall of the vat, the said rollers projecting over and bearing upon the drive-chain *e* only and being situated one at each side of each of the sprockets *e*³. These rollers serve to hold the drive-chain down upon the sprockets, so that the parts cannot get out of mesh, it being obvious, therefore, that the sag of the conveyer-chain between adjacent sprockets will always be uniform, since there is no tendency for the said conveyer-chain to slip because of its weight and that of the material carried upon it.

It will be seen from the foregoing description that the material to be dyed when once placed in one of the retaining devices or receptacles will be carried along from one end of the vat to the other with a rocking or oscillating movement which causes the dyeing liquid to thoroughly permeate the same, this action taking place near the upper level, where the liquid is clearest and most free from sediment. In order to better effect the thorough permeation of the material by the liquid, the machine, in accordance with the invention, is provided with a series of agitating devices or paddles *f*, each of the said paddles being shown as comprising several radial blades mounted on a transverse shaft *f*², arranged to be rotated in the liquid during the travel of the conveyer therethrough. The said paddles are preferably arranged, as shown, to set up converging currents at the points where the retaining devices travel over the intermediate supporting-sprockets, and, as herein shown, each of said sprockets has adjacent to it three of such paddles triangularly arranged and adapted to rotate in such a direction as to continually throw the liquid toward the retaining devices, the material being subjected to the currents of liquid as it approaches, passes over, and recedes from the sprocket. The shafts *f*² for the upper

paddles are shown as provided with sprockets f^3 , adapted to be driven by a chain f^4 , which in turn passes over a sprocket f^5 on a suitable shaft provided with a pulley f^6 , connected by a belt f^7 with a pulley upon the shaft d . The said chain, as shown, is carried in a zigzag direction along the several sprockets, engaging the upper side of one and the under side of the next, &c., so that the several paddles are rotated in opposite directions, each pair thus turning so as to force the liquid toward the retaining device between them. The lower paddles are shown as arranged directly below the supporting-sprockets for the conveyer, and are provided with gears f^{30} , meshing with gears f^{40} , which are mounted on the shafts b^{30} , which carry the said supporting-sprockets, the said shafts being uniformly driven, as has been stated, by means of the drive-chain e .

As herein shown, the vat may be provided near its ends with additional agitating devices or paddles somewhat below the main sprockets b^2 , the said paddles being arranged to rotate in such a way as to produce an upward current toward the retaining devices as they pass over the said end sprockets. These paddles are shown as mounted on suitable shafts and provided with sprockets f^9 , driven by chains f^{10} , passing over sprockets (indicated in dotted lines) mounted on the shafts b^{20} .

To support the conveyer as it travels along below the sprockets b^2 , the vat is provided with a track or guide, which may consist of two or more strips a^2 of suitable material extending from one end wall of the vat to the other and so positioned as to engage and support the retaining devices as they travel along. The said support is sufficiently far above the bottom of the vat to clear any sediment which may settle upon the said bottom, so that the material to be dyed is effectually kept from passing through and stirring up the sediment. The line of retaining devices, moreover, extending along the said support serves to break up the current produced by the agitating devices, so that the liquid at the bottom of the tank is not affected thereby and the sediment not stirred up.

It will be seen from the foregoing description that the material contained in the receptacles along the conveyer will be carried along by the said conveyer wholly submerged in the dyeing liquid, and as it travels along through the upper part of the liquid will not only be rocked or oscillated in the liquid so as to be subjected to the action thereof to the best advantage, but will also have the liquid forced toward it in converging currents, so as to insure a thorough permeation by the liquid of the whole of the material. As it travels back in the lower portion of the tank, moreover, it is held up away from the part where the sediment collects, and as each receptacle travels through at the same rate of speed each bunch of material is subjected to precisely the same action.

In feeding the apparatus it is essential, in order to obtain good results, to insert each bunch of material at the same point in the travel of the conveyer, so that each bunch will be submerged in the liquid as long as every other bunch and no longer, and it is desirable, moreover, that the material should be promptly submerged when first fed to the machine and promptly taken out when the dyeing operation is finished. To accomplish this, the apparatus is provided with means for lifting the conveyer-chain or the receptacle carried thereby above the level of the liquid at a certain predetermined point or points in the travel of the conveyer, the said conveyer being herein shown as arranged to travel over a lifting device g , shown as arms provided with a roller g^2 to engage the under side of the conveyer-chain, the said arm being connected with a shaft g^3 , which is adapted to be rotated by the operator to lift the roll g^2 and the conveyer which travels over the same. As herein shown, the shaft g^3 is provided with a segmental gear g^4 , meshing with a gear-wheel g^5 , mounted on a stub-shaft having a suitable bearing in the wall of the tank and provided with an operating handle or wheel g^6 . By turning the said wheel, therefore, the conveyer at this point can be thrown upward far enough to lift the receptacle thereon above the level of the liquid, so that the operator can open the said receptacle and take out the material which has been operated upon and replace it by new material to be dyed. The gear-wheel g^5 is shown as provided with a retaining-pawl g^7 , which is adapted to hold the said wheel after the lifting device has been moved upward, so that the operator is free to take out the material from the receptacle and replace it. The device may be provided, if desired, with one of these lifting devices at each end, one of which may be used for inserting the material and the other for removing it, so that the said material may be carried one and a half times around, thus being subjected twice to the action of the liquid where the currents are set up by the paddles. By the use of this lifting device the material can be promptly carried out of the liquid, so that there is no substantial interval of time between the exposure of the top of the material and the exposure of the bottom, which might result in a variation of shade, owing to the fact that certain dyes, especially indigo, oxidize with great rapidity. Furthermore, in the case of yarn, for example, the skeins when dyed with this apparatus are transverse to the carrier and not longitudinally inclined with relation to the surface of the liquid as they are drawn upward.

The machine is shown as provided with a pair of squeeze-rolls h adjacent to the lifting device above described, the said squeeze-rolls being conveniently driven by means of a sprocket-chain h^2 and sprocket upon the shaft b^{20} , so that as soon as the material is removed from the retaining device it can be subjected

to the action of the said squeeze-rolls. As herein shown, the retaining devices consist of perforated boxes, each provided with a hinged lid or cover, as indicated at the left of Fig. 1, and in order to insure the closing of the said covers if the operator through carelessness or lack of time fails to see that they are properly closed the machine is provided with a closing device *c*, which is shown as a spring-arm lying in the path of the retaining devices and adapted to engage the cover near the hinged end thereof and close the same down as it passes over the sprockets *b*². A similar device can be provided at the opposite end if the machine is provided with lifting devices at each end of the vat.

I claim—

1. In a dyeing apparatus the combination with a vat to contain the dyeing liquid; of a wholly-submerged conveyer provided with retaining devices for the material to be dyed; means for causing the said conveyer to travel through the liquid; and agitating or stirring devices operating in the liquid to produce currents of liquid toward the said retaining devices at certain points in their travel, as set forth.

2. In a dyeing apparatus, the combination with the vat adapted to contain dyeing liquid; of an endless traveling conveyer wholly submerged in the said liquid; retaining devices connected with said conveyer; and means for producing a rocking or oscillating movement of said devices during the travel of said conveyer, as set forth.

3. In a dyeing apparatus, the combination with a vat containing dyeing liquid; of an endless conveyer wholly submerged in the said liquid; a series of supports for the upper part of the said conveyer which is arranged to hang slack between said supports; receptacles for the material to be dyed connected with said conveyer; and agitating devices adjacent to said supports and arranged to operate in the liquid and set up converging currents of liquid toward the said supports, substantially as described.

4. In a dyeing apparatus, the combination with an endless conveyer extending between a pair of driving-sprockets; a drive-chain for rotating said sprockets; supporting-sprockets for the upper portion of the conveyer which is arranged to hang slack between the said supporting-sprockets; and means for uniformly driving said supporting-sprockets from the drive-chain aforesaid, substantially as described.

5. In a dyeing apparatus, the combination with a pair of sprockets; of a conveyer-chain provided with retaining devices for the material to be dyed and hung loosely over the said sprockets; intermediate supporting-sprockets for the upper portion of the said conveyer-chain; means for uniformly driving

all of said sprockets whereby the slack of the conveyer-chain is maintained uniform; and a support or track in the lower part of the vat for the lower portion of said conveyer-chain to prevent the same from sagging to the bottom of the vat and stirring up the sediment therein, substantially as described.

6. An apparatus for dyeing material such as yarn comprising a receptacle for the dyeing liquid; a conveyer for the material within the said receptacle and wholly submerged in the liquid; retaining devices or receptacles consisting of perforated boxes arranged to be opened for the reception and removal of the material, said boxes being connected with said conveyer; means for moving said conveyer out of the liquid to expose the boxes; and devices for automatically closing the lids of said boxes in the travel of the conveyer, substantially as described.

7. An apparatus for dyeing material such as yarn, comprising a receptacle for the dyeing liquid; a conveyer for the material within said receptacle and wholly submerged in the liquid, and means for moving said conveyer out of the liquid to expose the material at a predetermined point in the travel thereof, substantially as described.

8. A dyeing apparatus comprising a tank or receptacle to contain the dyeing liquid; an endless conveyer normally wholly submerged in the liquid; and means for raising said conveyer above the level of the liquid at a predetermined point in the travel thereof, said conveyer being sufficiently slack to admit of being thus raised, substantially as described.

9. A dyeing apparatus comprising a tank or receptacle to contain the dyeing liquid; an endless conveyer normally wholly submerged in the liquid; means for raising said conveyer above the level of the liquid at a predetermined point in the travel thereof, said conveyer being sufficiently slack to admit of being thus raised; and a supplemental endless driving-chain, as and for the purpose set forth.

10. A dyeing apparatus comprising a tank or receptacle to contain the dyeing liquid; an endless conveyer normally wholly submerged in the liquid; and a vertically-movable support for said conveyer, substantially as described.

11. A dyeing apparatus comprising a tank containing dyeing liquid; a conveyer normally submerged in said liquid; a movable support for said conveyer; and means for locking said support after it has been moved, as set forth.

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

JOHN C. THICKINS.

Witnesses:

JAMES P. CALLISON,
JOHN B. THICKINS.