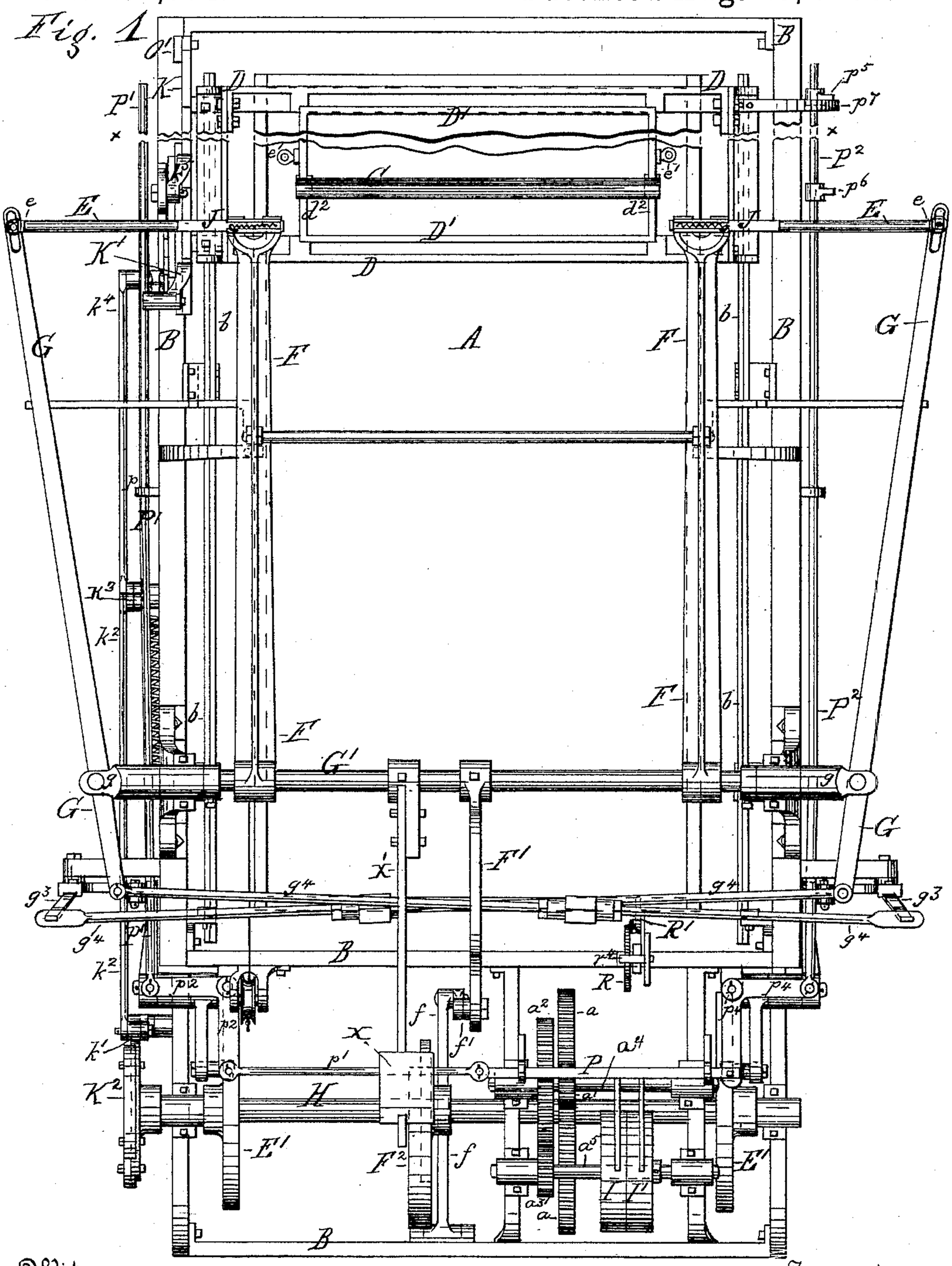
(No Model.) 7 Sheets—Sheet 1.

# L. DUCROS & E. TYMESON.

## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

Fig. 1

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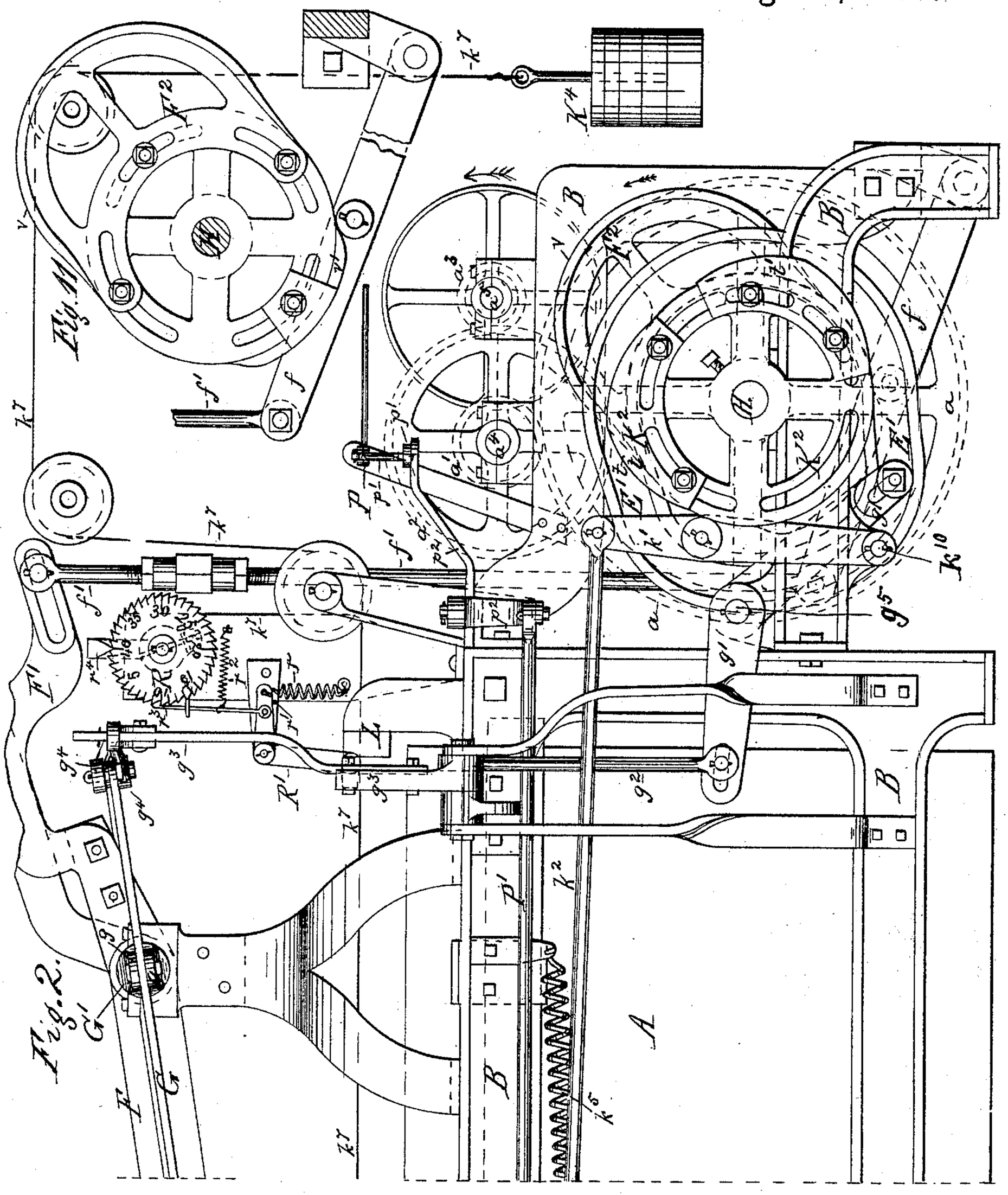
## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.



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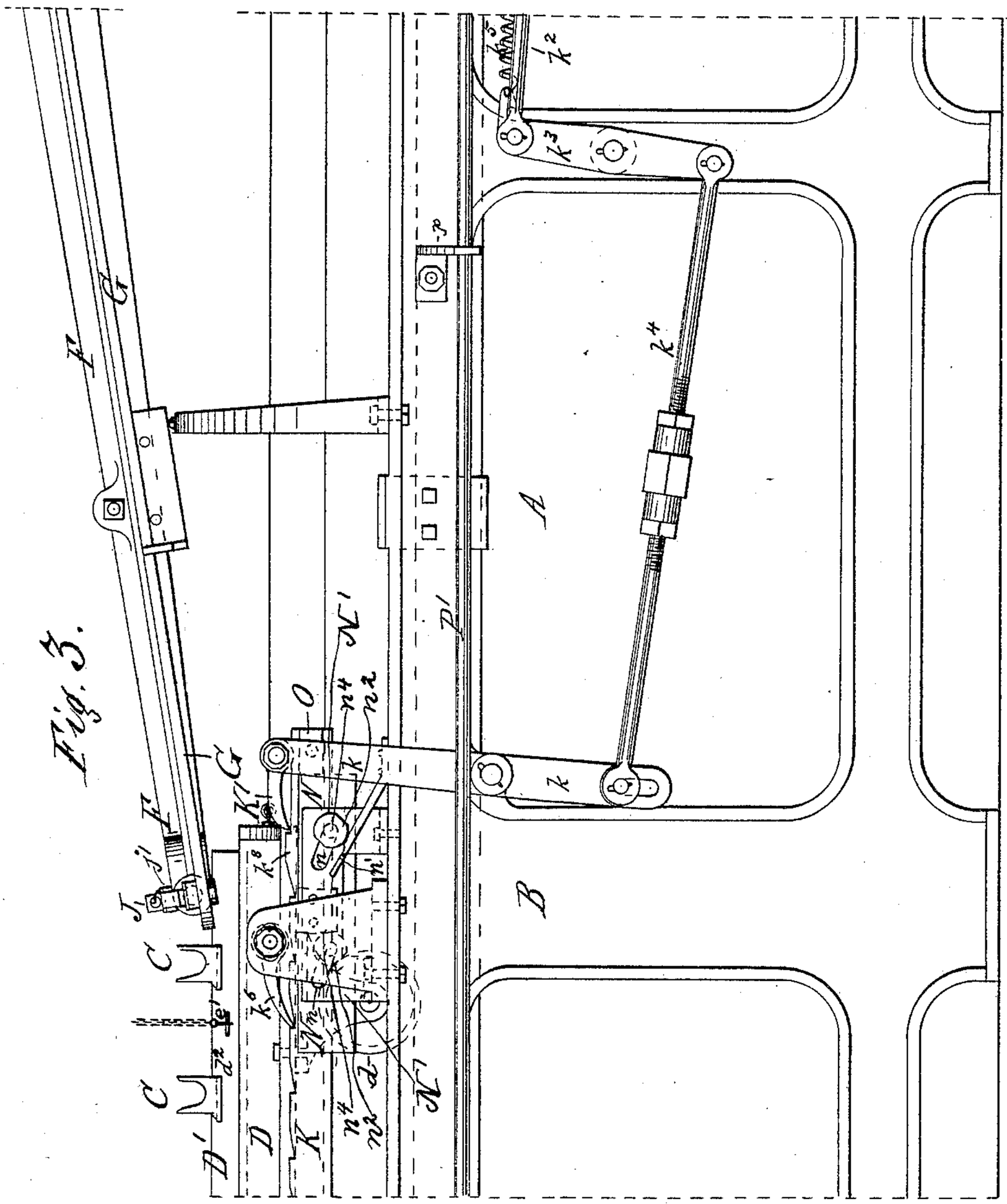
## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

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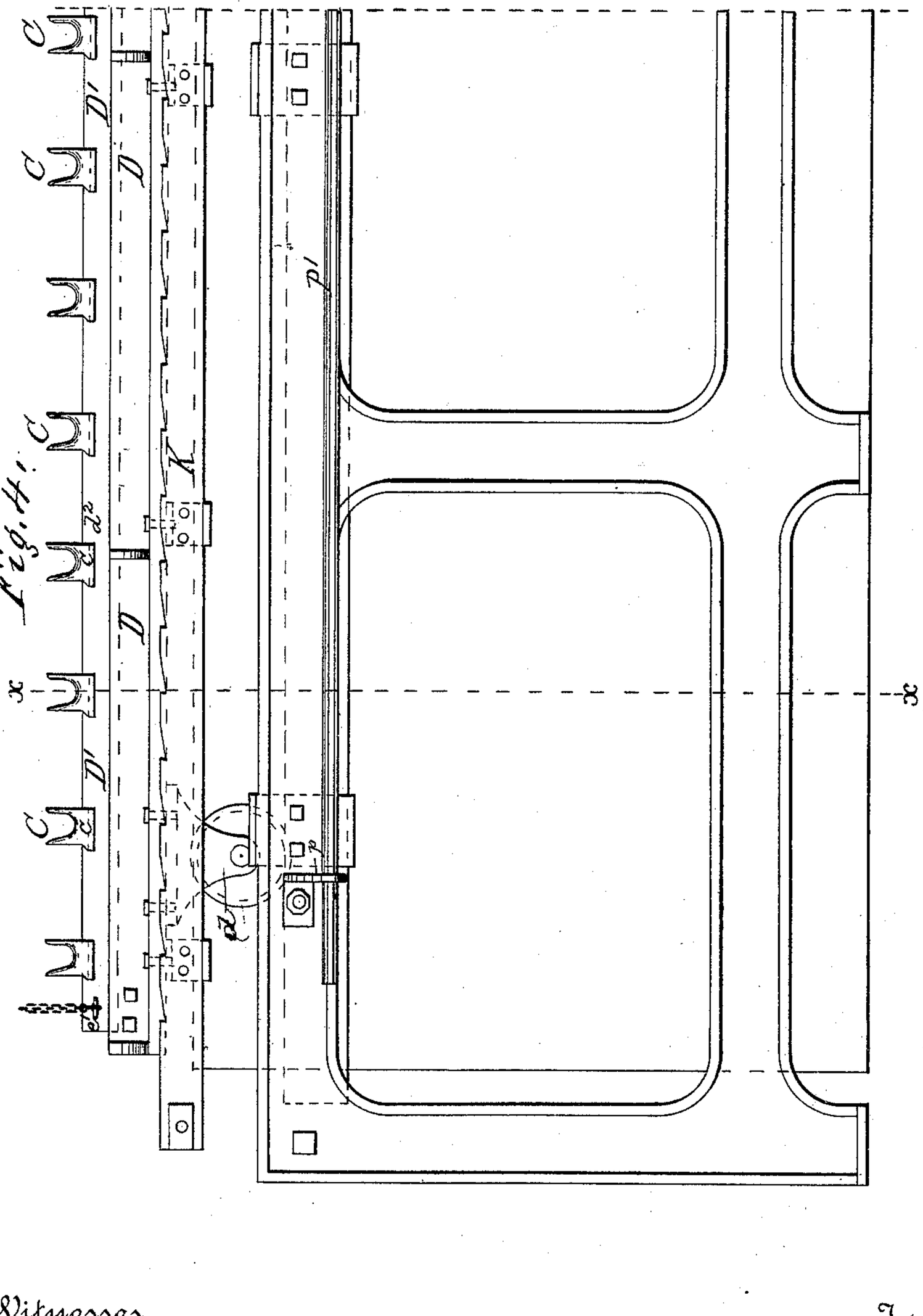
## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

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## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

Fig. 8.

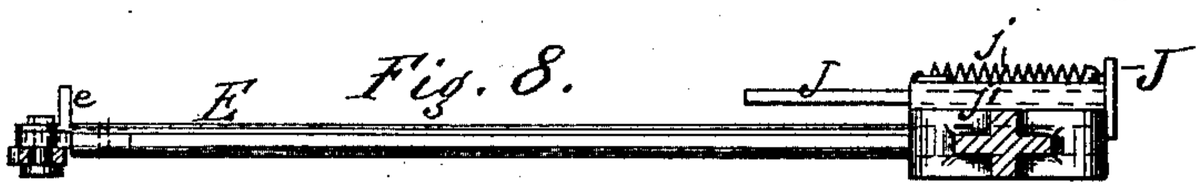



Fig. 7.

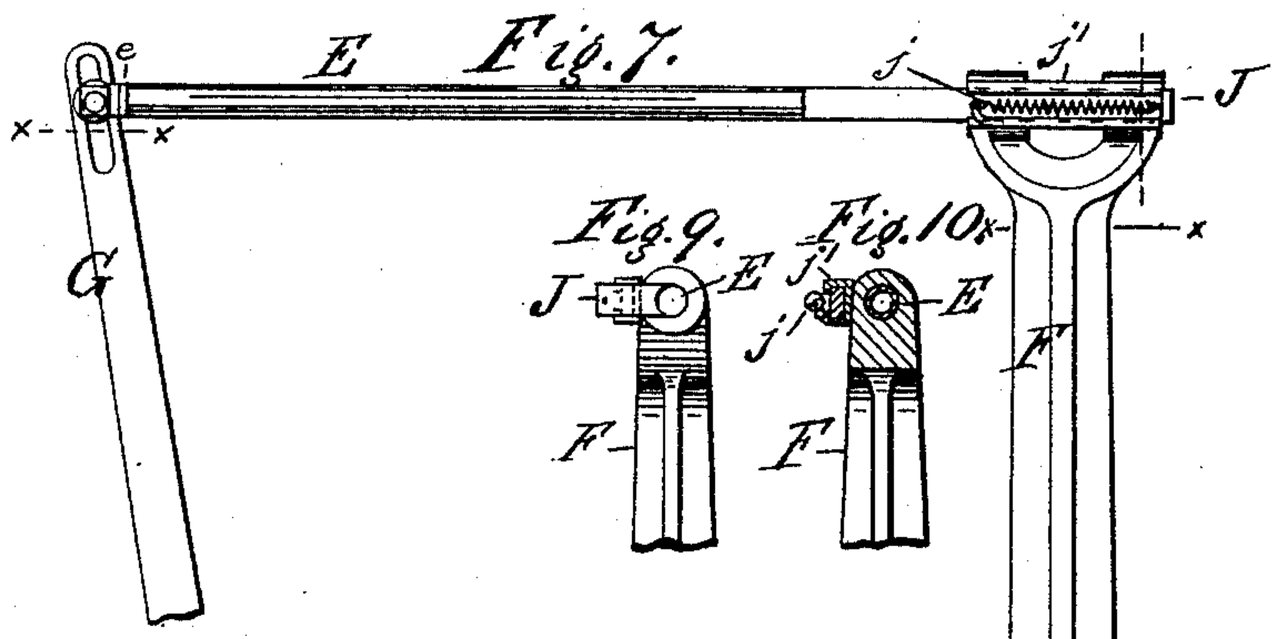


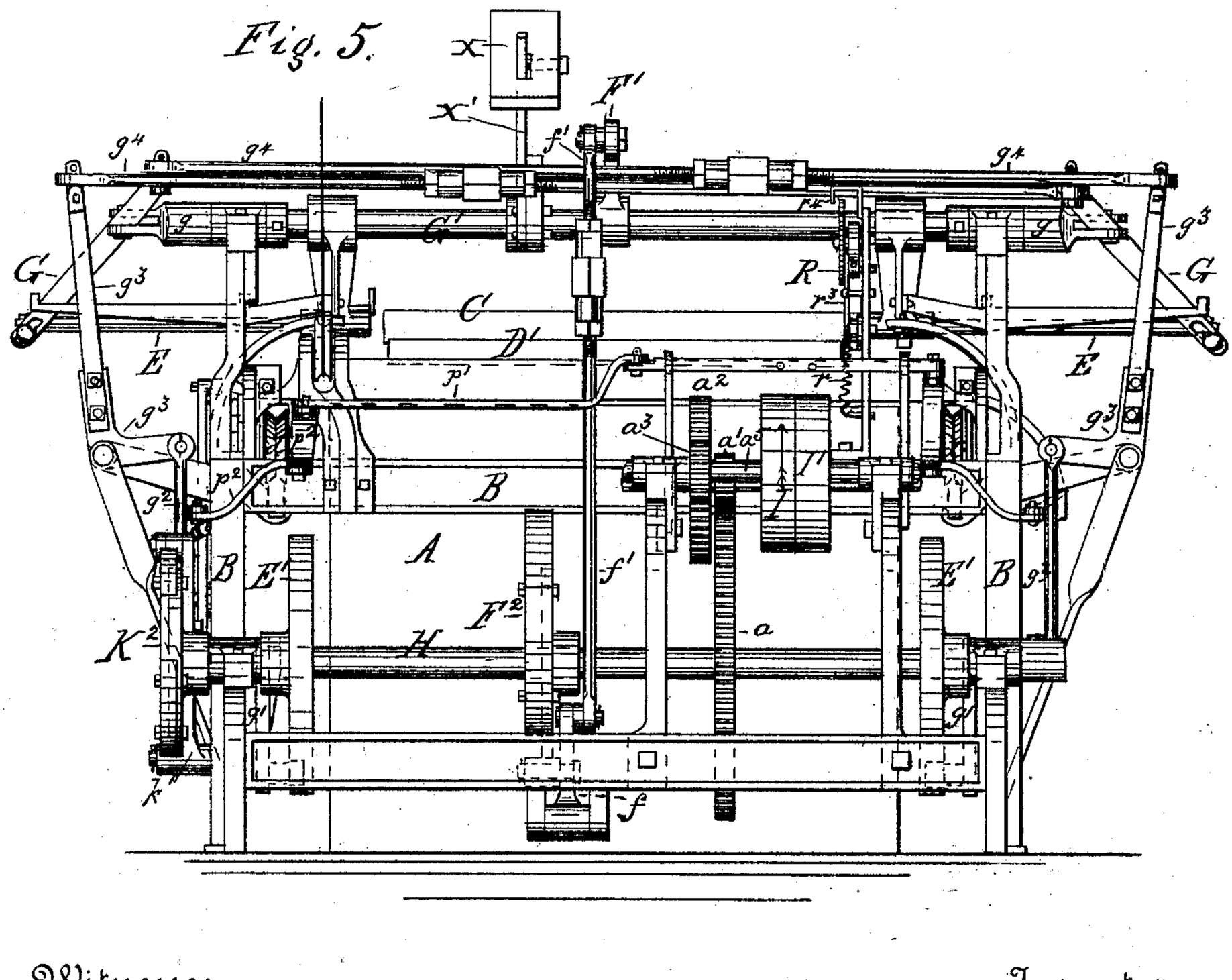

Fig. 9.




Fig. 10.




Fig. 5.

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## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

*Fig. 6a.*

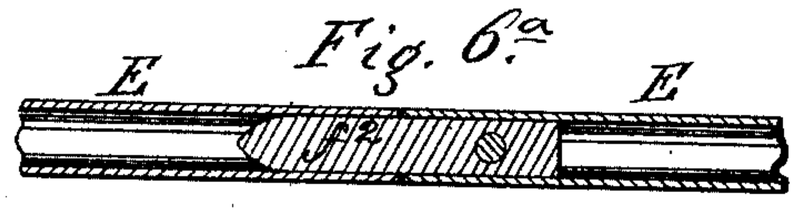
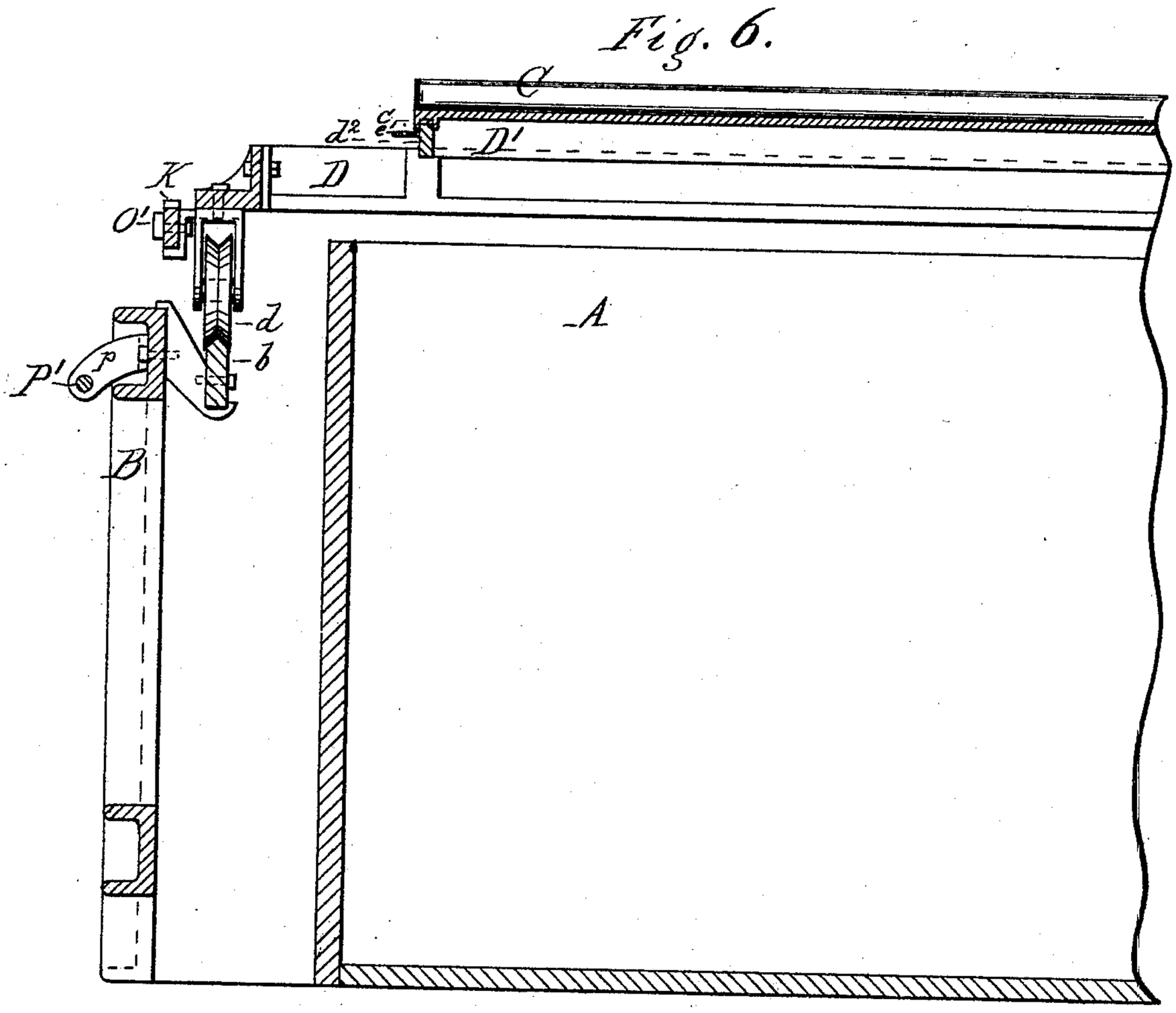



*Fig. 6.*

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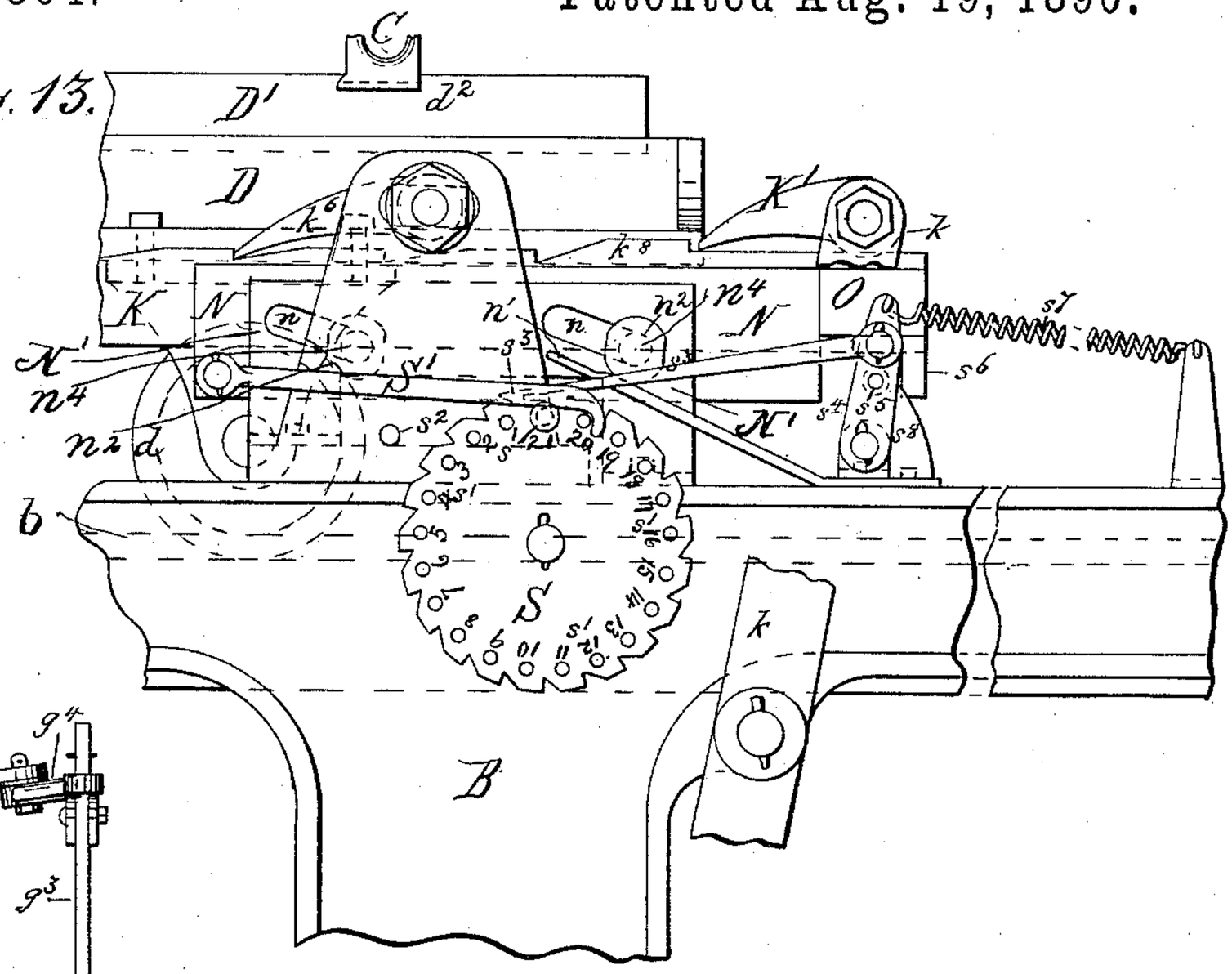
## DYEING APPARATUS.

No. 434,864. Patented Aug. 19, 1890.

Fig. 13.



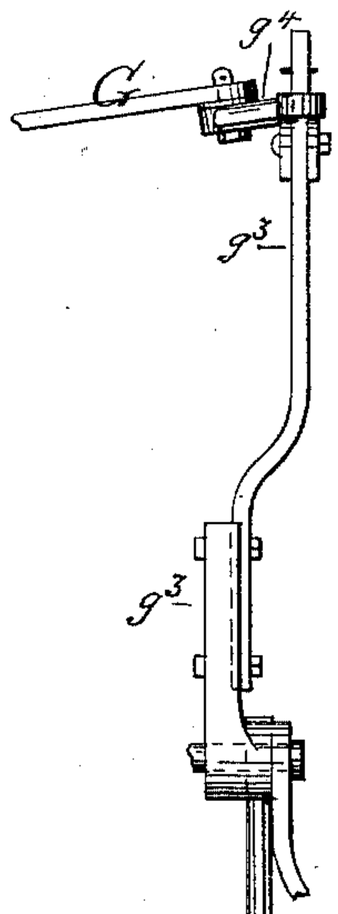
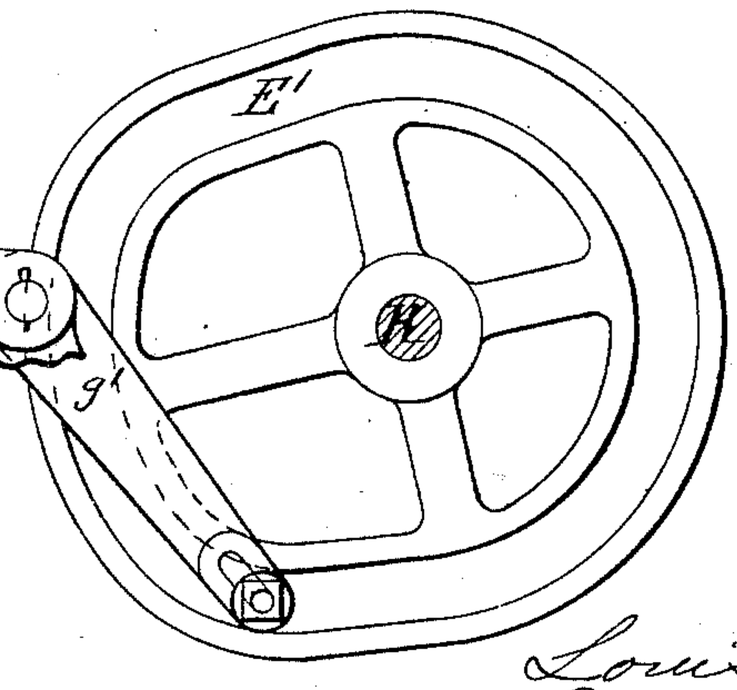




Fig. 12.

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# UNITED STATES PATENT OFFICE.

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## DYEING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 434,864, dated August 19, 1890.

Application filed April 5, 1888. Serial No. 269,715. (No model.)

*To all whom it may concern:*

Be it known that we, LOUIS DUCROS and EUGENE TYMESON, both of Yonkers, in the county of Westchester and State of New York, have made an invention of certain new and useful Improvements in Dyeing Apparatus; and we do hereby declare that the following, in connection with the accompanying drawings, is a full, clear, and exact description and specification of the same.

Previous to our invention it has been customary to hang the hanks of yarn which are to be dyed upon poles and to lower them into the dye-vat until the poles rest upon the opposite edges of the vat, and after the portions of the hanks of yarn which are hanging in the dye-liquor become wetted by it it has been customary to shift the hanks upon the poles by hand, so that the portions of said hanks which have been wet with the dye-liquor are drawn from the dye-vat, and the portions which rested upon the poles are let down into the dye-liquor. In order that the yarn may be dyed equally, this shifting of the hanks has to be repeated a number of times, and consequently a large amount of labor has been heretofore required for this purpose. In addition to this, various machines have been devised to shift the hanks or skeins of yarn in the dye-liquor, and so far as we know these machines operate upon the following plans: In some of them the skeins of yarn are hung upon rollers or upon reels, which are revolved so as to cause the skeins to move like endless belts running on pulleys. In others the skeins of yarn are held on revolving creels or frames which revolve in the dye-liquor. In others again the skeins are pulled laterally over the poles, but without raising the yarn from the poles. A machine also has been devised to lift and lower poles carrying hanks of yarn by means of two sets of hooks, one set of which is stationary during the transfer of the poles, while the other set of hooks has a compound movement imparted to it; but this machine necessitates the employment of two poles for each row of hanks and an intermediate transposition of the two poles.

The object of our invention is to operate upon the hanks or skeins or similar articles while in the dye-liquor by machinery in a manner similar to the manipulation of the skeins or hanks by hand, so as to attain the good effects in the dyeing of yarn which are incident to the hand manipulation of the skeins or hanks and at the same time reduce greatly the labor required.

Our invention consists of certain combinations of mechanical devices by means of which the hanks of yarn or other similar articles hanging upon poles may be shifted in the dye-liquor without hand labor. These combinations are set forth in detail in the claims at the close of this specification; and when our entire invention is used the hanks of yarn hanging upon any one pole are not only shifted in the dye-liquor, but each pole of a series upon which hanks of yarn are hung in a dye-vat has the hanks upon it shifted in succession, so that all the hanks of yarn which are being dyed at any one time in the same dye-vat are shifted in the dye-liquor the requisite number of times required to complete the dyeing of the yarn.

In order that our invention may be fully understood, we have represented in the accompanying drawings and will proceed to describe the form of dyeing apparatus which we prefer to use, and which embodies all parts of our invention in the best form at present known to us.

Figure 1 of said drawings represents a plan of the said apparatus with certain portions removed between the broken lines at $x\,x$ of the said figure. Figs. 2, 3, and 4 represent conjointly a side view, upon a larger scale than Fig. 1, of the said apparatus, each figure representing a section of about one-third of the total length. Fig. 5 represents a view of that end of the apparatus at which the camshaft of the lifting apparatus is located. Fig. 6 represents a partial transverse section of the apparatus at the line $x\,x$ of Fig. 4 and on the same scale as Figs. 2, 3, and 4. Fig. $6^a$ represents a longitudinal section of the inner ends of the shifting-rods. Fig. 7 represents a top view of one of the shifting-rods and its

connections. Fig. 8 represents an elevation of the same with the raising arm and lever in section at the lines *x x* of Fig. 7. Fig. 9 represents a side view of the inner side of the end of one of the raising-arms and its appurtenances, and Fig. 10 represents a longitudinal section of the same. Fig. 11 represents a side view of the lifting-cam and its appurtenances. Fig. 12 represents a side view of one of the shifting-rod cams and some of the connections with the shifting-rod. Fig. 13 represents a side view of a part of the apparatus, showing an automatic stop mechanism, which we prefer to use, as hereinafter described.

The dye-vat A of the said apparatus is of rectangular form, and is preferably deep enough to permit the hanks of yarn to hang in it from poles without touching the bottom. Its width should be adapted to the number of hanks of yarn which are to be placed upon the poles, a convenient width being about three and one-half feet. The length of this dye-vat should be adapted to the number of poles which are to be used for holding the hanks of yarn, and when the machinery is constructed in the form represented in the drawings we prefer that the distance between two successive poles should be about seven inches. The dye-vat sets within a frame B, which sustains the various moving parts of the apparatus. The series of poles C, from which the hanks of yarn are suspended, extend transversely across the dye-vat, and when the apparatus is in use these poles are sustained by a pole-carriage D, which is preferably made movable lengthwise of the main frame by being fitted with wheels *d*, that run upon longitudinal rails *b*, which are connected with the main frame B, so that the pole-carriage with the poles C and the hanks of yarn hanging thereon may be moved to and fro longitudinally of the vat for the purpose of placing each pole in succession in the proper position to have the hanks of yarn upon it shifted.

In order that the poles with the hanks of yarn may be readily applied to and removed from the dye-vat, we prefer to connect the poles with a movable frame D′, which may be raised bodily from the dye-vat, and may be replaced by another pole-frame of the same character having a new set of hanks applied to its poles. The ends *c* of the poles are preferably notched at their under sides to rest upon the sides of the pole-frame, and those sides $d^2$ also are preferably notched at the requisite distances to hold the poles in their proper relative position. Each pole is constructed in such manner as to permit it to be traversed longitudinally by a shifting-rod, and the construction of pole which we prefer for this purpose is a pole of gutter form or U-section, (as represented in the drawings,) open at the top, so that the shifting-rod, after being inserted endwise into the cavity of the pole and into the bights of the hanks of yarn hanging upon the pole, may be raised, so as to lift the hanks of yarn from the pole. If the dye-vat be sufficiently narrow, a single shifting-rod may be used to raise the hanks of yarn from the pole; but we prefer to use two shifting-rods E E, which are arranged at opposite sides of the pole-carriage, are inserted endwise into the bights of the hanks of yarn, are then raised to lift the said hanks, and are subsequently lowered to lower the said hanks into the dye-liquor, after which the shifting-rod is withdrawn endwise from the said hanks.

The mechanism which we prefer to use to impart these reciprocating movements to the shifting-rods is as follows: Each shifting-rod E is supported by an arm F, by means of which it may be raised and lowered, and is connected with a lever G, by means of which it may be inserted endwise into and withdrawn from the hanks of yarn. As two shifting-rods are used in the mechanism represented in the drawings, the two lifting-arms F F of the two shifting-rods E E are secured to a common rock-shaft G′, which is fitted with an intermediate arm F′, and this intermediate arm is operated by the lifting-cam $F^2$ through the intervention of a lever *f* and a link *f′*, so that as the said lifting-cam $F^2$ revolves the shifting-rods that are carried by said arms are raised and lowered or reciprocated up and down relatively to the pole-carriage. The lifting-cam $F^2$ is secured to a cam-shaft H, which is fitted to turn in suitable bearings upon the main frame B, and has a revolving motion imparted to it through the intervention of the cog-wheels and pinions *a* $a'$ $a^2$ $a^3$ and shafts $a^4$ $a^5$ by means of a belt applied to the driving-pulley I. The lever G, by means of which the shifting-rod is inserted and withdrawn endwise from the hanks of yarn, is pivoted to an extension *g* of the rock-shaft G of the raising-arms. The longer arm of this lever is connected pivotally with the outer end of the shifting-rod E, and the lever is vibrated in horizontal directions for the purpose of inserting and withdrawing the shifting-rod by means of a cam E′, which we call the "shifting-cam," and which is secured to the cam-shaft H and operates upon the said lever G and the shifting-rod E through the intervention of the lever *g′*, which swings on the fulcrum-stud $g^5$, Fig. 2, the rod $g^2$, the elbow-lever $g^3$, and a connecting-rod $g^4$. The reciprocation of the shifting-rod in a direction endwise of its length, for the purpose of entering into and withdrawing from the skeins or hanks of yarn hanging on the poles, is an essential feature of the invention, and whenever hereinafter the endwise-reciprocating shifting-rod is mentioned it is to be understood as one having that endwise-reciprocating movement.

Each endwise-reciprocating shifting-rod is fitted to slide endwise in the end of the lifting-arm F, and as the two reciprocating shifting-rods are inserted from opposite sides of the dye-vat, so that their inner ends come together, they are capable of lifting all the

hanks of yarn upon the pole in connection with which they are operating. When two endwise-reciprocating shifting-rods are so used, we prefer that the end of one of the two should be fitted with a pin or dowel $f^2$, Fig. 6ª, and that the inner end of the other shifting-rod should be socketed to receive the dowel, and that the endwise motion imparted to the shifting-rods by their cams E′ should be sufficient to cause the dowel $f^2$ of one rod to enter the socket of the other rod, so that the inner ends of the two shifting-rods are then connected, because such connection tends to render them stiffer when raising the hanks.

The shifting-rods may be constructed with advantage of drawn-copper tubes, as this material is light and stiff.

When an endwise-reciprocating shifting-rod is withdrawn from the hanks, it is desirable that the hanks should be prevented from moving along with the shifting-rod. In order to prevent such movement, the lifting-arm of a shifting-rod is fitted with a stripper J, which is preferably arranged to slide in a guide $j'$, Figs. 7, 8, 9, and 10, at the outer end of said arm above the shifting-rod E. The stripper is fitted with a spring $j$, which tends to hold it in its outermost position, as represented at Fig. 8, and a shoulder $e$ is connected with the outer end of the shifting-rod E to operate upon the outer end of the stripper J and push that stripper inward as the shifting-rod reaches its innermost position, so as to push the hanks of yarn toward the inside of the dye-vat.

In order that each pole C of the series on the pole-carriage D may be carried longitudinally of the dye-vat, the pole-carriage D is moved or fed longitudinally of the said vat, and the moving or feed mechanism which we prefer to use for this purpose is as follows: A rack-bar K is secured to the carriage, and a reciprocating feed-pawl K′ is provided to engage with the teeth of the said rack-bar and move it and the pole-carriage forward. The said feed-pawl is pivoted to the upper end of a pawl-lever $k$, which is operated by the feed-cam $K^2$ through the intervention of a lever $k'$, which swings on the fulcrum-stud $k^{10}$, Fig. 2, rod $k^2$, counter-lever $k^3$, and rod $k^4$. The feed-pawl K′ is preferably moved in a forward direction only by the action of the feed-cam $K^2$, and in this case the return movement of the feed-pawl is effected by means of a spring $k^5$.

In order that the pole-carriage D may not be retrograded during the backward movement of the feed-pawl, a stop-pawl $k^6$ is provided to drop in behind the teeth of the rack-bar in succession and prevent such retrograde movement.

In the operation of the said machine it is expedient that the bights of the hanks of yarn after being raised from the pole should be lowered, so as to drop into the vat between the pole from which they were raised and the next succeeding pole, so that portions of the hanks which previously to the raising hung in the dye-liquor are left hanging upon the pole when the hanks are lowered, and that those portions of the hanks which rested on the poles previous to the raising are dropped into the dye-liquor when the hanks are lowered. Hence the lengths of the teeth of the rack-bar K are preferably equal to half the distance between two successive poles C C, and the reciprocating movement imparted to the feed-pawl K is sufficient to move the pole-carriage the said half-distance. When the carriage has been fed or moved forward sufficiently to present the series of poles in succession to the reciprocating shifting-rods, the feed mechanism is disengaged or temporarily stopped by raising the feed-pawl and stop-pawl, and the carriage is then retrograded. This retrograde movement of the carriage may be effected by means of a feed mechanism operating in the reverse direction to that above described; but we prefer to effect it by means of a weight $K^4$, connected by a rope $k^7$ with one end of the carriage. In order that the carriage may be stopped when it has been retrograded by the weight $K^4$, a bumper L is provided in position to be struck by the rear end of the carriage when it reaches its rearmost position, and we prefer that the face of this bumper shall be a spring—such, for example, as a block of india-rubber—to prevent excessive jar.

In order to facilitate the operation of the apparatus, we have combined the pole-carriage with means for disengaging the feed-pawl and the stop-pawl from the feed-rack when the pole-carriage reaches the end of its forward movement and for permitting the re-engagement of the said two pawls with the feed-rack when the pole-carriage reaches the end of its retrograde movement. For this purpose a slide N is provided, and is fitted with two pins $n^4$, Fig. 13, which are arranged to move in inclined slots $n$ $n$, formed in a plate N′, secured to the frame B of the machine, so that when the said slide is moved in a forward direction the inclination of the said slots causes the slide to rise and raise the pawls from the teeth of the feed-rack, and when the slide is moved backward the inclination of the said slots compels it to move downward and lower the pawls into engagement with said feed-rack. In order that the said slide may be raised when the pole-carriage reaches the end of its forward movement, a stop O is secured to the rear end of the feed-rack K in a position to come in contact with said slide N and compel it to move endwise and rise, and a spring-pawl $n'$, Figs. 3 and 13, is provided to engage with the head $n^2$ of one of the pins and hold the slide in its raised position with a yielding pressure. In order that the said slide may be moved backward when the carriage reaches the end of its retrograde movement, a second stop O′ is secured to the forward end of the rack-bar K in position to come in contact with the slide N and move it backward and downward as

the carriage reaches the end of its retrograde movement, the spring-pawl $n'$ yielding to the pressure produced by the action of the stop O'.

In order to insure the lifting of both pawls clear of the rack-bar, it is expedient to make the last tooth $k^8$ of the rack-bar a little higher than the others, so that when the slide has been raised high enough to disengage the feed-pawl K', from this last tooth the stop-pawl has been lifted entirely clear of the teeth of the rack-bar in advance of it. When the carriage reaches the end of its forward movement, the driving-belt should be shifted from the fast pulley I to the loose pulley I', so as to stop the operation of the shifting-rods while the carriage is being retrograded. This shifting of the belt may be done by hand; but in the apparatus represented in the drawings a belt-shipper is provided, which may be operated either by hand or by the movement of the carriage. The bar P of this belt-shipper is fitted to slide in brackets connected with the frame of the machine, and for the purpose of enabling it to be operated by hand the bar of the shipper is connected by a link $p'$ and an elbow-lever $p^2$ with a hand shipper-rod P', which extends, preferably, along the main frame lengthwise thereof and is supported in one or more guides $p$, so that it is within reach of the attendant standing at one side of the apparatus and can be readily operated by him. In order that the said belt-shipper may be operated when the carriage reaches the end of its forward movement, the belt-shipper is combined with the carriage. To this end the bar P of the shipper is connected by an elbow-lever $p^4$ with the shipper-rod $P^2$, which extends lengthwise of the frame of the machine and is supported thereon in one or more guides, and this shipper-rod $P^2$ is provided with two stops $p^5$ $p^6$, Fig. 1, which are moved alternately by means of the shipping-arm $p^7$, secured to the pole-carriage D. Hence when the pole-carriage approaches the end of its forward movement the shipping-arm $p^7$, acting upon the stop $p^5$, moves the shipper-rod $P^2$ and the shipper P with which that rod is connected, so as to shift the belt from the fast to the loose pulley, thus causing the cam-shaft H and the reciprocating shifting-rods E, which are operated by means of the cams on that cam-shaft, to stop, and as the carriage approaches the end of its retrograde movement the shipping-arm $p^7$ comes in contact with the other stop $p^6$, so as to shift the belt from the loose pulley I' to the fast pulley I, and thus cause the reciprocating shifting-rods to commence operating anew.

The number of times which the carriage is moved to and fro may be counted by the operator; but we prefer to combine the pole-carriage with an indicator either directly or through the intervention of some other part of the apparatus moving in accordance with the pole-carriage, so that the indicator shall indicate automatically the number of movements of the carriage. The indicator which we prefer to use has the form of a ratchet-toothed disk R, which is moved the space of one tooth for each forward movement of the pole-carriage. For this purpose an elbow-lever R' is supported upon the frame of the machine with its lower arm in position to be struck by the end of the pole-carriage D (or by a projection from it) as the carriage approaches the end of its retrograde movement, and a spring $r$ is provided to move the elbow-lever R' in the reverse direction as the pole-carriage is moved forward. The distance to which the elbow-lever can be moved by the spring $r$ is limited by a pin $r'$, and the elbow-lever is fitted with a hook $r^3$, which engages with the ratchet-teeth of the indicator with a yielding pressure incident to the action of a spring $r^2$. The retrograde movement of the pole-carriage causes the hook $r^3$ to rise and take hold of the next succeeding tooth of the indicator, while the forward movement of the pole-carriage permits the hook-spring $r$ to draw the hook downward, and thus turn the indicator the space of a tooth.

In order that the indicator may be prevented from retrograding while its hook $r^3$ is being moved to engage with a succeeding tooth, the indicator is provided with a friction-band, (shown in dotted lines at Fig. 2,) which grasps the stud on which the indicator R turns. An index $r^4$ also is provided to show the number of teeth of the indicator which have been moved past it, thereby indicating the number of operations of the pole-carriage.

When the pole-carriage has been moved to and fro the desired number of times, the operation of the apparatus may be stopped by turning the feed-pawl K' by hand upward and backward, so as throw it out of engagement with the feed-rack K; but we prefer that the stoppage should be effected by the operation of the apparatus itself when the pole-carriage has completed its last forward movement. For this purpose the mechanism represented in Fig. 13 may be employed, a pin-wheel S, having at least as many pin-holes $s'$ as the number of forward movements of the pole-carriage which are to be effected before the apparatus is stopped, being pivoted to the frame of the apparatus. The pin-wheel is fitted with a movable pin $s$, and the slide N is provided with a pivoted hook S', which is held within the range of movement of the said pin $s$ of the pin-wheel by means of a guide $s^2$.

In order that the pin-wheel may be moved, its rim is preferably formed into ratchet-teeth, and a reciprocating hook $s^3$ is provided to engage with these ratchet-teeth in succession and turn the wheel the extent of one tooth. The said hook $s^3$ is conveniently reciprocated by means of a rocking-arm $s^4$, which is fitted on its inner side with a projection or pin $s^5$, that is within the range of movement of a dependin g projection $s^6$ from the pole-carriage, so that when the pole-car-

riage approaches the end of its forward movement the hook $s^3$ is moved forward to engage with the next succeeding tooth of the pin-wheel S. When the pole-carriage commences to retrograde, its depending projection $s^6$ leaves the hook-arm $s^4$, which is then pulled backward by the operation of a spring $s^7$, so as to turn the pin-wheel the angular distance between two succeeding pin-holes. A stop $s^8$ is provided to limit the distance to which the hook $s^3$ can be moved by the operation of the spring $s^7$. The movable pin $s$ is placed in the proper hole of the pin-wheel S to be turned to the position in which it is represented in Fig. 13 during the forward movement next preceding the last-desired forward movement of the pole-carriage, so that when the feed-pawl K′ moves forward in engagement with the last tooth $k^8$ of the feed-rack K the pole-carriage being moved thereby has its depending projection $s^6$ brought in contact with the projection of the hook-arm $s^4$, and the hook is thereby moved forward to the next succeeding ratchet-tooth of the pin-wheel. When, then, the pole-carriage begins to move backward under the operation of the weight $K^4$, the hook-spring $s^7$, moving the pin-wheel, and the movable pin $s$, carried by the pin-wheel, cause the latter to engage with the swinging hook S′ and pull the slide N rearward sufficiently to drop the pawls K′ $k^6$ into engagement with the rack-bar K and stop its further backward movement with the carriage by the operation of the weight $K^4$. As the belt-shipper has been moved during the last forward movement of the carriage to shift the driving-belt to the loose pulley, the revolution of the cam-shaft H has been stopped previous to the commencement of the retrograde movement of the pole-carriage, so that when the slide N has been operated by the pin of the pin-wheel, as above described, and the retrograde movement has been checked by the dropping of the pawls into engagement with the rack-bar K all parts of the apparatus remain at rest until again started by the operator by shifting the movable pin $s$ to another hole (or by turning the pin-wheel S backward the number of holes corresponding with the number of operations of the carriage to be made in dyeing the next lot of hanks) and by moving the slide N forward, thereby lifting the pawls, so as to permit the carriage to be retrograded by the weight $K^4$. When the hanks of yarn have been sufficiently dyed, they may be removed from the apparatus by lifting each pole separately and carrying it away from the dye-vat; but as this separate removal of the poles would occupy considerable time we prefer to raise the pole-frame D′, with all its poles and with the hanks hanging upon said poles, bodily from the dye-vat. In order that this may be effected readily, we prefer to fit the pole-frame D′ with eyes $e'$, with which hooks connected with lifting-chains may be engaged, so that the said chains and the pole-frame with which they are connected may be raised by power and the pole-frame may be transferred from the apparatus, and that another pole-frame, to the poles of which a new set of hanks have been applied, may be transferred to the pole-carriage.

The operation of our said apparatus is as follows: Assuming that a pole-frame D′, supplied with hanks of yarn hanging from its poles, has been applied to the apparatus, the pole-carriage is permitted to be retrograded until the most forward pole of the series is opposite the ends of the endwise-reciprocating shifting-rods E. As the driving-belt is shifted to the fast pulley I by the time the retrograde movement of the carriage stops, the shifting-rods E immediately commence to operate by the action of the shifting-cam E′ and enter endwise into the cavity of the first pole and into the bights of yarn hanging thereon. When the shifting-rods have been entered their full distance, they are raised by the lifting-cam $F^2$ and lift the hanks of yarn. During this lifting movement the feed mechanism moves the carriage forward half the distance between two successive poles, the first projection or grade $t$ of the feed-cam $K^2$ operating for this purpose. When, then, the shifting-rods are lowered by the action of the lifting-cam $F^2$, they lower the hanks of yarn into the dye-vat in the space between the lifting-rods and the pole from which the hanks were lifted, the hanks then hanging in the form of loops. When the shifting-rods have been lowered, they are withdrawn from the bights of the hanks, and as they are withdrawn the stripper J for each endwise-reciprocating shifting-rod prevents the bights of the hanks from moving outward of the dye-vat with the shifting-rod. As the shifting-rods are withdrawn endwise from the bights of the hanks with which they are engaged the hanks drop into the dye-vat. When the endwise-reciprocating shifting-rods have been withdrawn, the second projection $t'$ of the feed-cam $K^2$ comes into operation and operates the feed-pawl K′ to move the pole-carriage the distance of one tooth of the feed-bar, thus bringing the second pole of the series opposite the ends of the shifting-rods, so that the hanks of yarn hanging on the second pole may be shifted in turn. The operation of shifting the hanks hanging upon each pole is repeated until the pole-carriage reaches its most forward position and the yarn upon all the poles has been shifted, whereupon the pawls K′ $k^6$ are thrown out of engagement, as previously described, (by the operation of the slide N,) and the carriage is retrograded by the weight $K^4$ to have the shifting of the hanks of yarn repeated. When the movements of the carriage have been repeated the required number of times, the operation of the machine is stopped, the dyed hanks of yarn are removed from the dye-vat, and fresh hanks are put in their places. During the retrograde movement of the carriage the

trailing of the hanks of yarn in the dye-liquor operates as a brake to slow down the movement of the carriage by the action of the weight $K^4$, and the amount of this weight should be adjusted in accordance with the number of hanks which are to be dyed at any one time, so that the carriage may not retrograde too rapidly. As the number of hanks dyed at any one operation may vary, we prefer to construct the weight in sections, as represented at Fig. 2, more or less of which sections may be used as found expedient for the number of the hanks of yarn. The presence of the hand shipper-rod P′ at the side of the apparatus enables the attendant to stop the operation of the apparatus at any time in case such stoppage be expedient.

It is possible that the endwise-reciprocating shifting-rods when lowered between the poles may from some accident be not withdrawn to their full extent, in which event the next feeding movement would bring the next succeeding pole against the shifting-rod and bend it. In order to provide against risk of injury from such a contingency and to give the attendant time to notice such difficulty, the lifting-cam $F^2$ is fitted with a second but low lifting-grade *v′*, Fig. 11, which makes a second but slight lift and lowering of the shifting-rods E after they have been lowered by the main grade *v*, and raises them free of the edges of the next succeeding pole, and thus prevents injury in case the end of the shifting-rod has not been sufficiently withdrawn to clear the pole.

We prefer to apply a counterpoise X, Fig. 1, to counterbalance the weight of the hanks of yarn and to connect this counterpoise with the rock-shaft G′ by means of an arm X′.

Although the above-described apparatus embodies all parts of our invention in the forms in which we prefer to construct them, it is evident that more or less of those parts may be used as found expedient. Thus, for example, the combination of the belt-shipping device with the pole-carriage may be broken by removing the stops $p^5$ and $p^6$, so that the apparatus is not stopped by its own operation when the carriage is to be retrograded without affecting the combination of the pole-carriage with the endwise-reciprocating shifting rod or rods. So, also, one endwise-reciprocating shifting-rod may be removed, leaving one only to be operated. The main frame also may be constructed complete for use with more or less of the operating members, and may be sold without the dye-vat, leaving the purchaser to add the dye-vat in his dye-house.

We claim as our invention—

1. The combination, substantially as before set forth, of the pole-carriage with the endwise-reciprocating shifting-rod.

2. The combination, substantially as before set forth, of the series of poles, the endwise-reciprocating shifting-rod, and the pole-carriage.

3. The combination, substantially as before set forth, of the shifting-rod, the lifting-cam by which said rod is moved crosswise of its length, and the shifting-cam by which said rod is moved endwise.

4. The combination, substantially as before set forth, of the pole-carriage and two endwise-reciprocating shifting-rods arranged at opposite sides of said carriage.

5. The combination, substantially as before set forth, of the series of poles, the pole-carriage, the endwise-reciprocating shifting-rod, and the feed mechanism by means of which the relative position of the poles to the said shifting-rod is changed.

6. The combination, substantially as before set forth, of the pole-carriage with a pole-frame and poles removably mounted on said carriage.

7. The combination, substantially as before set forth, of the pole-carriage, the endwise-reciprocating shifting-rod, the feed mechanism by which the position of the pole relatively to said shifting-rod is changed, and the stop mechanism by means of which the feed mechanism is disengaged.

8. The combination, substantially as before set forth, of the pole-carriage, the feed mechanism, the endwise-reciprocating shifting-rod, the weight for retrograding the pole-carriage, and the stop mechanism by which the feed mechanism is engaged when the pole-carriage has been retrograded by the operation of said weight.

9. The combination, substantially as before set forth, of the endwise-reciprocating shifting-rod, the pole-carriage, the feed mechanism, and the pin-wheel mechanism by whose movement the apparatus is stopped after the carriage has been operated the desired number of times.

10. The combination, substantially as before set forth, of the dye-vat, the pole to hold yarn to be dyed, the pole-carriage, and the endwise-reciprocating shifting-rod.

11. The combination, substantially as before set forth, of the dye-vat, the carriage, the set of poles, the feed mechanism, and the endwise-reciprocating shifting-rod.

12. The combination, substantially as before set forth, of the pole-carriage, the pole, the feed mechanism, and the shifting-rod by means of which an article on the pole is engaged by said rod and alternately raised and lowered.

In witness whereof we have hereto set our hands this 3d day of April, A. D. 1888.

LOUIS DUCROS.
EUGENE TYMESON.

Witnesses:
JOHN A. DOWE,
HAROLD BROWN.