No. 773,461. PATENTED OCT. 25, 1904.

W. P. BENHAM & J. K. WILLIAMSON.

TAPESTRY PRINTING MACHINE.

APPLICATION FILED APR. 5, 1904.

NO MODEL. 4 SHEETS—SHEET 1.

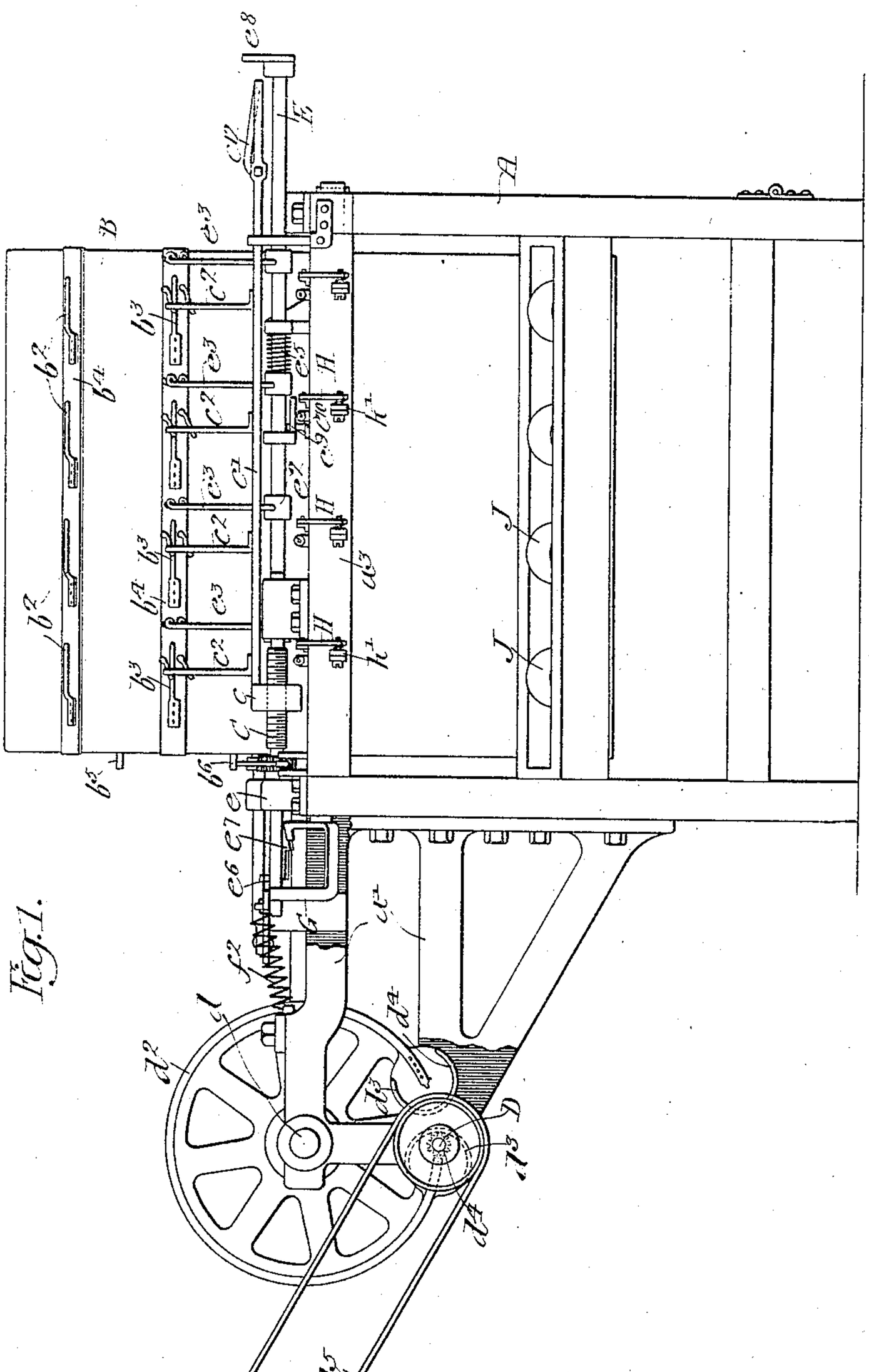

Fig. 1.

Witnesses:
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Titus V. Sons.

Inventors:
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NO MODEL. 4 SHEETS—SHEET 2.

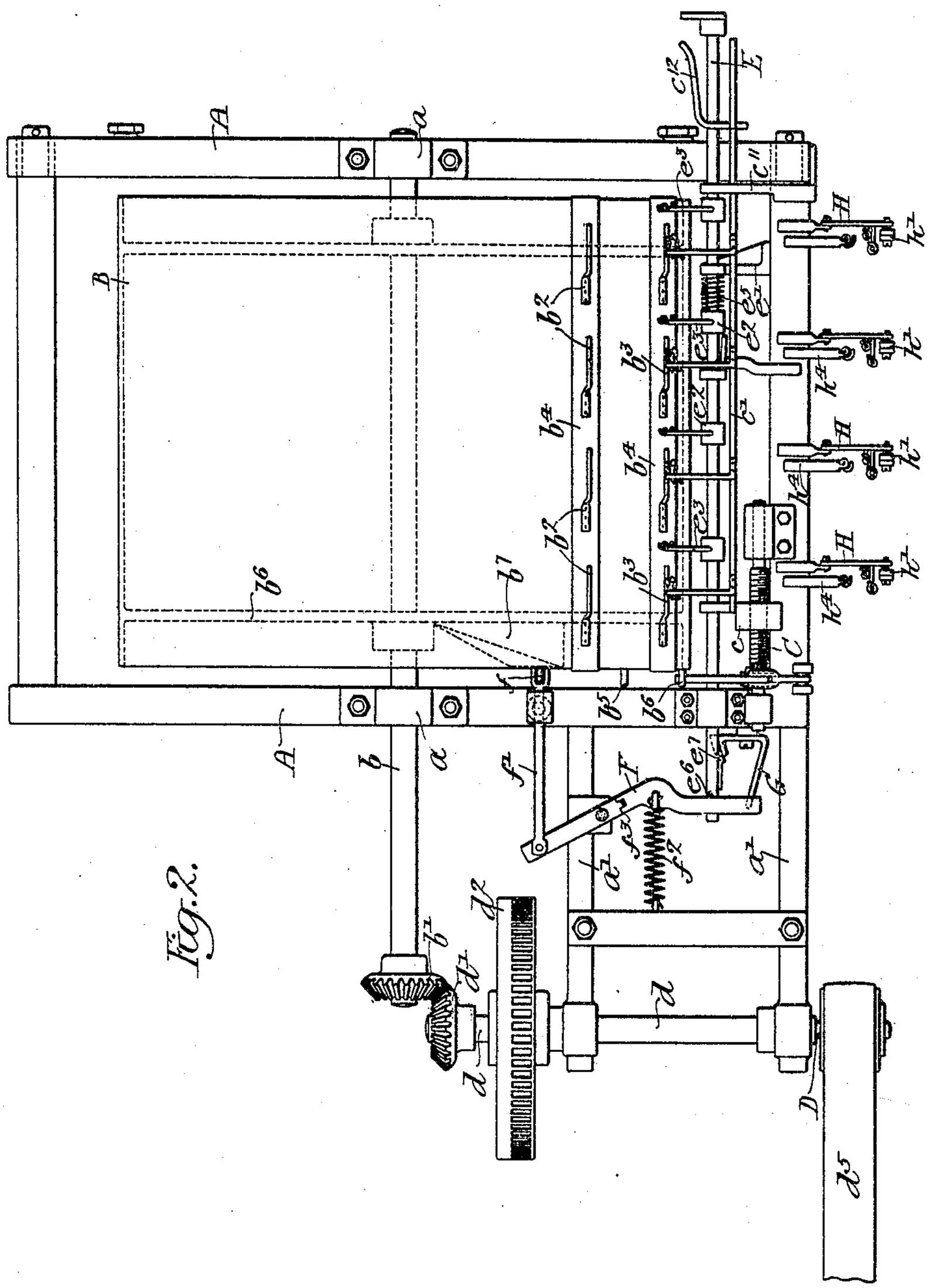

Fig. 2.

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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4.

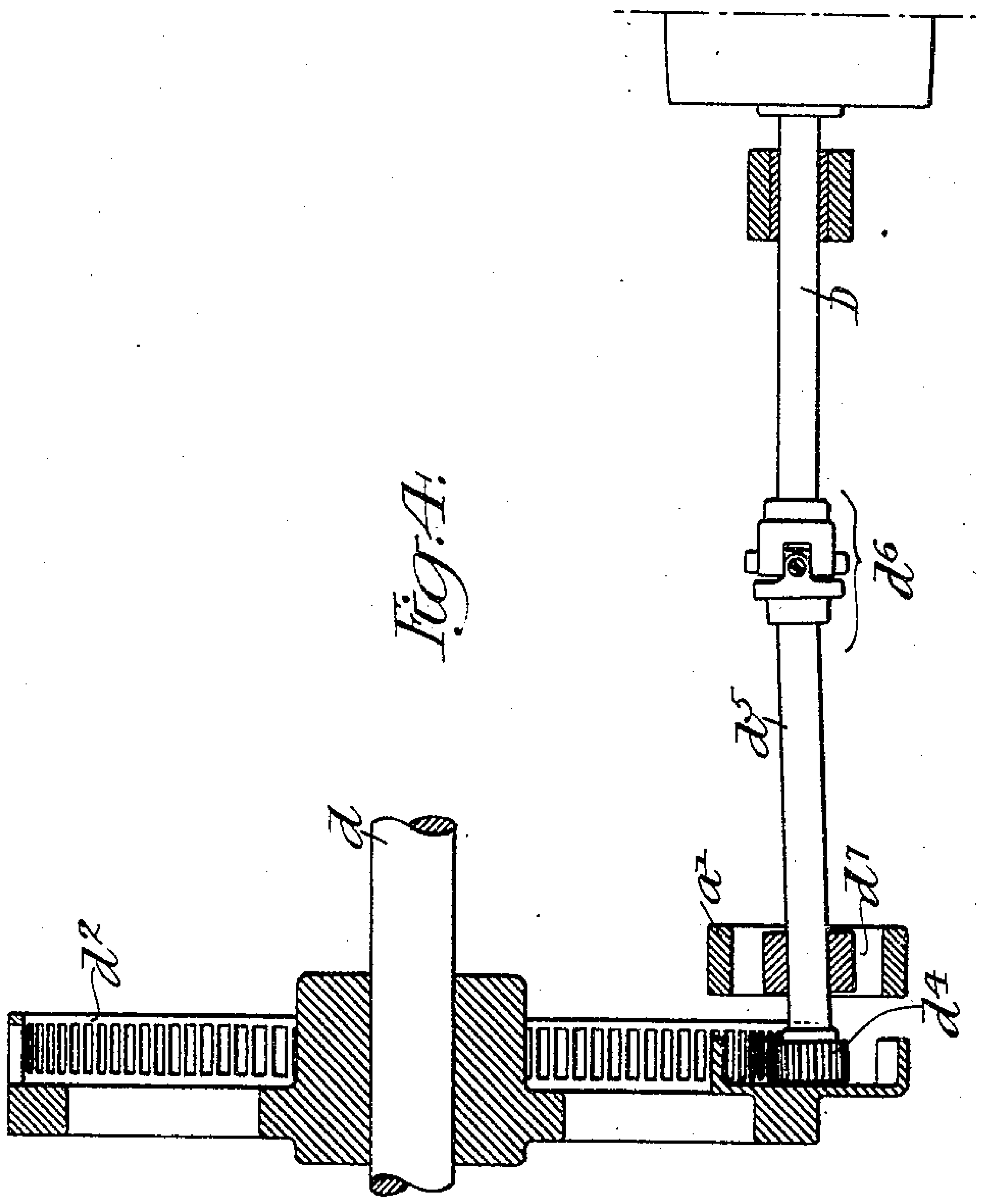
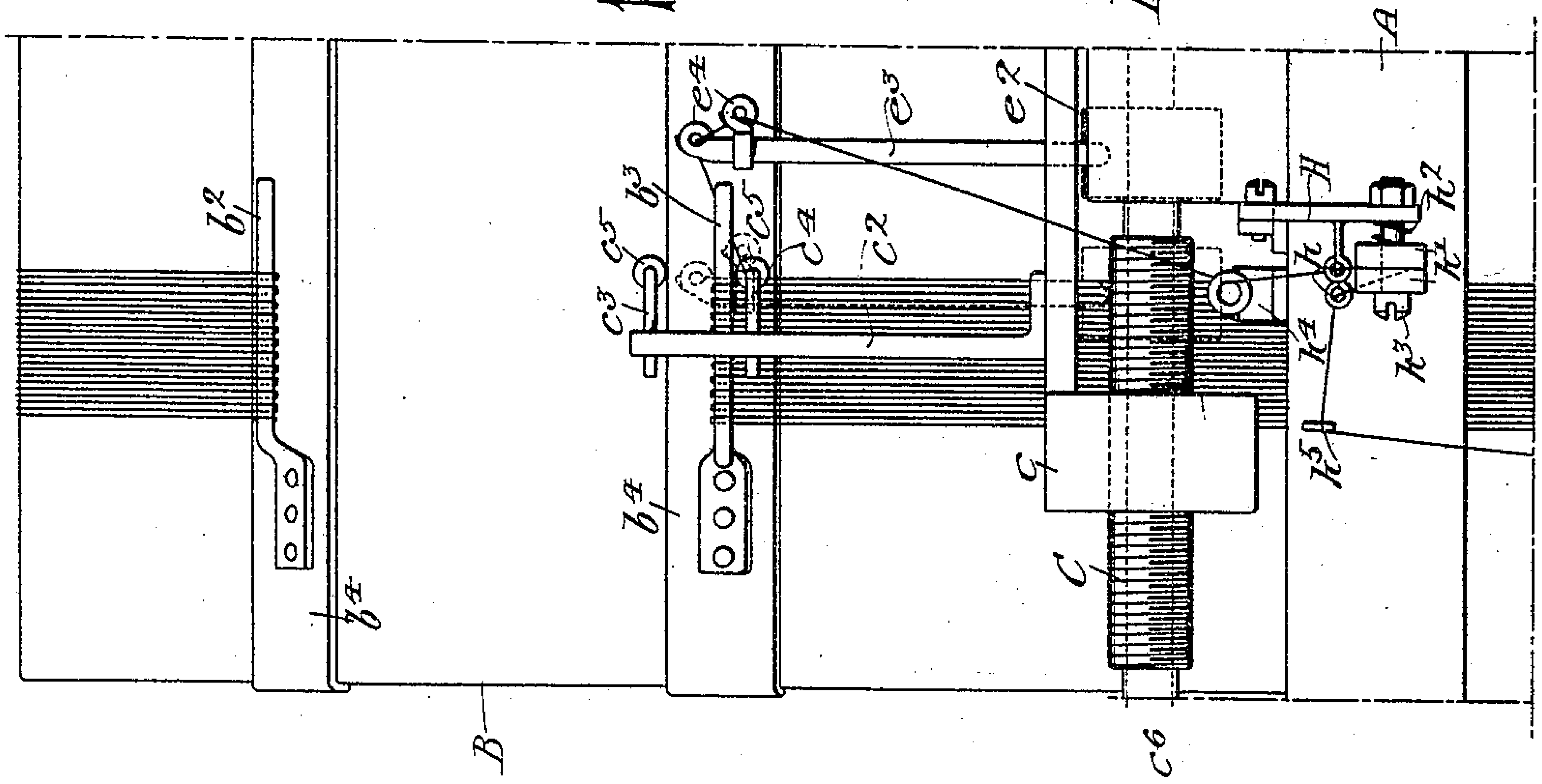


Fig. 3.



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APPLICATION FILED APR. 5, 1904.

NO MODEL. 4 SHEETS—SHEET 4.

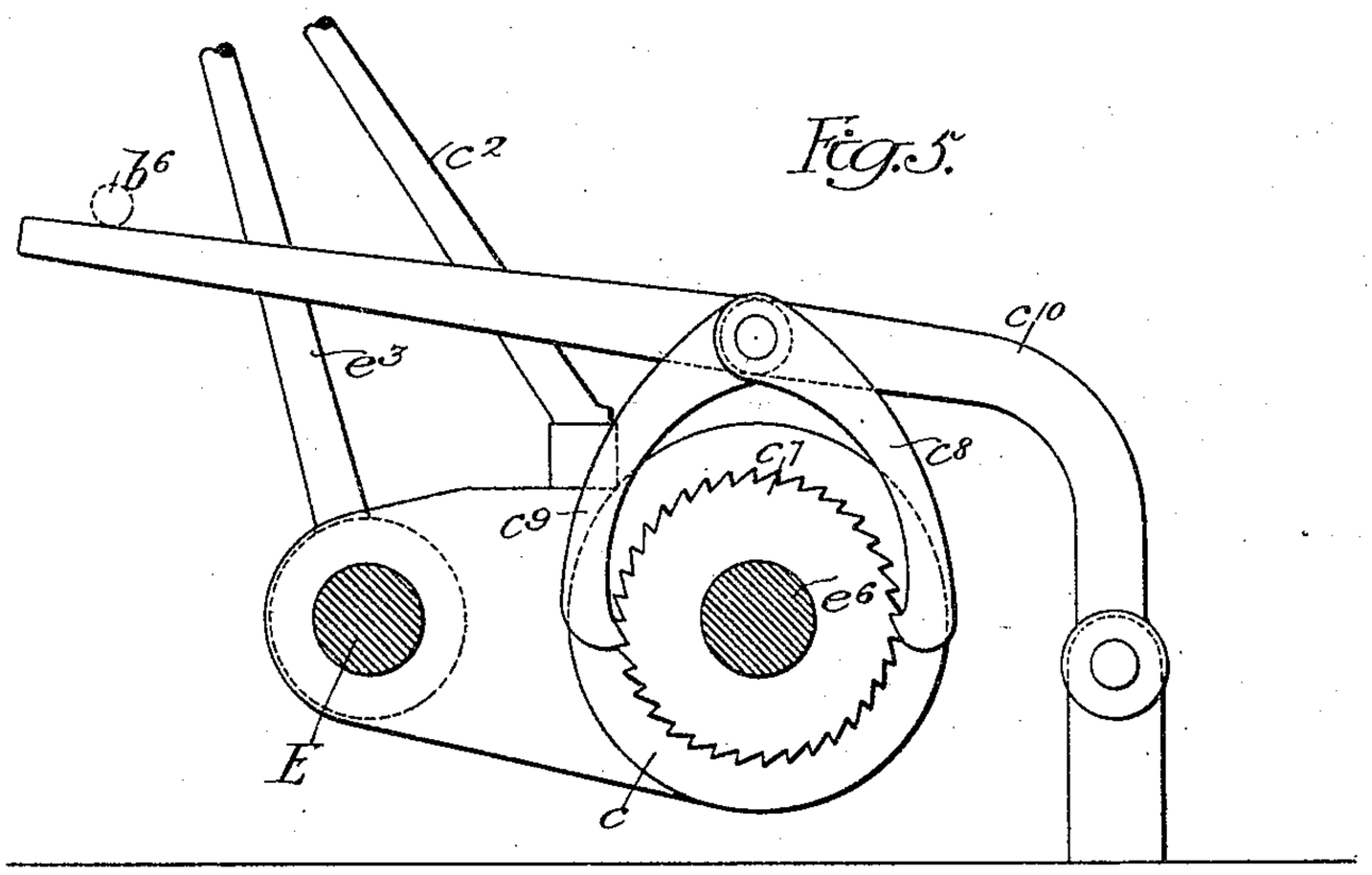

Fig. 5.

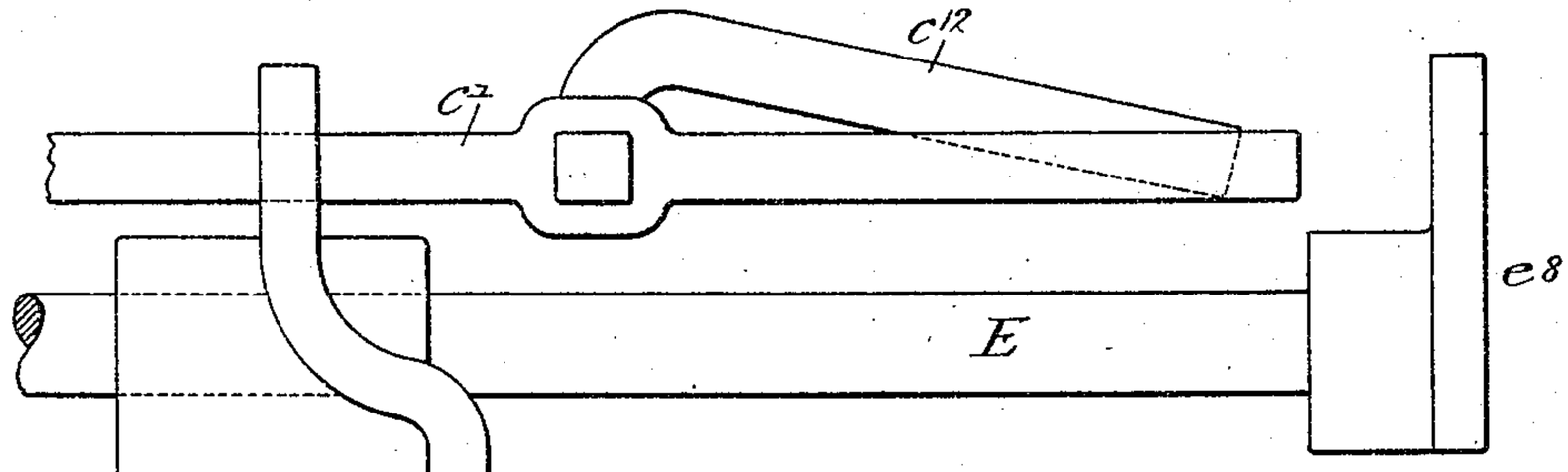

Fig. 6.

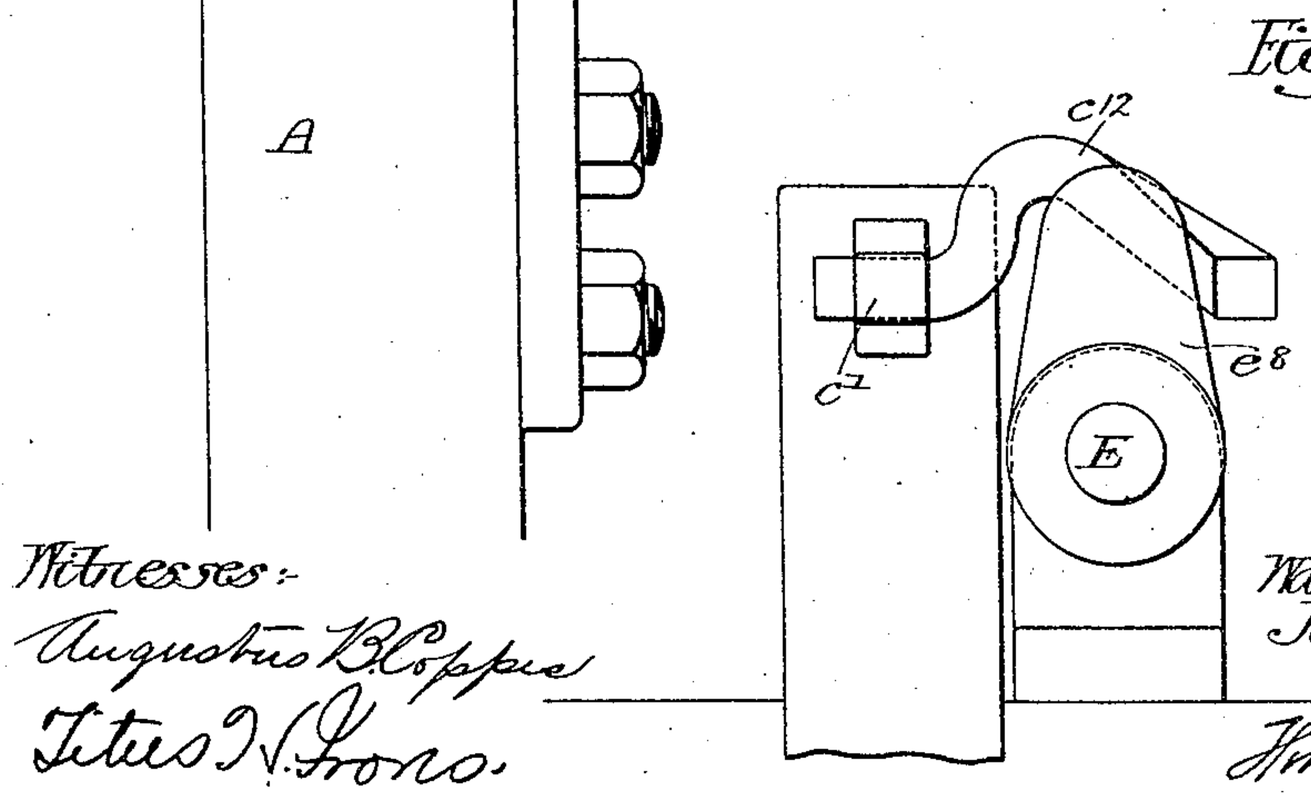

Fig. 7.

Witnesses:
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No. 773,461. Patented October 25, 1904.

UNITED STATES PATENT OFFICE.

WALTER P. BENHAM AND JOHN K. WILLIAMSON, OF PHILADELPHIA, PENNSYLVANIA.

TAPESTRY-PRINTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 773,461, dated October 25, 1904.

Application filed April 5, 1904. Serial No. 201,780. (No model.)

To all whom it may concern:

Be it known that we, WALTER P. BENHAM and JOHN K. WILLIAMSON, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Tapestry-Printing Machines, of which the following is a specification.

The object of our invention is to provide a machine by which it shall be possible to print a greater length of warp than has hitherto been possible upon a drum of a given size, or, what is the same thing, to reduce the size of the drum necessary for the support of the warp for a given length of tapestry while the same is being printed.

It is further desired to provide a novel combination of mechanism for winding yarn upon a drum in such manner that it shall be possible to print at a single operation the yarn necessary for a piece of goods of greater length than has been conveniently done hitherto. In order to so dispose a warp upon a drum that it shall be possible to print it as indicated, it is our object to provide means for laying the yarn of said warp back and forth upon said drum.

These objects we attain, as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of our improved machine, showing certain of the devices for governing the winding of yarn upon the drum. Fig. 2 is a plan view of our machine, further illustrating the detail construction of the yarn-winding mechanism. Fig. 3 is an enlarged end elevation of a portion of the mechanism for causing the yarn to be caught on the hooks or catches by which it is retained in position on the drum. Fig. 4 is a sectional elevation showing the detail construction of one form of mechanical movement for oscillating the drum. Fig. 5 is an enlarged side elevation of the ratchet mechanism for feeding the guide bar or bars so as to distribute successive strands of yarn uniformly alongside of one another on the drum. Fig. 6 is an enlarged elevation of the mechanism for oscillating the yarn-guiding bar, and Fig. 7 is an end elevation of the mechanism shown in Fig. 6.

In preparing for printing the warp from which tapestry, &c., of various kinds is made it has hitherto been customary to wind upon a drum a continuous length of yarn in the same direction, and the length of the piece of goods which could be made up from any particular warp depended altogether upon the length of the circumference of the drum employed. It will be readily understood, therefore, that in order to print warps for relatively long pieces of tapestry it was necessary to provide exceedingly large drums, which were both costly to manufacture and of such size as to occupy valuable floor-space, besides being unwieldy to operate.

By our invention we provide means for winding one or any practical number of warps upon a drum in such manner that the piece or pieces of goods resulting from the same may be made of any length up to one practically double that of the circumference of the drum upon which it is wound.

In the above drawings, A is the supporting-framework of the machine, provided with bearings *a*, suitably placed for the reception of the drum-supporting shaft *b*. In the present instance the drum B is carried by said shaft so as to be revoluble within the frame, and the shaft is driven from a shaft *d*, supported at right angles thereto in bearings carried on brackets *a'*, projecting from the frame A, there being beveled gear-wheels *b'* and *d'*, by which said shafts are operatively connected. There is interposed between said shaft *d* and a shaft D, driven from any desired source of power, some form of reversing mechanism by which the shaft *b*, and consequently the drum supported thereby, may be turned through any desired arc and then turned backward through the same arc, after which it is again reversed, and so on. In order to accomplish this, we employ in the present instance a curved double-faced rack d^2, keyed to the shaft *d* and of such a length that its ends are some distance from each other, as shown in Fig. 1. It may be noted that the length of this rack determines the arc through which the drum is oscillated, and it will be understood by those skilled in the art that by va-

rying the length of this curved rack it is possible to correspondingly vary the arc of oscillation of the drum.

Formed from centers practically coincident with the ends of the rack are two curved guides d^3, and there is a pinion d^4 on the shaft d^5, placed to engage either face of the rack d^2 and be directed around the ends of the same by the guides a^3. In order to permit of the said pinion passing around the ends of the rack, as well as to permit of its engagement with either side of the same, we connect the shaft d^5 to the shaft D through a universal connection d^6 and support said shaft d^5 at a point near the pinion d^4 in a sliding bearing d^7, movable in a suitably-formed portion of one of the brackets a'.

It will be seen that in the drawings we have illustrated a drum provided with four sets of mechanism for simultaneously winding four warps upon the drum, and although in the description hereinafter we shall refer more particularly to but one of these sets of mechanism it is immaterial how many of these sets are employed, since their use is merely a matter of duplication of apparatus and suitable design of the drum and frame.

For each warp to be wound there are two hooks or catches b^2 and b^3, formed, preferably of rods supported at one end so as to overhang and extend parallel with the face of the drum. In the case illustrated said catches are shown as supported upon slidable bands b^4, extending across the face of the drum and movable toward and from each other thereupon to suit the length of warp which it is desired to print.

Upon a cross-bar a^3 of the frame, extending parallel with and adjacent to the face of the drum B, we support a feed-screw C, and there is a bar c' attached to a threaded nut c, movable on said screw, which carries for each warp under treatment a projecting arm c^2, near whose ends are placed two hooks c^3 and c^4, each having a spherical or blunt end c^5. This screw C is fixed to or formed integral with a spindle c^6, carrying a ratchet-wheel c^7, engaged by two pawls c^8 and c^9, connected to a pivotally-supported bar or arm c^{10}.

There are projecting from the side of the drum B two pins b^5 and b^6, so placed as to alternately engage the arm c^{10} and turn it first in one direction and then in the opposite direction upon its pivot. For example, when the drum has been oscillated far enough to bring the pin c^5 under the arm c^{10} this latter will be raised, and since the pawl c^8 is positively engaged with the tooth of the ratchet-wheel c^7 said wheel will be turned through a certain arc, while when the drum B is oscillated in a reverse direction the pin b^6 will strike the upper surface of the arm c^{10} to move it downwardly. Such motion causes the pawl c^9 to move the wheel c^7, while the pawl c^8 simply slips over the teeth into its original position, ready for another upward movement of the arm c^{10}. By this means the nut c, with its attached parts, is periodically moved forward across the face of the drum.

It will be seen that the bar c' is provided with a bearing c^{11} at the side of the frame most distant from the screw C and carries on its end a cam-bar c^{12} for a purpose hereinafter set forth.

In addition to the bar c' there is extending substantially parallel to the axis, and consequently to the face of the drum B, a longitudinally-movable bar E, carried in bearings e and e' and having fixed to it a collar e^2 for each separate body of warp under treatment. From this collar projects an arm e^3, having at its end one or more (in the present instance two) open spiral guides e^4 for the strand of yarn under treatment. Said bar under the action of a spring e^5 normally tends to remain in such a position that each of its arms e^3 is adjacent to the supported end of its respective catches b^2 and b^3, said spring being connected between the bearing e' and one of the collars e^2. Said bar E also carries at one end a projecting-pin e^6, which is engaged by one arm of a lever F, pivoted to the bracket a', as shown in Fig. 2.

There is on one end of the drum a segmental cam b^7, upon which bears a roller f on the end of a bar f', attached to the second arm of the lever F. A spring f^2 retains said bar in engagement with the cam b^7 or with the end b^6 of the drum, as the case may be, so that when the lever F is turned on its pivot by the action of said cam upon the rod f' the bar E will be moved longitudinally, so as to compress the spring e^5.

From Figs. 1 and 2 it will be seen that there is pivoted to the side of the frame A a lever G, provided with one arm placed to engage a beveled projection or cam e^7 on the bar E and having another arm placed to engage an arm of the lever F adjacent to its point of engagement with the pin e^6. When, therefore, the bar E is moved longitudinally by the engagement of the pin e^6 with the lever F, the beveled surface or cam e^7 will act upon one arm of the lever G, so as to turn this latter on its pivot. Such turning will cause the other arm of said lever to push upwardly the arm of the lever F and cause it to disengage the pin e^6, said arm being made, if desired, in two sections hinged together, as indicated at f^3. This disengagement of the pin e^6 from the lever F permits the bar E to move longitudinally under the action of the spring e^5, and since the pin e^6 has an inclined upper surface when the drum B is turned so that the cam b^7 no longer forces out the rod f' the lever F will slip over the pin e^6, so as to engage the same, and will again move the rod E when the cam b^7 causes movement of said lever F.

A tension device is employed with each individual winding mechanism, which is construct-

ed, as shown in detail in Fig. 3, so as to take up whatever slack may exist from time to time in the yarn. This device consists of a bar H, pivoted to one of the members of the frame A and carrying at its end a pair of guides h and a pair of disks h', between which the yarn passes and which are pressed together by a spring h^2, carried upon the bolt h^3, in which said disks are supported.

In addition to the above there are two other guides, h^4 and h^5, on the frame and also some suitable device for supporting bobbins or balls of yarn J.

We further provide means for oscillating the bar E to a limited extent and for this purpose employ a projecting arm e^8, fastened upon said bar adjacent to an inclined cam-arm c^{12}, carried on the bar c'. This cam-arm is so bent that when it engages the arm e^8 the bar E is caused to turn through an angle of about sixty degrees. In order to return said bar to its original position after such turning, we provide a collar fastened to the shaft E, having an arm e^9 placed to engage with a projection e^{10} on the frame of the machine. This arm e^9 is inclined at an angle to the line of the shaft E, so that as said shaft is moved longitudinally it engages the projection e^{10} and turns the shaft through an angle equal to but opposite to that through which said bar was turned by the action of the parts e^8 and c^{12}.

Under operating conditions the turning of the shaft D by the belt d^5 causes the drum B to be oscillated alternately in opposite directions through an angle which in the present instance is about three hundred and fifty degrees. The yarn to be wound is led from a bobbin through the guide h^5 to the tension device, through the guide h^4 on the frame, and through the guides e^4 on the arm e^3.

In the beginning of the operation the end of the yarn is led from the second of the guides e^4 and fastened to one of the catches, as b^2, at a point adjacent to its supported end. The various pieces of apparatus are so timed that when the winding is started the bar E is in its normal position with the spring e^5 not compressed and the roller f of the rod f' bearing upon the plane portion of the end b^6 of the drum B. Under these conditions the collar e^2 and the arm e^4 will be in the positions indicated in dotted lines in Fig. 3, while the warp will pass around one of the hooks, c^4, on the arm c^2, the tension exerted by the part h' being so adjusted that the pivoted arm H will be supported in the position shown in Fig. 2.

As the device is operated so that the drum is turned and made to approach the end of its path of oscillation the cam b^7 by pushing outwardly the rod f' turns the lever F on its pivot and moves the bar E longitudinally, so as to compress the spring e^5. This action causes the arm e^3 to gradually move into the position shown in full lines in Fig. 3, and after it has passed beyond the line of the ends of the catches b^2 and b^3 said bar E is turned by the engagement of the part e^8 with the cam-arm c^{12}, so that the guide-holding end of said arm e^3 is moved inwardly toward the surface of the drum. By the time this inward motion has brought the yarn nearer the surface of the drum than is the end of the catch b^3, as shown in Fig. 3, the inclined cam-surface e^7 in the bar E has turned the lever G on its pivot sufficiently to free the pin e^6 from the lever F. It will be understood that just before this release takes place the drum has reached such a position that the catch b^3 is in the position shown in Fig. 3, and the longitudinal motion of the bar E under the action of the spring e^5 therefore loops the yarn over the end of said catch. Immediately thereafter the mechanism shown in Fig. 4 reverses the direction of the rotation of the drum B, so that it moves in the direction of the arrow in Fig. 3, laying a strand of yarn alongside of and parallel with the strand previously laid. The amount of motion of the arm c^2 and the collar c, carrying the same, necessary to avoid bringing two successive strands upon each other is obtained by the partial revolution of the screw C under the action of the mechanism illustrated in Fig. 5, as above described. As the return longitudinal movement of the bar E above noted is taking place the inclined arm e^9 of said bar is brought into engagement with the projection e^{10}, carried by the frame, so that said bar is turned back to its original position. Any slack in the yarn, which may occur by reason of the consequent receding of the arm e^3 from the surface of the drum, is at once taken up by the pivoted arm H, which automatically turns so as to maintain the tension constant. As the revolution of the drum continues the second strand of yarn is laid alongside of that previously placed until as the catch b^3 comes around the bar E is again moved so that said strand is led inwardly and finally looped over the end of said catch just as the direction of rotation of the drum is again reversed. After the drum has been wound so that its entire available space is filled with the warp this latter is painted or printed in the well-known manner, after which it is removed from the catches and employed in looms for the manufacture of tapestry.

It will be seen that there is available for weaving a length of warp double the distance around the drum between the catches instead of merely a length equal to the circumference of the drum.

While we show in the drawings herewith a drum provided with four sets of winding and looping mechanism, it will be understood that there is practically no limit to the number of sets of such mechanism which may be used with a single drum except that imposed by the matter of convenience and strength of the materials employed. It will be further un-

derstood that any periodical reversing mechanism may be substituted for the reversing mechanism employed, as it is immaterial as to how the revolution of the drum is reversed, so that it occurs at predetermined points. Again, while we prefer to use the particular form of looping mechanism illustrated, it will be understood that other devices may be employed for placing the yarn upon the hooks or catches b^2 and b^3 at the end of each oscillation of the drum.

Should it be desired to wind a warp of less length than that illustrated in the drawings above shown, it will be understood that the pieces b^4 upon the drum can be adjusted as desired so as to vary the circumferential distance between them. In such a case the double-faced rack would be made of such a length to properly reverse the rotation of the drum at the time when the yarn is looped upon the catches.

It is to be understood that while we have shown our invention as applied to a revoluble drum upon which is wound the yarn to be printed it is possible that other devices may be employed to support the yarn which would come within the scope of our invention, it being intended that our invention shall cover, broadly, any means for winding a body of yarn back and forth upon a suitable supporting structure for the purpose of printing the same.

We claim as our invention—

1. In a tapestry-printing machine the combination of a drum for yarn, yarn-holding devices or sets of devices thereon, with means for turning the drum and mechanism for causing the yarn to engage with said holding devices, substantially as described.

2. The combination of a drum for yarn, with mechanism for winding yarn circumferentially back and forth on the drum and means for holding the yarn in position, substantially as described.

3. The combination of a drum, yarn-holding devices carried thereby, means for oscillating the drum and mechanism for delivering yarn to the drum and placing it in engagement with the holding devices as the drum is oscillated, substantially as described.

4. The combination of a drum, catches carried by the same, means for oscillating the drum and a device for winding yarn back and forth on the drum and placing it in engagement with said catches as the drum is oscillated, substantially as described.

5. The combination in a tapestry-printing machine of a drum, means for oscillating the same, means for laying back and forth upon said drum a warp to be printed and means for holding said warp in place, substantially as described.

6. The combination of a drum, means for rotating the same, means for periodically reversing such rotation, yarn-holding devices on the drum, with a bar having operating means for causing yarn guided thereby to be brought into engagement with said holding devices on the drum, substantially as described.

7. The combination of a drum, means for rotating and periodically reversing the same, two catches on the drum, with a yarn-carrying bar having operating means to cause it to loop yarn over one of said catches at the time of the reversal of the drum, substantially as described.

8. The combination of a frame, a drum, means for rotating and periodically reversing the drum, yarn-holding means on the drum, a bar carried on the frame having means for guiding yarn and means for moving the bar longitudinally to cause it to place the yarn in engagement with the holding devices on the drum, substantially as described.

9. The combination of a frame, a drum, means for rotating and periodically reversing the drum, yarn-holding means on the drum, a bar on the frame, with mechanism for moving said bar longitudinally and axially to cause yarn to be brought into engagement with the yarn-holding devices, substantially as described.

10. The combination of a frame, a drum, means for rotating and periodically reversing the drum, catches on said drum having overhung ends with mechanism on the frame for looping a strand of yarn over one of said catches each time the rotation of the drum is reversed, substantially as described.

11. The combination of a drum, means for rotating and periodically reversing the drum, catches adjustably carried upon the surface of the drum and means for placing a strand of yarn in engagement with one of said catches each time the rotation of the drum is reversed, substantially as described.

12. The combination of a frame, a drum, means for rotating and periodically reversing the same, yarn-holding devices carried upon the surface of the drum, a bar on the frame, means for moving said bar to cause it to place yarn in engagement with one of the holding devices at each reversal of the drum and means for causing successive strands of yarn to lie parallel upon the face of the drum, substantially as described.

13. The combination of a drum, means for rotating and periodically reversing the same, a pair of yarn-holding devices thereon, an arm for guiding yarn to the drum, a second arm engaging the yarn before it passes to the first arm and means for moving said second arm to cause it to place a strand of yarn successively in engagement with the said holding devices, substantially as described.

14. The combination of a drum, means for rotating and reversing the same, yarn-holding devices on the drum, an arm having mechanism for moving it toward the surface of the drum and means for moving said arm across

the face of the drum to cause it to bring a strand of yarn into engagement with said holding devices, substantially as described.

15. The combination of a drum, means for rotating and periodically reversing the same, two rods upon the drum supported so as to overhang the surface of the same, an arm having mechanism for moving it toward the face of the drum and means for moving it parallel with said face so as to loop yarn alternately upon said overhung rods, substantially as described.

16. The combination of a drum, means for rotating and periodically reversing the same, two rods upon the drum supported so as to overhang the surface of the same, an arm having mechanism for moving it toward the face of the drum and means for moving it parallel with said face so as to loop yarn alternately upon said overhung rods, with means for causing successive windings of yarn to be placed parallel to each other, substantially as described.

17. The combination of a drum having driving and reversing mechanism, yarn-holding devices on the drum, a cam, a yarn-carrying bar operated therefrom so as to move across the face of the drum and mechanism for moving said bar toward the drum, substantially as described.

18. The combination of a drum having driving and reversing mechanism, yarn-holding devices on said drum, a yarn-carrying arm having a cam for moving it in one direction across the face of the drum and a spring for moving it in a reverse direction, with mechanism for turning said bar each time the drum is reversed, substantially as described.

19. The combination of a drum, means for driving and reversing the same, means on the drum for holding yarn, mechanism for placing yarn in engagement with said holding means and means for maintaining a substantially constant tension on the yarn, substantially as described.

20. The combination of a drum, with mechanism for simultaneously winding a plurality of strands of yarn circumferentially back and forth upon said drum and means for retaining said strands in position, substantially as described.

21. The combination of a drum, with mechanism for simultaneously winding a plurality of strands of yarn back and forth upon the same, means for retaining the yarn on said drum and means for causing each winding of yarn to be laid alongside of the winding previously laid, substantially as described.

22. The combination of a drum, a plurality of sets of yarn-holding devices thereon, means for driving and reversing the drum, a bar having a plurality of yarn-carrying arms, with means for moving said bar longitudinally and means for oscillating it, substantially as described.

23. The combination of a rotatable yarn-supporting structure having yarn-holding devices, means for driving and periodically reversing the direction of rotation of said structure, with mechanism for causing yarn to be engaged by one of said holding devices each time the direction of rotation of the yarn-supporting structure is reversed, substantially as described.

24. The combination of a support for a body of yarn, with automatic laying mechanism for placing said yarn back and forth upon said support in a single layer and means for holding the yarn in position thereon, substantially as described.

25. The combination of a supporting structure, catches carried by the same, means for moving the structure and a device for winding yarn back and forth upon said structure and placing it in engagement with the said catches as the support is moved, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WALTER P. BENHAM.
JOHN K. WILLIAMSON.

Witnesses:
WILLIAM E. BRADLEY,
JOS. H. KLEIN.