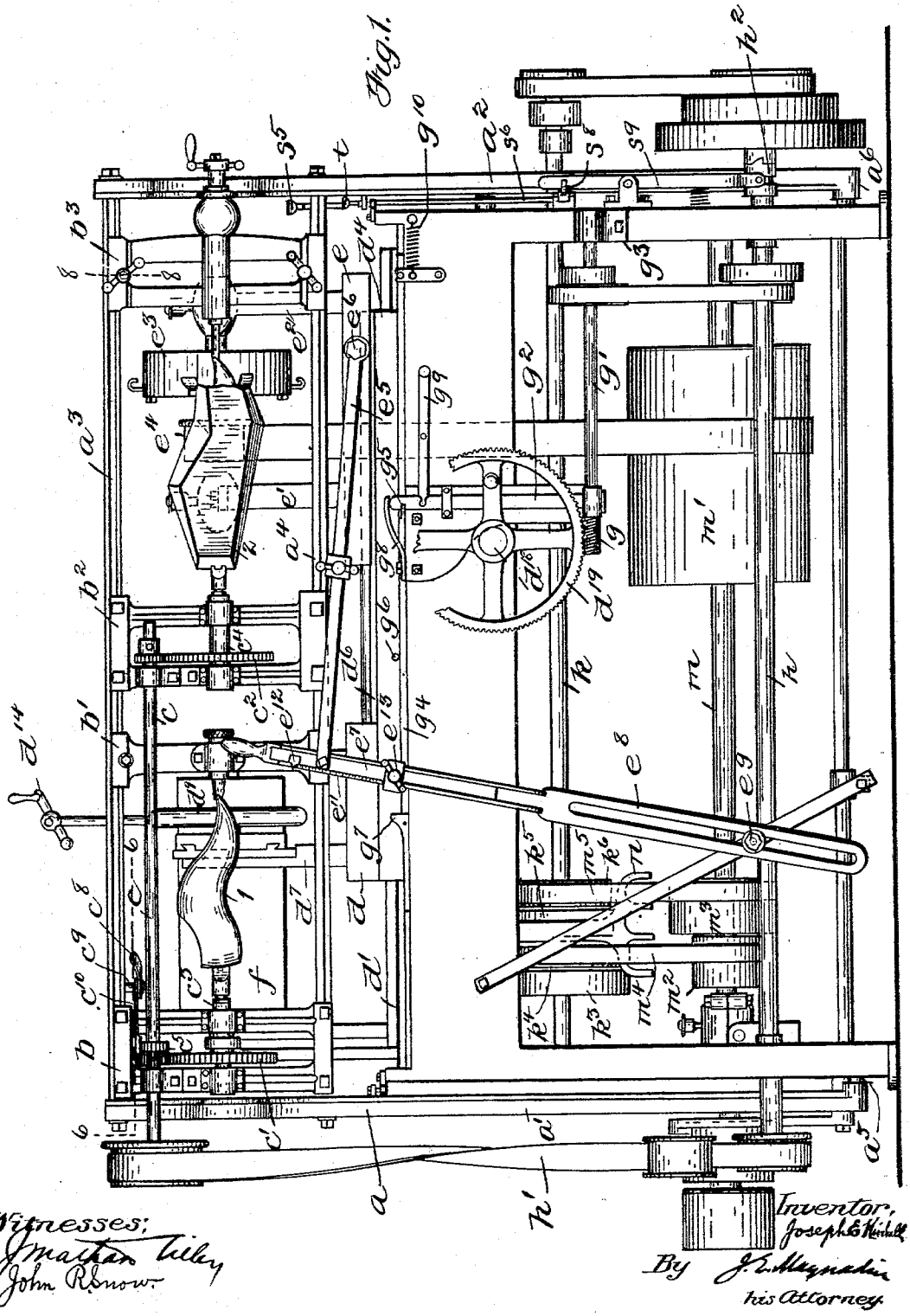
(No Model.) 6 Sheets—Sheet 1.

J. E. KIMBALL.

MACHINE FOR TURNING IRREGULAR FORMS.

No. 546,160. Patented Sept. 10, 1895.

Fig. 1.



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(No Model.) 6 Sheets—Sheet 2.

J. E. KIMBALL.

MACHINE FOR TURNING IRREGULAR FORMS.

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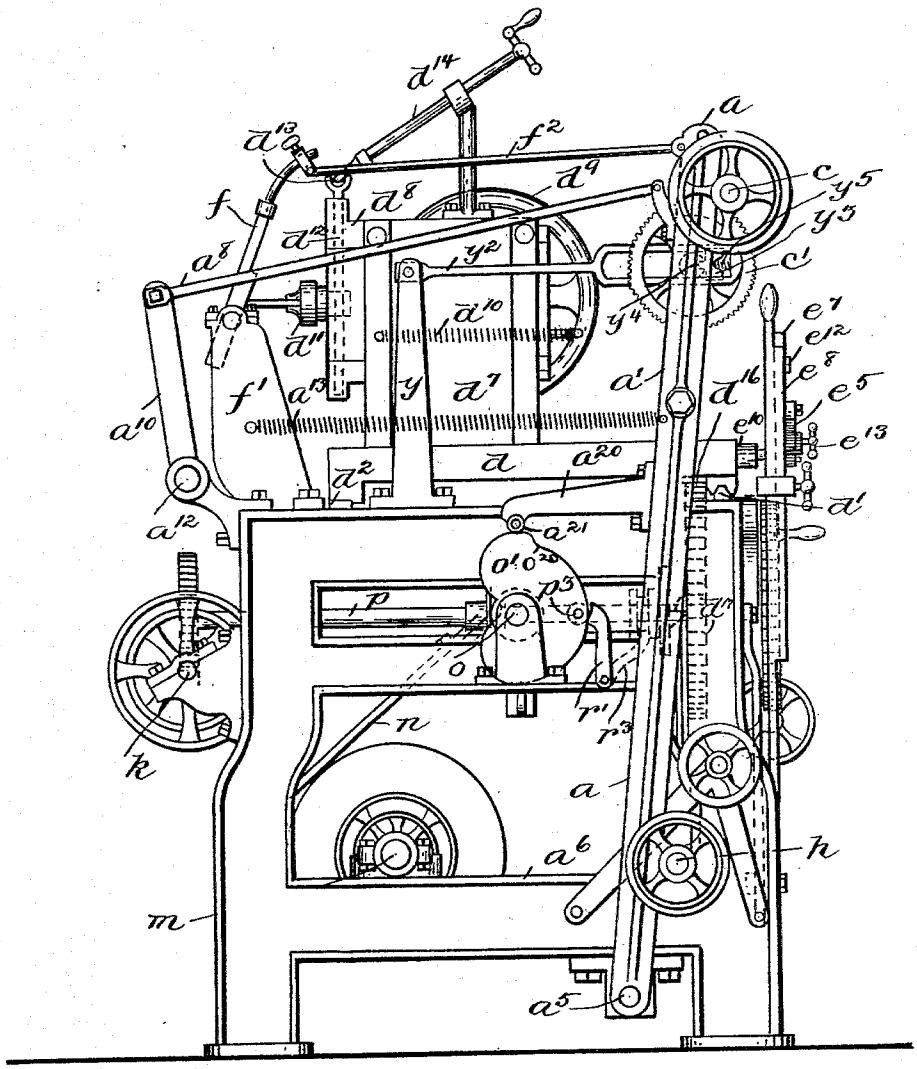

Fig. 2.

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(No Model.) 6 Sheets—Sheet 3.

J. E. KIMBALL.

MACHINE FOR TURNING IRREGULAR FORMS.

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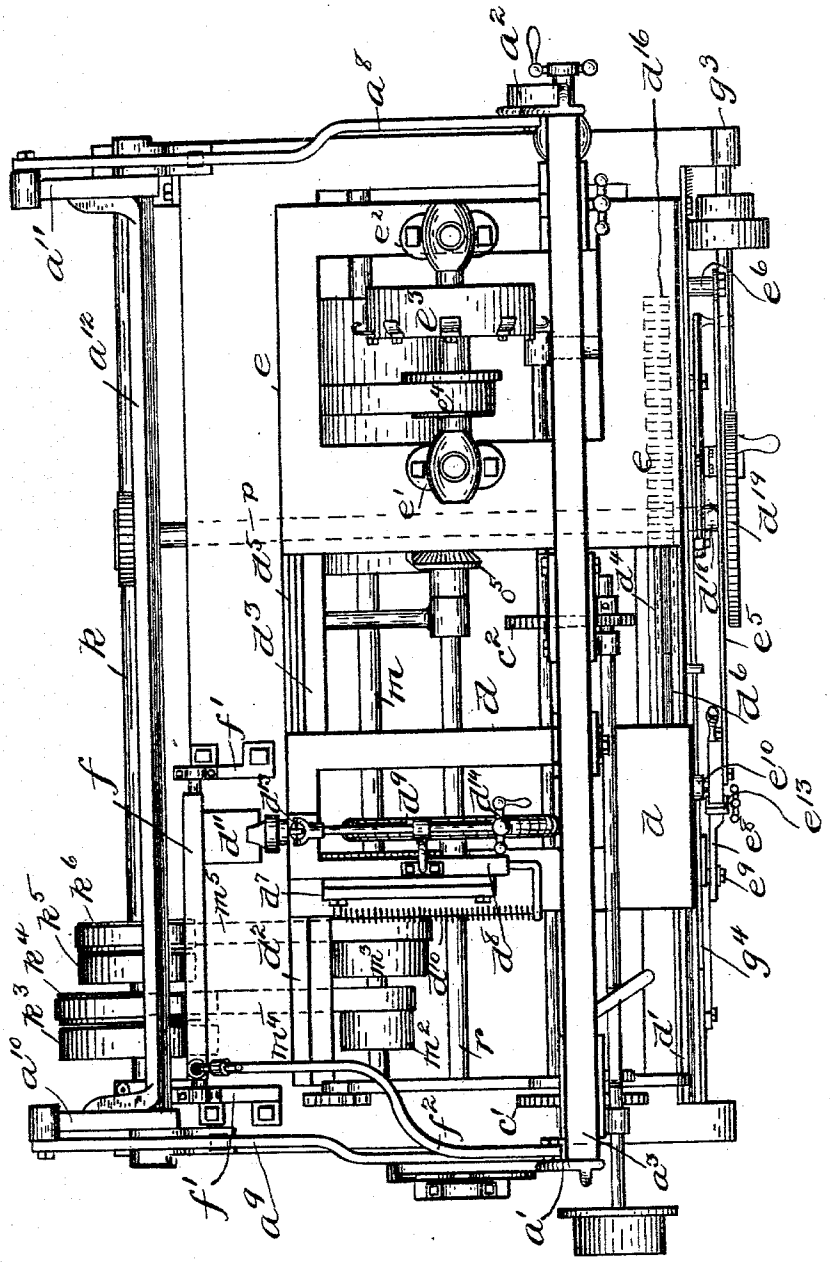

Fig. 3

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(No Model.) 6 Sheets—Sheet 4.

J. E. KIMBALL.

MACHINE FOR TURNING IRREGULAR FORMS.

No. 546,160. Patented Sept. 10, 1895.

Fig. 4.

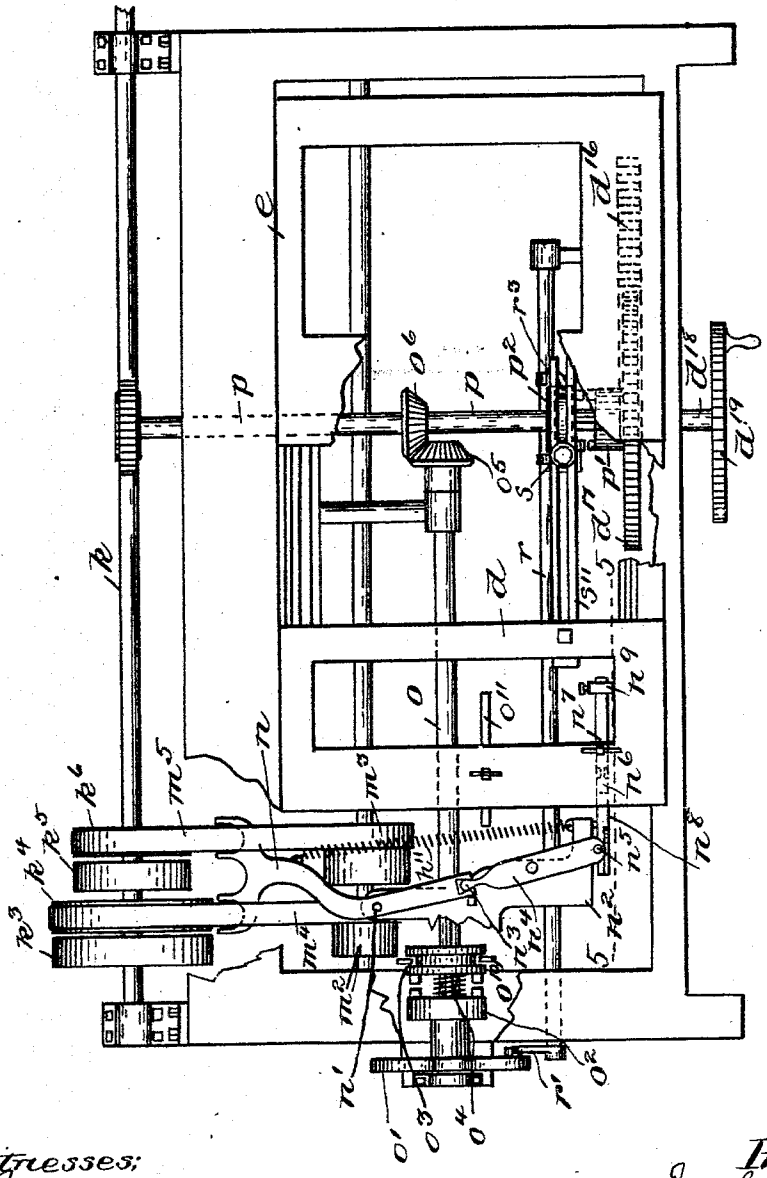
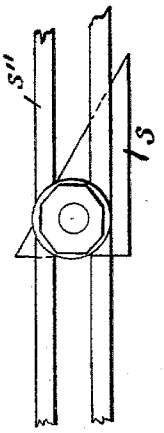


Fig. 9.



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(No Model.) 6 Sheets—Sheet 5.

J. E. KIMBALL.

MACHINE FOR TURNING IRREGULAR FORMS.

No. 546,160. Patented Sept. 10, 1895.

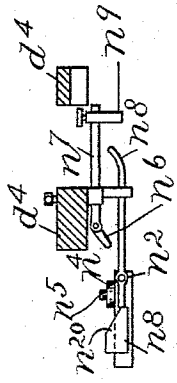

Fig. 5.

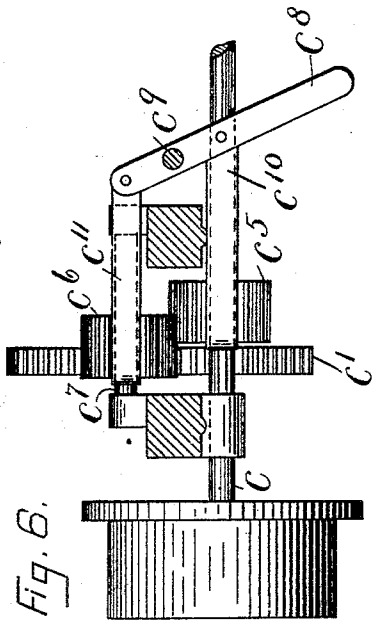

Fig. 6.

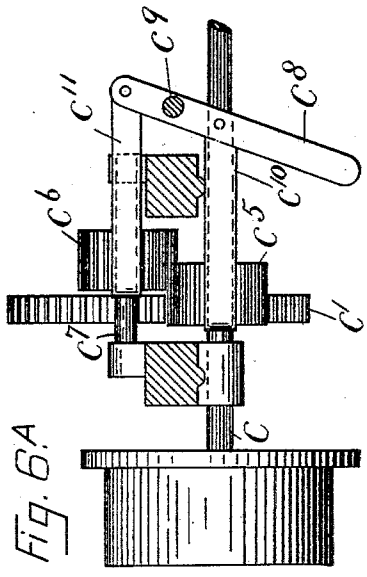

Fig. 6A.

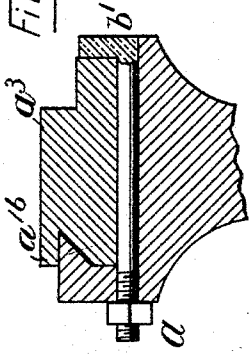

Fig. 8.

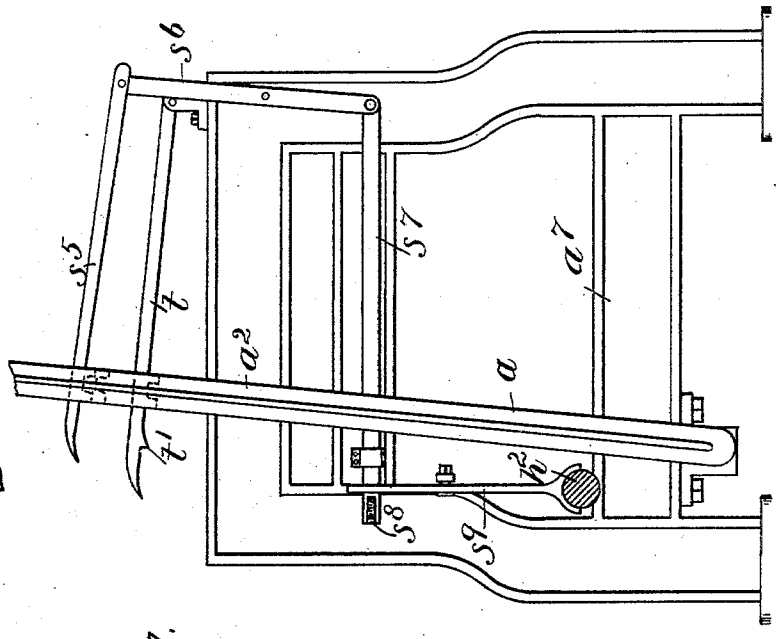

Fig. 7.

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MACHINE FOR TURNING IRREGULAR FORMS.

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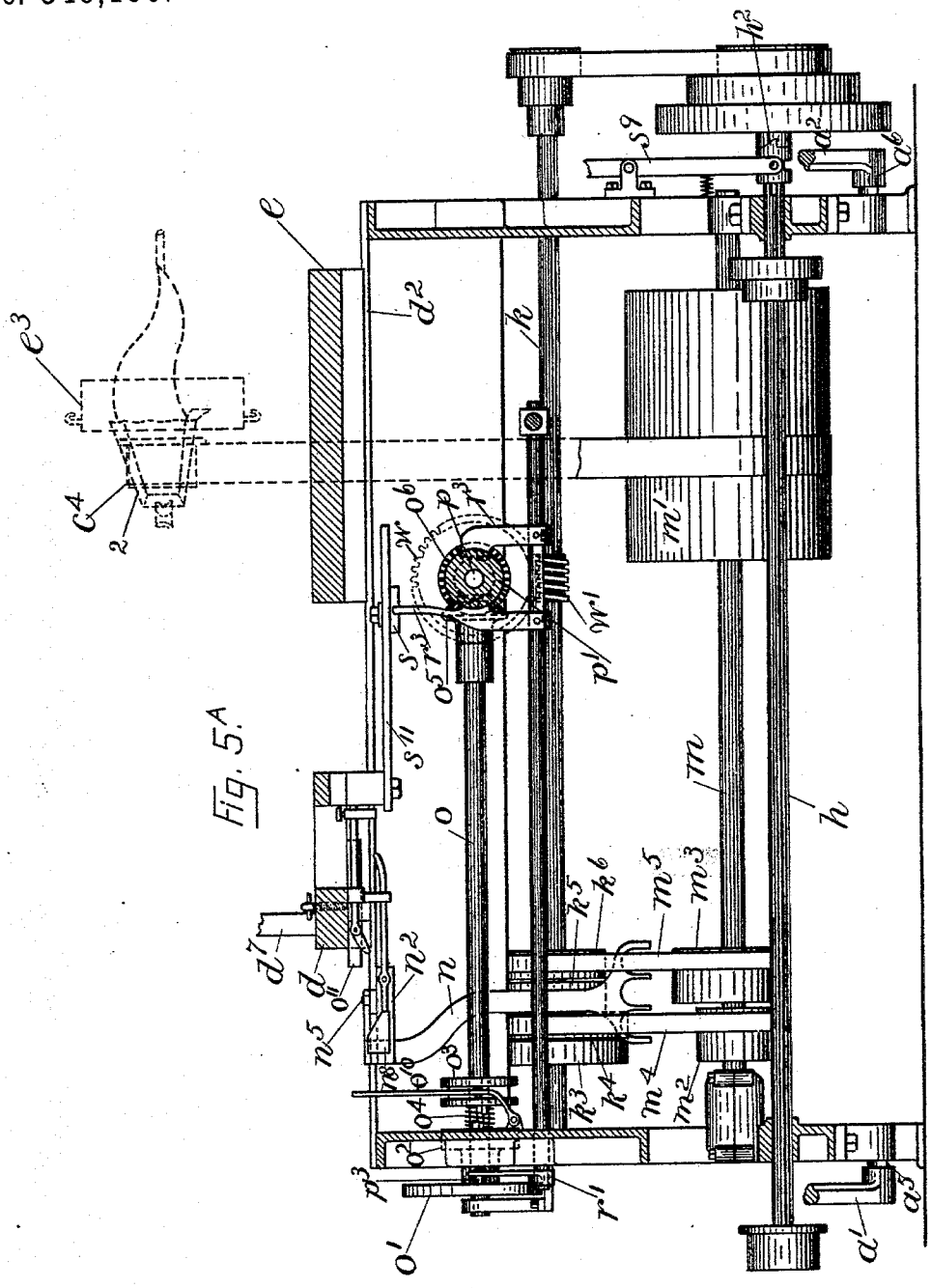

Fig. 5A

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UNITED STATES PATENT OFFICE.

JOSEPH E. KIMBALL, OF ABINGTON, MASSACHUSETTS.

MACHINE FOR TURNING IRREGULAR FORMS.

SPECIFICATION forming part of Letters Patent No. 546,160, dated September 10, 1895.

Application filed June 17, 1893. Serial No. 477,904. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. KIMBALL, of Abington, in the county of Plymouth and State of Massachusetts, have invented an Improved Machine for Turning Irregular Forms, of which the following is a specification.

The invention is herein described as embodied in a machine for turning lasts, although it will be obvious that the invention is not limited to such specific form or purpose.

The main features of machines of this class are a model and block rotating in line upon a swinging frame and a model-guide and cutter traveling with relation to the model and block, with the model in contact with the guide and the cutter cutting away the surplus material of the block, so that the varying contour of the model will vibrate the frame to feed more or less of the block to the cutter and thus shape the block on the lines of the model.

The main object of my invention is to produce a machine of this class in which the motion of the carriage to cause the guide to do its work in connection with the model and the cutter to do its work in connection with the block is automatically stopped at the desired time, the guide and model and the cutter and block are automatically separated, the model and block automatically stopped with the model in the desired position, and the carriage automatically moved back ready for a second operation.

The main feature of my invention consists in the combination in a machine of this class of automatic mechanism for stopping the operation of the cutter on the block at the desired time, for stopping the rotation of the model and block, with the model in the desired position, and for carrying the parts back to their starting-point.

Other features of my invention relate to important matters of construction by which the quality of the work is improved and the machine is made more durable and efficient.

It will be obvious that the guide and cutter may be moved toward and away from the axis of the model and block, and that the model and block may be moved past the guide and cutter; but in practice it is better to mount the head-stocks and tail-stocks of the model and block in a swinging frame and to mount the guide and cutter upon carriages, as in that form of my machine shown in the drawings. It will be obvious that a single carriage will be used, except when the length of the last or other article differs from the length of the model; but when an article longer or shorter than the model is to be turned two carriages must of course be used, for the reason that one must have a longer or shorter travel than the other.

In the accompanying drawings, forming a part of this specification, Figure 1 is a front elevation of my improved machine; Fig. 2, an end view looking from the left of Fig. 1. Fig. 3 is a top plan; Fig. 4, a partial plan view showing the shipper and the mechanism for returning the carriages; Fig. 5, a detail partly in section on line 5 5 of Fig. 4, showing the devices for actuating the shipper. Fig. 5^a is a vertical section on line 5 5 of Fig. 4, but more complete than Fig. 5. Fig. 6 is a detail on line 6 6 of Fig. 1 of the mechanism for reversing the revolution of the model, showing the gear c' driven by pinion c^5 through pinion c^6. Fig. 6^a is a similar view to Fig. 6 showing c' driven directly by c^5, c^6 being out of mesh with c'. Fig. 7 is a partial end view of the machine looking from the right of Fig. 1, showing the devices for retaining the frame away from the guide and cutter and for stopping the carriage-feed and the mechanism that rotates the model and block. Fig. 8 is a detail on line 8 8 of Fig. 1, and Fig. 9 is a detail of the device for stopping the return movement of the carriages.

In the drawings the swinging frame a is composed of standards a' a^2 and cross-pieces a^3 a^4, which are supports for the stocks b b' b^2 b^3. The standards a' a^2 are supported at a^5 a^6 at the base of the machine and are connected by rods a^8 a^9 with the arms a^{10} a^{11} of a rocker-shaft a^{12}, by which the frame is braced. A spring a^{13} tends to pull the frame inwardly. The head-stocks b b^2 support shaft c, which drives gears c' c^2, secured on spindles c^3 c^4, which revolve the block 1 and model 2. The axis of the block and the axis of the model must be in line; but the dogs or centers which support the model must be rotated in some cases in same direction as the dogs or centers which support the block, and in other cases in the opposite direction, in order that the

machine may turn rights and lefts from the same model. This is accomplished by the gears c' c^2, which mesh with pinions on shaft C, and when pinion c^5 meshes with gear c' the spindles c^3 c^4 and block 1 and model 2 revolve in the same direction. Pinion c^5 (see Figs. 2, 6, and 6A) is splined on shaft c, and pinion c^6 is loose on a stud c^7, supported by the headstock b. Lever c^8 is fulcrumed on pin c^9, secured upon the cross-piece a^3, and is connected with straps c^{10} c^{11}, jaws on which engage the pinions c^5 c^6, so that when the end of lever c^8 is moved to the left it will cause pinion c^5 to mesh with gear c' and pinion c^6 to unmesh with gear c', and c' will then be driven directly by pinion c^5; but when lever c^8 is moved back pinion c^6 will mesh with gear c' and also with pinion c^5, and thus the motion of c' will be reversed to produce a right last from a left model, or vice versa. This is also a feature of my invention, for although the pinions c^5 c^6 are not new with me I am the first to connect them by mechanism, so that the act of moving one into gear with c' moves the other out of gear with c', thereby greatly facilitating and making certain the operation of setting the machine to turn a right or a left.

Upon the bed of the machine are tracks d' d^2, upon which slides the model-carriage d, provided with elongations d^3 d^4, upon which are tracks d^5 d^6, on which the cutter-carriage e is mounted. Upright d^7 on carriage d carries the support d^8, which is movable in ways on the upright d^7, the support d^8 carrying the guide-wheel d^9. Spring d^{10} is connected to support d^8 and upright d^7. A projection d^{11} is secured upon a threaded spindle d^{12}, which is connected by a universal-joint d^{13} with a crank d^{14}, by which the projection d^{11} is moved vertically. The projection d^{11} is held by spring d^{10} in engagement with a fan-board f, mounted upon uprights f' and connected by rod f^2 with the frame a. The projection d^{11} can thus be moved toward and from the axis of fan-board f to vary the throw of support d^8, and consequently limit the movement of the frame a to bring the axis of the block nearer to or farther from the cutter, and thus make the last larger or smaller than the model in directions at right angles to the axis.

The cutter-carriage e supports the uprights e' e^2, on which the cutter e^3 and pulley e^4 are mounted. The cutter-carriage e has a movement independent of the model-carriage by means of an adjustable link e^5, connected to cutter-carriage e at e^6 and connected to sliding block e^7 on lever e^8, the lever being provided with a movable fulcrum e^9 and connected to the model-carriage d, all as usual. The lever bears a graduated scale e^{11}, and pointer e^{12} on block e^7 can be secured by clamp e^{13} at the desired adjustment to vary the length of travel of carriage e to make a last which is longer or shorter than the model.

Upon the under side of carriage d is a rack d^{16}, which is engaged by a pinion d^{17}, fixed on shaft d^{18}, upon which is also the gear d^{19}, driven by worm g on shaft g'. Shaft g' is journaled at one end on a slide g^2 and at the other end in a movable bearing g^3. A rod g^4 slides in a groove in the front of the machine and has a tooth g^5, which engages a notch in the slide g^2. A pin g^6 on guide-carriage d strikes a projection g^7 on the rod g^4 when the carriage has reached the limit of its travel and releases the slide g^2, which drops down, aided by spring g^8, and thus separates the worm and gear. (The slide g^2 can be raised by lever g^9 and the tooth g^5 will then re-engage the slot by the pull of spring g^{10}.) Shaft g' is driven by shaft h, which also drives shaft c through belt h'. Shaft h is driven through clutch h^2 by shaft k, which is in turn driven by main shaft m, upon which is the drum m', which drives cutter e^3. Shaft k is driven through pulleys m^2 m^3 on shaft m and belts m^4 m^5 and pulleys k^4 k^5 on shaft k, pulleys k^4 k^5 being fast and pulleys k^3 k^6 loose on shaft k. A shipper n is fulcrumed at n' upon a bracket n^2 and is connected at n^3 with lever n^4, also fulcrumed on bracket n^2. A pin n^5 on lever n^4 is acted upon by a finger n^6 on rod n^7, adjustably secured on the bottom of part d^4 of carriage d, so that as the carriage d moves to the left lever n^4 is pushed over until engaged and held by lever n^8 and the belts m^4 m^5 shifted from pulleys k^4 k^6 to pulleys k^3 k^5 and the speed of shaft k thereby diminished, thus causing the carriages to move slowly and the model and block to rotate at a less speed while the cutter is forming the comb or instep part of the last. The finger n^6 slides over the incline n^{20} on lever n^8 and at the proper moment the collar n^9 strikes lever n^8 and releases lever n^4 and the belts are returned to the pulleys k^4 k^6 by spring h^{11} and shaft k resumes its normal speed.

The devices for automatically returning the carriage are as follows: An arm a^{30} is secured on the standard a' and carries cam-roll a^{21} of cam o', which is supported loosely upon shaft o, one member o^2 of a clutch being secured to the cam o', the other member o^3 splined on the shaft o and separated from member o^2 by spring o^4. A forked arm o^{10} embraces clutch o^3 and is acted upon by the adjustable tripper o^{11} to operate the clutch. Shaft o is continuously driven through bevel gears o^5 o^6 by shaft p, which is in turn driven by gear w and worm w' on shaft k. Shaft p is suitably supported from the bed of the machine and connects with clutch member p' on shaft d^{18}, the other member p^2 of that clutch being splined on shaft p. Rocker-shaft r is provided on one end with an arm r', which is engaged by the roll p^3 on cam o', and is also provided with a forked arm r^3 for the clutch member p^2. A tripper s, adjustably secured on support s^{11}, fast to the carriage d, engages the forked arm r^3 at the proper moment and separates the clutch, in order to stop the return movement. When the frame a is swung forward away from the guide and cutter by

cam o' acting on arm a^{20}, shaft h is stopped automatically by a rod s^5, detachably connected at one end to the frame a and at the other end to a lever s^6, connected with a rod s^7, having at its outer end a wedge s^8, which acts upon lever s^9 to separate clutch h^2 and stop-shaft h. When the frame a has swung forward the required distance, the projection t' on rod t engages the frame and prevents its return until latch $t\,t'$ has been raised. The model must be stopped always in one position—namely, with the comb of the model uppermost—and to insure this I provide an upright y supporting one end of link y^2, the other end embracing the model-spindle. A spring-latch y^3 slides in the link and has a tooth y^4 which engages a recess in the spindle and is pressed into engagement with the slot by a spring y^5 when the frame a is swung outward, so that the rotation of the model is stopped with the comb uppermost. This stopping of the model always in the desired position has never before been accomplished in any machine of this class and is an essential feature of my invention, for the reason that it is necessary before shifting the gear c^5 to bring it into or out of mesh with the gear c', that the relation of gears c^5 and c' shall be such that the dogs on spindles c^3 and c^4 are parallel when c^5 is shifted. Moreover, it is practically essential that the dogs on the spindles c^3 and c^4 shall always be parallel when the the rotation of the model and block is automatically stopped, in order to prevent imperfect work from false setting of a fresh block. Cross-piece a^3, Fig. 8, is provided with a ledge a^{16}, which projects over the top of stocks $b\,b'\,b^2\,b^3$ and prevents dust entering the bearing-surface a^{17}. This is especially important with regard to the tail-stocks $b'\,b^3$, which must be frequently adjusted and always kept true.

The operation of the machine is as follows: The model and block are placed in position while the frame is held out by the latch $t\,t'$ and the carriages d and e are at the starting-point. Rod t is raised and the frame swings forward until the model and block are in contact with the guide and cutter, the latter being constantly rotated by shaft m. As the frame swings forward, the levers $s^5\,s^6\,s^7$ cause wedge s^8 to release lever s^9 and thereby close clutch h^2, and shaft h is started and the model and block revolved. Lever g^9 is then depressed and the worm g engaged with gear d^{10}, starting the carriage d. As the carriages move to the left, the block is shaped to correspond with the model, and as the guide approaches the comb of the model shipper n moves belt m^5 from loose pulley k^6 to fast pulley k^5 and belt m^4 upon the loose pulley k^3 from fast pulley k^4, so that the carriages move more slowly and the model and block rotate at a less speed. When the comb is passed, lever n^8 is tripped by dog n^9 and the belts are returned to their first position by spring h^{11}. When the carriage d reaches the end of its travel toward the left, pin g^6 on part d^4 of carriage d strikes projection g^7 and moves slide g^4 to release slide g^2, which is forced down by its spring g^8 to separate worm g and gear d^{10} and stop the carriage-feed; but a moment before the dog o^{11}, acting through the usual forked lever o^{10}, throws clutch member o^3 into engagement with o^2 to rotate cam o', which hangs by gravity with roll p^3 in a vertical line with the axis of the cam, when o^2 and o^3 are disengaged. As cam o' turns, the cam-surface o^{20} engages the arm a^{20} and forces frame a away from the guide and cutter and the tooth y^4 engages the notch in spindle c^3 and stops the rotation of the model and last at their proper positions, and the frame is held by latch $t\,t'$. At the same time the clutch h^2 is thrown out by lever s^9 and wedge s^8, stopping shaft c. As cam o' continues to revolve, the roll P^3 engages arm r', which rocks shaft r to engage clutch members p^2 and p' and thereby rotate pinion d^{17} in the opposite direction and return the carriages. On the return movement the forked arm r^3 is struck by tripper s on carriage d, unclutching p' and p^2, and the carriages come to rest. Clutch o^2 o^3 is disengaged by spring o^4 as carriage d moves away from it and cam o' resumes its normal position. When the frame a is held out by the latch $t\,t'$, the operator removes the last and replaces it by a block, releases latch $t\,t'$ and after allowing frame a to swing into place depresses lever g^9 to lift slide g^2 and bring worm g into gear and start the carriage.

The main advantage embodied in my improved machine is the combination of a model and block whose axes are in line with a cutter and guide by means of automatic mechanism for giving a relative motion to the model and block and the cutter and guide in a direction to cause the surface of the model to act with the guide and the surface of the block to be acted on by the cutter and to cause the model and block to be separated from the cutter and guide and the motion of the model to be stopped with the model always in the required position. Obviously the construction of the automatic mechanism, which I have shown as giving a rotary motion to the model and block on the same axial line and a motion of the cutter and guide parallel with the axial line of the model and block, and a sidewise motion of the model and block toward and from the cutter and guide while the cutter is acting to remove the surplus material from the block, and a further sidewise motion of the model and block away from the cutter and guide after the block is stopped, may be widely varied, and while the mechanisms described for imparting these various motions automatically are those I prefer, yet the principle of my invention is the automatic stopping of the model and block with the model always in the required position, when the model and block rotate on axis in the same line, and are automatically governed in their relation to the

guide and cutter, as above described. Moreover, I am the first to devise a machine in which all the motions of model and block on the same axial line with relation to a guide and cutter are automatic, and while this has been done in machines for turning certain irregular forms, (see, for example, patents to Kromer, No. 422,809, dated March 4, 1890, and to Hoopes, No. 372,796, dated November 8, 1887) yet my improved machine is the first wholly automatic machine adapted for that class of work in which the axis of the model must always be in the same line on the axis of the block.

What I claim as my invention is—

1. In combination a model and block on the same axial line; a guide and cutter; a carriage for giving the relative motions endwise; a frame for giving the relative motions sidewise; and automatic mechanism for moving the carriage, stopping the motion of the carriage in one direction, separating the model and block from the guide and cutter, and stopping the rotary motion of the model and block with the model always in the required position, all combined and operating substantially as and for the purposes specified.

2. In a machine for turning irregular forms a carriage, a rack and pinion, direct and reverse motion devices for the pinion, a cam normally out of action, a clutch controlling that cam, a tripper carried by the carriage to operate the clutch controlling the cam, a second clutch operated by the cam and when in gear reversing the motion of the pinion and a second tripper carried by the carriage to open the second clutch, when the carriage reaches the end of its return stroke, all combined and operating to move the carriage in one direction, automatically stop its motion at a desired point, connect the pinion with its reverse motion devices, and stop the carriage at the end of its return stroke, substantially as set forth.

3. In a machine for turning irregular forms the combination of the model, its driving gear c', pinions c^5 and c^6, lever c^8 and connections c^{10} c^{11}, to reverse the motion of gear c' by a single motion of lever c^8, all substantially as described.

4. In combination a model and block on the same axial line; a guide and cutter; a carriage for giving the relative motions endwise; a frame for giving the relative motions sidewise; automatic stop mechanism for controlling the carriage and governing the last block; and automatic mechanism for moving the carriage endwise in both directions, and separating the model and block from the guide and cutter; all combined and operating to make the automatic machine above described.

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