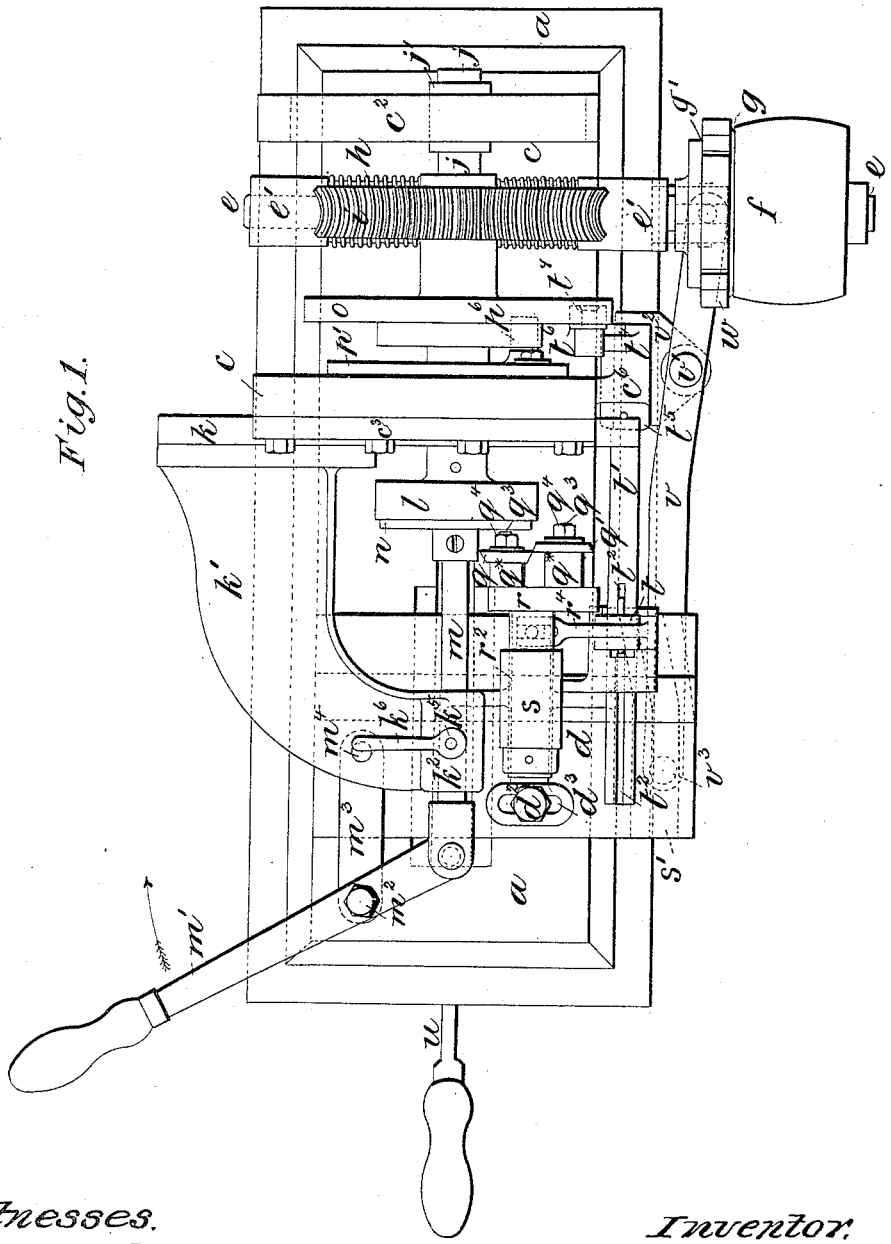
(No Model.) 6 Sheets—Sheet 1.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

Fig. 1.



Witnesses.
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By James L. Norris.
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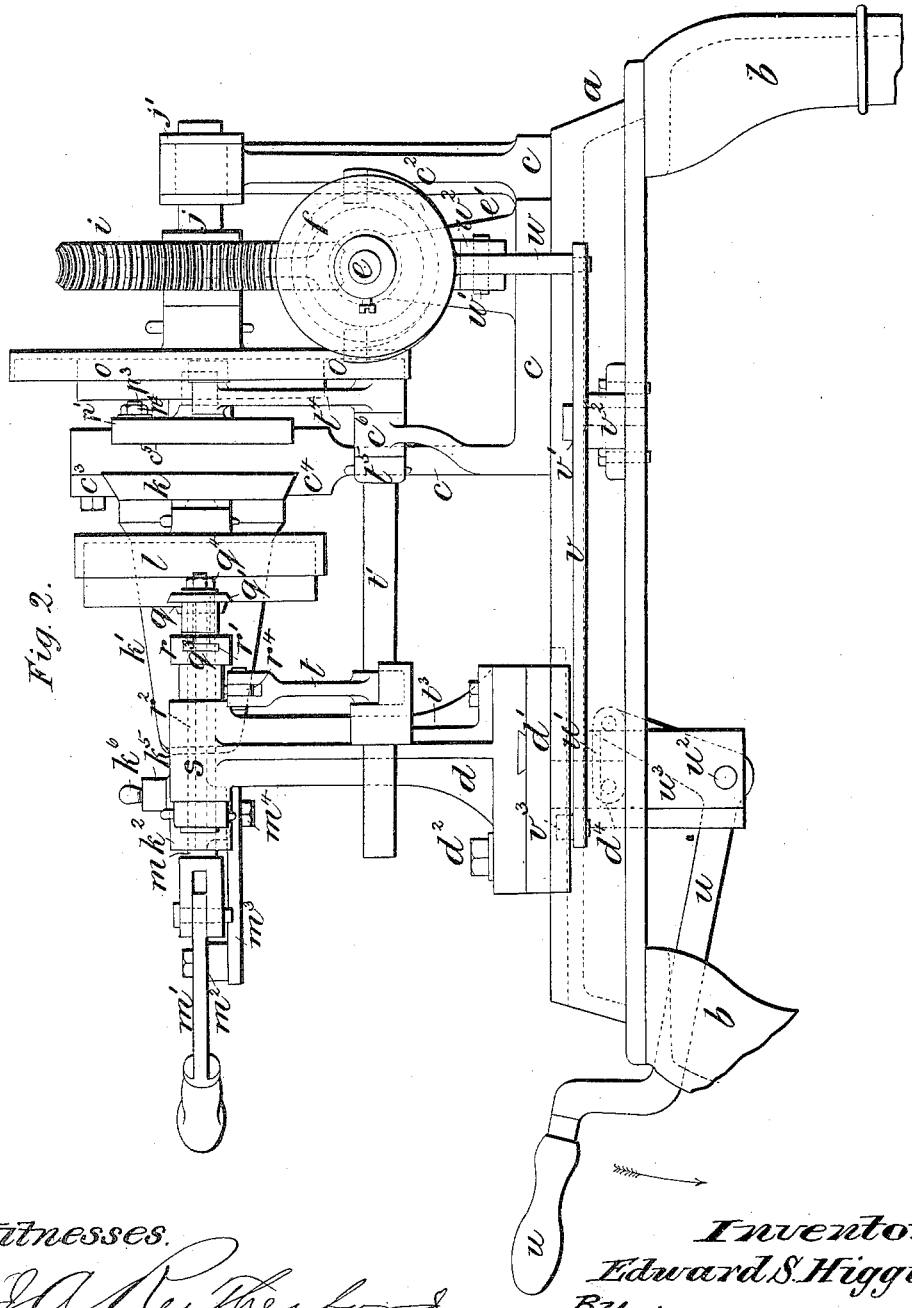
(No Model.) 6 Sheets—Sheet 2.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

Fig. 2.



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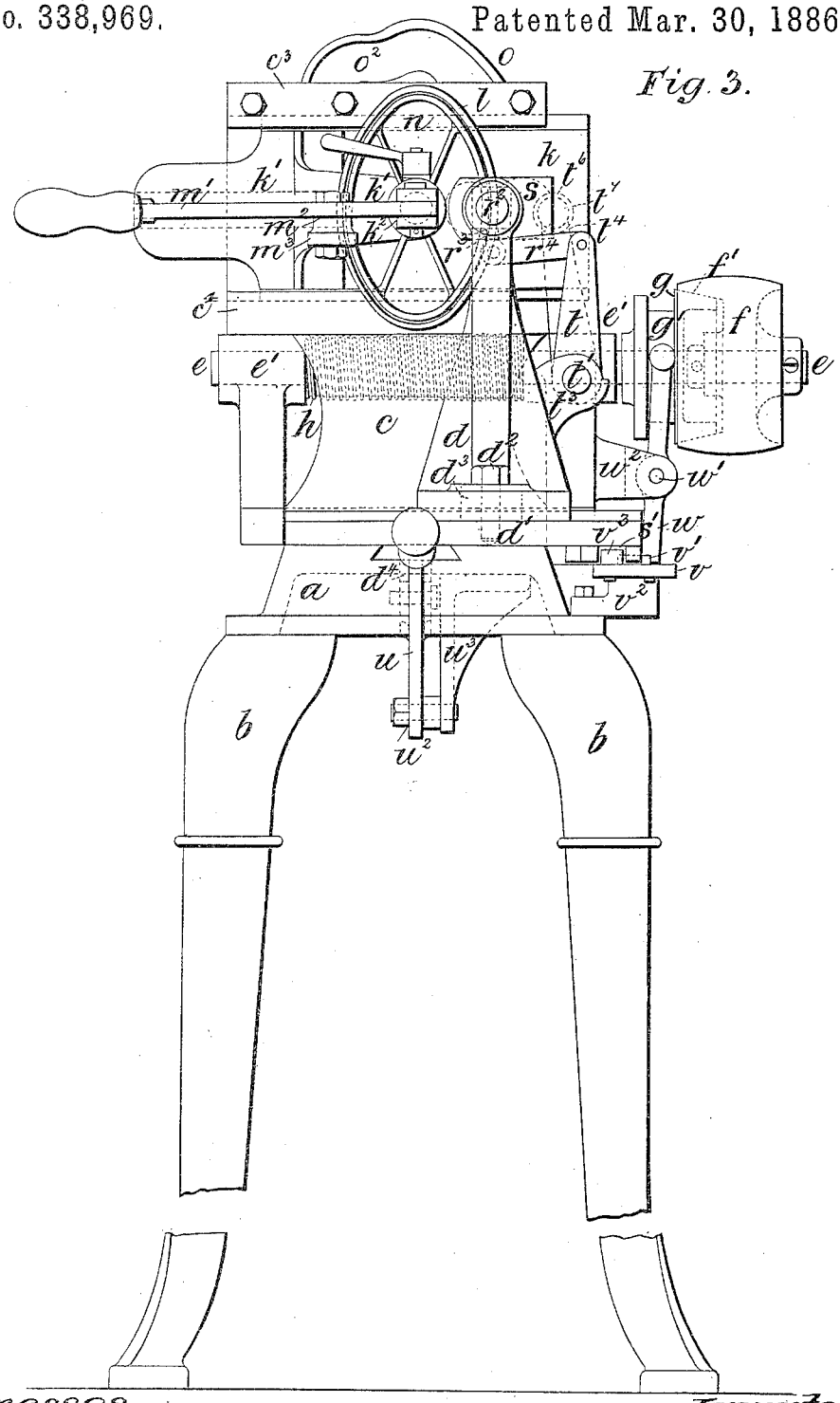
(No Model.) 6 Sheets—Sheet 3.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

Fig. 3.

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(No Model.) 6 Sheets—Sheet 4.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

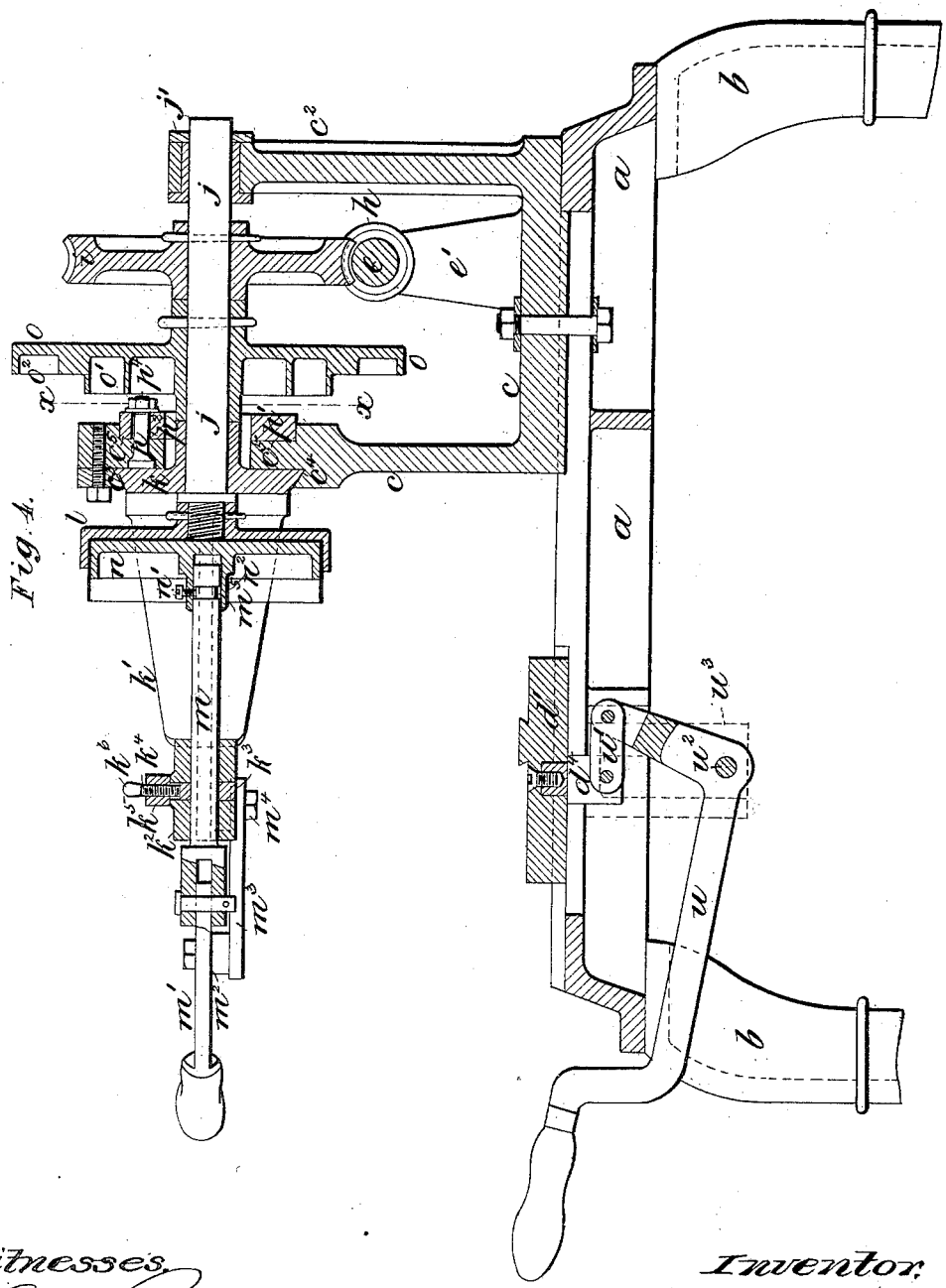

Fig. 4.

Witnesses.
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6 Sheets—Sheet 5.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

*Fig. 5.*

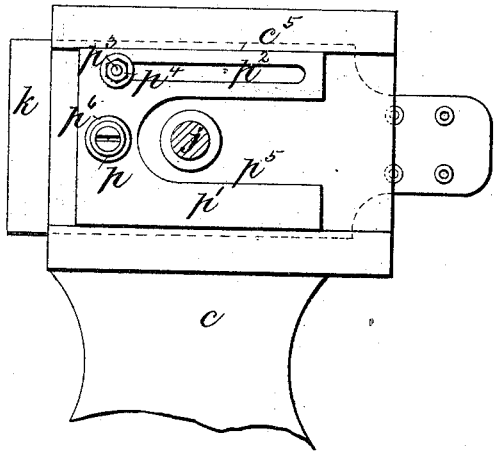



*Fig. 7.*

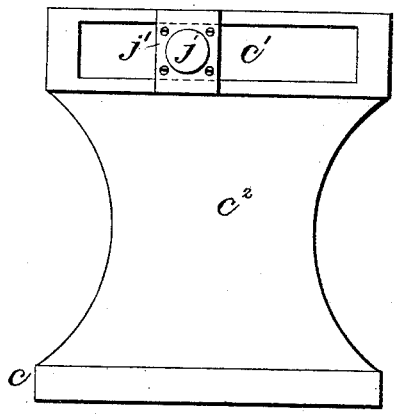



*Fig. 6.*

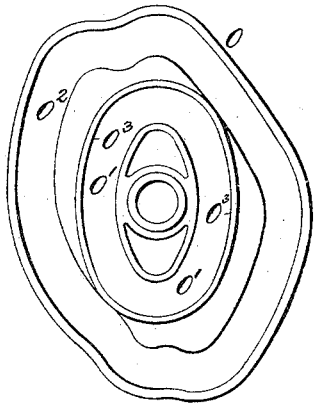
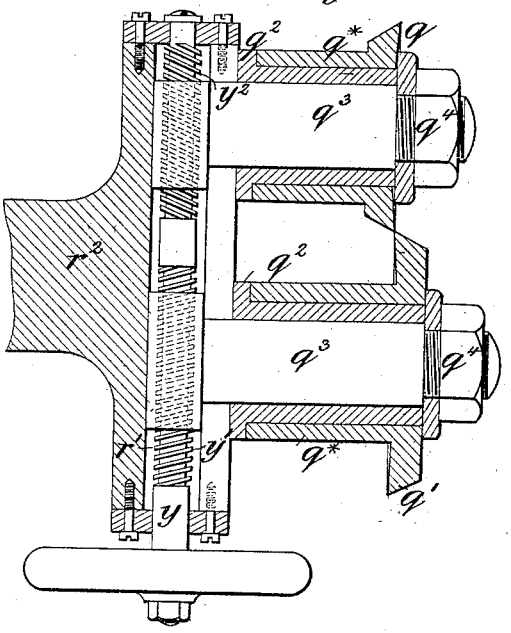



*Fig. 8.*

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(No Model.)

6 Sheets—Sheet 6.

# E. S. HIGGINS.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

No. 338,969. Patented Mar. 30, 1886.

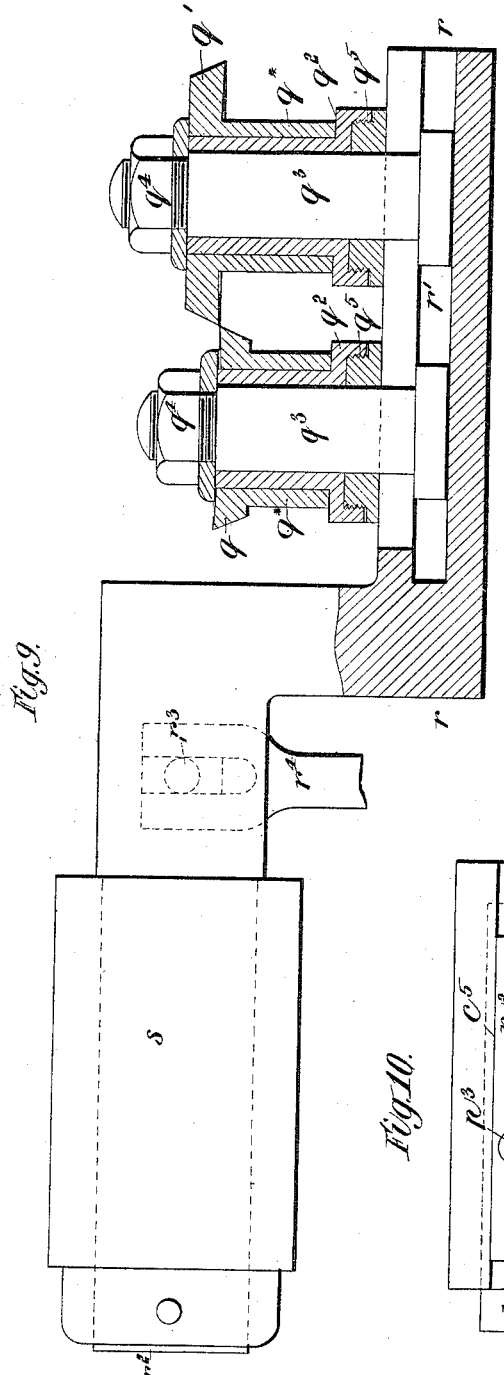

Fig. 9.

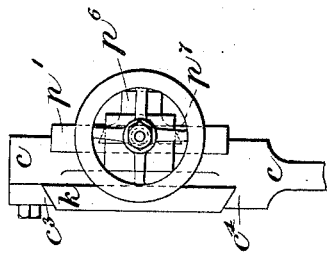

Fig. 11.

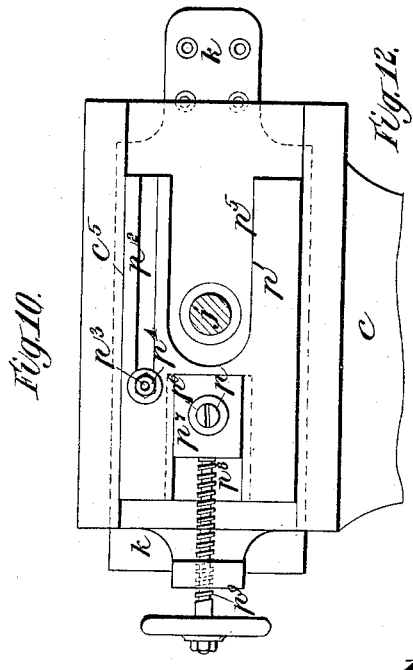

Fig. 10.

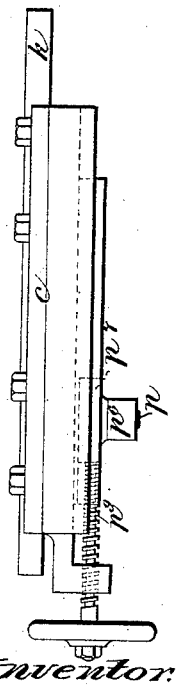

Fig. 12.

Witnesses
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Edward S. Higgins.
By James L. Norris.
Atty.

# UNITED STATES PATENT OFFICE.

EDWARD SMITH HIGGINS, OF LONDON, ENGLAND, ASSIGNOR TO CLAUD THORNTON CAYLEY, OF SAME PLACE.

## MACHINE FOR TRIMMING THE EDGES OF HOLLOW ARTICLES.

SPECIFICATION forming part of Letters Patent No. 338,969, dated March 30, 1886.

Application filed December 9, 1885. Serial No. 185,202. (No model.) Patented in England February 11, 1885, No. 1,918.

*To all whom it may concern:*

Be it known that I, EDWARD SMITH HIGGINS, of London, England, engineer, have invented new and useful Improvements in Machines for Trimming the Edges of Hollow Articles of Sheet Metal and for Similar Purposes, (for which I have obtained Letters Patent in Great Britain, No. 1,918, dated February 11, 1885,) of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to machines for trimming the edges of hollow articles stamped or otherwise formed from sheet metal, and for similar purposes.

My improved machine is chiefly designed for trimming the edges of boxes or other hollow articles of oval or similar form, or of irregular form, but not having sharp angles or corners. It is, however, also advantageous for trimming the edges of hollow articles of circular form and large diameter. The said machine can, moreover, be readily adapted for cutting sheet metal to form blanks from which such articles are to be made, or for turning solid articles of wood, metal, or other material.

An essential feature of my said invention is the employment of a cam having a groove corresponding in shape with the periphery of the box or other article to be trimmed, or of the blank or other article to be formed by cutting or turning. This cam is fixed upon a spindle or shaft, which is supported in sliding bearings, and which carries the chuck or work-support, and the said cam is arranged in combination with a stationary pin or stud, which fits into the cam-groove. Therefore, as the said spindle or shaft is rotated, it will be moved laterally to and fro (according to the shape or configuration of the cam-groove) in such a manner that the article to be trimmed, cut, or turned will always be kept in its proper position relatively to the cutting tool or tools. I usually provide the machine with a series of interchangeable cams the grooves whereof differ in respect of their shape or dimensions, or both.

My said invention, moreover, comprises various improvements hereinafter set forth.

In the accompanying drawings, Figure 1 is a plan, Fig. 2 a side elevation, Fig. 3 a front elevation, and Fig. 4 a vertical longitudinal central section, of a machine constructed in accordance with my said invention for trimming the edges of hollow articles made from sheet metal by stamping, drawing, or piecing. Fig. 5 is a transverse section on the line *x x*, Fig. 4. Fig. 6 is a face view of a cam hereinafter described. Fig. 7 is a rear elevation of part of the said machine. Figs. 8 and 9 are plans, partly in horizontal section, showing modifications of my invention; and Fig. 10 is a rear elevation, partly in vertical section; Fig. 11, a side elevation, and Fig. 12 a plan showing a further modification of my said invention.

Like letters indicate corresponding parts throughout the drawings.

*a* is the base-plate or bed of the machine, which is supported upon standards *b*.

*c* is a bracket, which is firmly secured to the base-plate *a*, and which I will hereinafter term the "head-stock."

*d* is a bracket which supports the cutter-carrier hereinafter described.

*e* is the driving-shaft, which is supported in bearings *e'*, fixed or formed on the head-stock *c*.

*f* is a pulley, which is fitted to rotate upon the said shaft, and around which a belt is to be passed, to connect it with any suitable motor.

*g* is a friction-cone, which is keyed upon the shaft *e* so that it is free to slide to and fro thereon, but will rotate therewith, and which is designed to be put into or out of gear with a hollow friction-cone or conical surface, *f'*, on the pulley *f*, by the means hereinafter described.

*h* is a worm or endless screw fixed or formed on the shaft *e* and gearing with a worm-wheel, *i*, fixed on the spindle or shaft *j*, which I will hereinafter term the "live spindle." This spindle is supported at one end in a bearing, *j'*, fitted to slide to and fro in a slot, *c'*, in the bracket $c^2$, forming part of the head-stock *c*. The said spindle is supported near its other end in a bearing in the plate or block *k*, which is fitted to slide to and fro between guides $c^3$ $c^4$, fixed or formed on the head-stock *c*. The inner extremity of the spindle *j* is screw-

threaded, and a chuck, $l$, of suitable shape to receive the article to be trimmed, is screwed or otherwise secured thereon. A curved bracket, $k'$, is firmly attached to the slide $k$, and has a bearing, $k^2$, at its extremity. A shaft, $m$, is fitted with a capability of axial movement in the bearing $k^2$, and is coupled at one end to a lever, $m'$, which is coupled at $m^2$ to a link, $m^3$, pivoted at $m^4$ to the bracket $k'$. A block or holder, $n$, is secured to the free end of the shaft $m$ by means of a screw, $n'$, inserted in a boss, $n^2$, formed on the holder $n$, and projecting into an annular groove or recess, $m^5$, in the said shaft. The said holder is therefore free to rotate upon the said shaft. This holder is of such shape that it will fit into the article to be trimmed. By moving the lever $m'$ in one or the other direction the said holder can be pressed firmly into the article to be trimmed after the same has been placed in the chuck $l$ or moved away from the said chuck to permit the removal of the trimmed article and the insertion of another article to be trimmed. A ring or annular piece, $k^3$, provided with a screw-threaded extension, $k^4$, is fitted to slide up and down in a slot in the bearing $k^2$, and the shaft $m$ is passed through the said ring. A nut, $k^5$, provided with a handle, $k^6$, is fitted upon the said extension. When the holder $n$ has been moved up to the chuck to hold the work therein, the nut $k^5$ is to be screwed up or tightened to retain the shaft $m$ in position in the bearing $k^2$, and thus prevent the displacement of the work while it is being trimmed.

$o$ is a cam, which is fixed upon the live spindle $j$, and has two grooves, $o'$ $o^2$. The groove $o'$ is of the same shape or configuration as the edge or periphery of the article to be trimmed. In the cam shown in the drawings the said groove is elliptical or approximately so.

$p$ is a pin or stud fixed in a plate, $p'$, which is fitted to slide to and fro in a groove or channel, $c^5$, in the head-stock $c$. The plate $p'$ is made with a slot, $p^2$, through which extends a bolt, $p^3$, fixed in the head-stock $c$, so that the said plate and the pin or stud $p$, carried thereby, can be moved toward or away from the live spindle $j$, according to the size of the article to be trimmed. The bolt $p^3$ is provided with a nut, $p^4$, whereby the plate $p'$ can be firmly secured in any position to which it may be adjusted. The plate $p'$ is, moreover, cut away at $p^5$, to permit the lateral movement of the spindle $j$, as hereinafter described. The pin or stud $p$ is provided with an anti-friction roller, $p^6$, which fits into the groove $o'$ of the cam $o$. Therefore, when the spindle $j$ is rotated, the said pin or stud will act alternately upon the inner and outer faces of the said groove, and thus cause the lateral movement of the spindle $j$ alternately toward and away from the said pin or stud, according to the shape or configuration of the cam-groove and the adjustment of the plate $p'$ in the groove or channel $c^5$.

$q$ $q'$ are two rotary cutters which are fixed or formed on sleeves $q^*$, and are fitted to rotate upon hollow cylinders or distance-pieces $q^2$, placed upon the bolts $q^3$. These bolts are fitted with a capability of lateral adjustment in a slot, $r'$, in the cutter-carrier $r$, as shown in Figs. 2 and 8, so that the cutters can be moved toward or away from each other. The bolts $q^3$ are provided with nuts $q^4$, whereby they can be secured in any position to which they may be adjusted. The said nuts, when tightened, bear against the hollow cylinders or distance-pieces $q^2$, leaving the cutters $q$ $q'$ and their sleeves $q^*$ free to rotate thereon. The cutter-carrier $r$ is fixed or formed on a shaft, $r^2$, supported in a bearing, $s$, formed on the bracket $d$. An arm, $r^3$, is fixed on the shaft $r^2$, and is coupled by means of a link, $r^4$, to an arm, $t$, which is fitted upon a shaft, $t'$, and is connected therewith by a key fitting into a longitudinal groove or channel, $t^2$, in the said shaft, so that the arm $t$ is free to move to and fro upon the said shaft, but will rotate therewith. This shaft $t'$ is supported in a bearing in the bracket $t^3$, which is firmly secured to the bracket $d$, and also in a bearing in the bracket $c^6$, fixed or formed on the head-stock $c$. An arm, $t^4$, is fixed on the shaft $t'$, the endwise movement of which shaft is prevented by the said arm $t^4$ and by a fixed collar, $t^5$. The arm $t^4$ is provided with an anti-friction roller, $t^6$, Fig. 1, which roller is mounted loosely upon the pin or stud $t^7$ and fits into the groove $o^2$ of the cam $o$. The bracket $d$ is fitted to slide transversely to and fro upon a block, $d'$, so that the cutters can be moved toward or away from the spindle $j$, according to the size of the article to be trimmed. The bracket $d$ is dovetailed to the said block $d'$, and is secured thereto by means of bolts $d^2$, passing through slots $d^3$ in the said bracket. The block $d'$ is fitted to slide longitudinally to and fro on the base-plate $a$, to which it is dovetailed, as shown. The said block is provided with a lug or projection, $d^4$, whereby it is coupled by means of a link, $u'$, to a bent lever, $u$, pivoted at $u^2$ to a bracket, $u^3$, extending downward from the base-plate $a$. A lever, $v$, is pivoted at $v'$ to a bracket, $v^2$, fixed or formed on the base-plate $a$. This lever is provided at one end with a pin or stud, $v^3$, fitting into a curved or inclined groove, $s'$, in the under side of the block $d'$. The other end of the lever $v$ is coupled to a forked lever, $w$, which is pivoted at $w'$ to a bracket, $w^2$, fixed or formed on the head-stock $c$. The prongs or arms of the forked lever $w$ project into an annular groove or recess, $g'$, in the friction-cone $g$. When the lever $u$ is moved in the direction indicated by the arrow in Fig. 2, the block $d'$, the bracket $d$, and the cutters supported thereby will be moved away from the work. In this movement of the block $d'$ the lever $v$ will be turned around or about its pivot $v'$ to throw the clutch out of gear and stop the machine. When the lever $u$ is moved in the reverse direction to that indicated by the said arrow, the cutters will be moved up to the work, and the lever $v$

will be turned so as to put the clutch into gear and start the machine. I thus provide for moving the cutters up to the work and starting the machine or stopping the machine and moving the cutters away from their operative position by a single movement of the lever *u*.

The operation of the machine above described is as follows—that is to say: The parts are shown in the drawings in the position which they occupy when a box or other article is being trimmed. The outer edge, $o^3$, of the cam-groove *o'* is of the same size and configuration as the outer edge or periphery of the said box or other article. Therefore, as the spindle *j* is rotated it will be moved first away from the cutters *q q'* until one end of the said box or other article arrives between the same, and then toward the said cutters until the central point of one side of the box or other article arrives between the same, and so on. The edge to be trimmed will thus be kept always in the proper position for the cutters to operate thereon. The cam-groove $o^2$ is of such shape that while the article is being trimmed the cam will act upon the arm $t^4$ and move the same in one or the other direction, and thereby keep the cutters always in such a position that the plane passing through their axes will be at right angles to the part being trimmed. By these means I provide for automatically adjusting the cutters relatively to the work, and thereby greatly facilitating the trimming operation, and enabling such operation to be performed in a much more efficient manner than would be practicable if the cutters were not provided with means for altering the angle thereof relatively to the work, as above specified.

When the box or other article has been trimmed, the lever *u* is moved in the direction indicated by the arrow in Fig. 2, to stop the machine and move the cutters away from the work. The nut $k^5$ is slackened and the lever *m'* is moved in the direction indicated by the arrow in Fig. 1, to draw back the holder *n*, and thus permit the removal of the trimmed article from the chuck *l* and the insertion therein of another article to be trimmed. The lever *m'* is then moved in the reverse direction to that indicated by the arrow, to clamp the work firmly between the holder *n* and the chuck *l*, and the nut $k^5$ is tightened to hold the shaft *m* and holder *n* firmly in position. The lever *u* is then raised to move the cutters up to the work and start the machine, and the operation above described is repeated. In the lateral to-and-fro movement of the spindle *j* and parts carried thereby the worm-wheel *i* rolls backward and forward upon the worm *h*. Therefore the transmission of motion from the shaft *e* to the spindle *j* is unaffected by such lateral movement, with the exception of the speed being slightly increased when the wheel rolls upon the worm *h* in one direction, and decreased when the said wheel rolls thereon in the reverse direction.

When the edge of the article to be trimmed is slightly bent outward or inward, it is sometimes necessary to move the cutters a short distance away from each other in order to permit their engagement with the work, and then bring them together again. For this purpose I prefer to employ, in combination with the bolts $q^3$, a screw, *y*, Fig. 8, provided with right and left hand threads *y' y²*, which work in correspondingly screw-threaded holes in the heads of the bolts $q^3$. This screw *y* is secured in the carrier *r* in any suitable manner, so that it is free to rotate therein, but its endwise movement is prevented.

To adapt my improved machine for cutting sheet metal to form oval, elliptical, or other blanks from which the boxes or other hollow articles are to be made, I proceed as follows—that is to say: I substitute for the carrier above described a cutter-carrier, *r*, constructed as shown in Fig. 9. The slot *r'* in this carrier, instead of being at right angles to the shaft $r^2$, is parallel therewith. Therefore, when the said carrier is in place in the bracket *d*, the cutters will be parallel with the spindle *j*, instead of at right angles thereto. Moreover, instead of the cutters being moved up to and away from the work, as above described, I prefer that the work should be moved up to and away from the cutters. For this purpose the pin or stud *p* is fixed in or formed integrally with a piece, $p^7$, fitted to slide to and fro in a groove or channel, $p^8$, in the plate *p'*, and adjustable in the said groove or channel by means of a screw, $p^9$. By turning this screw in one or the other direction the said pin or stud, the cam *o*, and consequently the work can be moved away from or toward the cutters.

When the machine is to be used for cutting sheet metal to form blanks, it is preferably so arranged that the live spindle *j* will be vertical instead of horizontal; but it is obvious that the machine can be arranged to operate in any desired position, according to the class of work for which it is required.

In Fig. 9 I have shown a further modification of my invention, whereby I provide for adjusting the cutters relatively to each other to compensate for wear. For this purpose I make each of the hollow cylinders or distance-pieces $q^2$ in two parts, which are united by screwing, as at $q^5$. When the cutters become worn, the parts of one distance-piece are slightly unscrewed to lengthen the same, or the parts of the other distance-piece are slightly screwed up to shorten the same, or both these operations are performed. The cutters when they become worn are thus brought into contact with each other.

I sometimes provide other means than those above described for permitting the lateral to-and-fro movement of the spindle *j* while the said spindle is being rotated. For instance, I substitute for the worm and worm-wheel a pulley fixed on the said spindle, and arranged to be driven by a belt, which is perpendicular to the path of the said spindle and pulley, or

approximately so, and is of such length that its tension will not be affected by the to-and-fro movement thereof.

It is obvious that by providing a slide-rest or other suitable support for a turning-tool the machine above described can be adapted for turning solid articles of wood, metal, or other material—that is to say, to serve as a turning-lathe.

What I claim is—

1. In a machine for trimming the edges of hollow articles of sheet metal, or for similar purposes, the combination of means for moving the work laterally to and fro while it is rotating, and means for automatically adjusting the cutters according to the shape of the article to be trimmed, as and for the purposes above specified.

2. The combination, with the live spindle *j*, of the cam *o*, fixed on the said spindle, and the stationary pin or stud *p*, projecting into the groove *o'* of the said cam, whereby a lateral reciprocating motion is imparted to the said spindle, for the purpose specified.

3. The combination of the lever *u*, the block *d'*, the bracket *d*, the levers *v w*, and the clutch *g*, substantially as set forth, whereby the cutters are moved to or from the work and the machine started or stopped by a single movement of the said lever *u*, as above specified.

4. The combination of the cutter-carrier *r*, the shaft *t'*, the arms *t t'*, the link $r^4$, and the cam *o*, provided with the groove $o^2$, substantially as set forth, for automatically adjusting the cutters relatively to the work, as and for the purpose specified.

5. The cutter-carrier *r*, having a slot, *r'*, parallel with its shaft $r^2$, to receive the bolts $q^2$, which support the cutters *q q'*, substantially as and for the purpose set forth.

6. The hollow cylinders or distance-pieces $q^2$, formed in two parts, which are united by screwing or otherwise, substantially as described, so that the cutters *q q'* can be adjusted relatively to each other to compensate for wear, as above specified.

7. The combination, with the cam *o*, cutters *q q'*, and plate *p'*, provided with the groove or channel $p^8$, of the screw $p^9$, and the pin or stud *p*, fixed or formed on the sliding block $p^7$, substantially as described, whereby I provide for moving the work to and from the cutters, as and for the purpose specified.

8. The combination of the driving-shaft *e*, having worm *h*, the spindle *j*, provided with worm-wheel *i*, the cam *o*, carried by said spindle, and having grooves *o' o²*, one of which has an outer edge, $o^3$, of the same size and configuration as the outer edge or periphery of the article to be acted on by the cutters, the shaft *t'*, having arms *t t'*, the shaft $r^2$, having arms $r^3$, means for connecting the arms $r^3$ and *t*, the cutter-carrier *r*, and the cutters *q q'*, substantially as described.

9. The combination of the live spindle *j*, the chuck *l*, the holder *n*, shaft *m*, levers *m' u*, and nut $k^5$, substantially as described.

10. The combination of a live spindle supported in sliding bearings, a cam fixed upon said spindle and having a groove corresponding in shape with the periphery of the article to be trimmed, a chuck or work-support carried by said spindle, and a fixed pin or stud engaged with the cam, whereby the rotating spindle is caused to move laterally to and fro in such a manner that the article to be acted on will always be kept in its proper position relatively to the cutting tool or tools, substantially as described.

11. The combination of a live spindle, a chuck and a cam carried by said spindle, adjustable cutters, and means for connecting said cutters and cam, whereby the said cutters are automatically adjusted relatively to the work, substantially as described.

12. The combination of a live spindle supported in sliding bearings, a cam carried by said spindle and grooved to correspond with the configuration of the article to be acted on, a fixed pin engaged with the cam, whereby the rotating spindle is caused to move laterally to and fro in such a manner as to cause the article to be always kept in proper position with relation to the cutting devices, a work-supporting chuck carried by the spindle, adjustable cutter, and means for connecting the cutters and cam so as to effect an automatic adjustment of said cutters with relation to the work, substantially as described.

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

EDWARD SMITH HIGGINS.

Witnesses:

DAVID YOUNG,

WALTER MORRIS.