Dec. 3, 1935. J. M. WYER 2,022,797

MEANS FOR SPINNING METAL

Filed Aug. 1, 1934 4 Sheets-Sheet 1

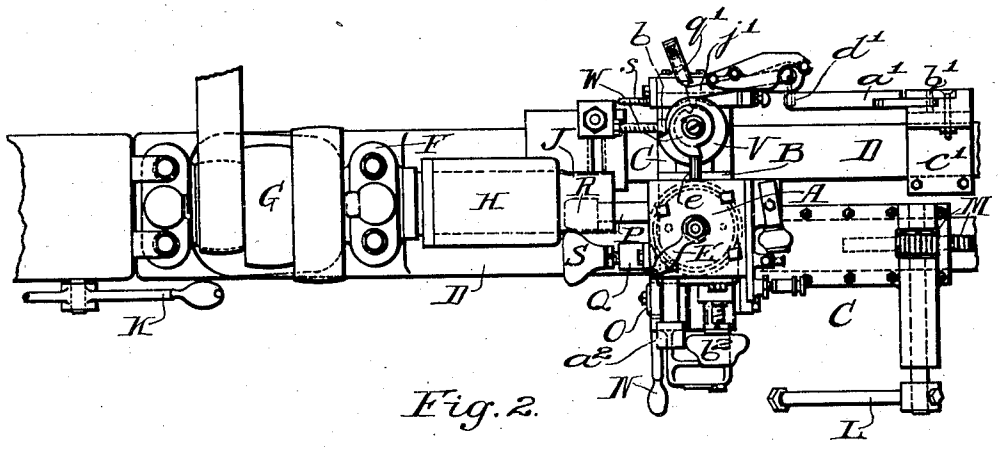


Fig. 2.

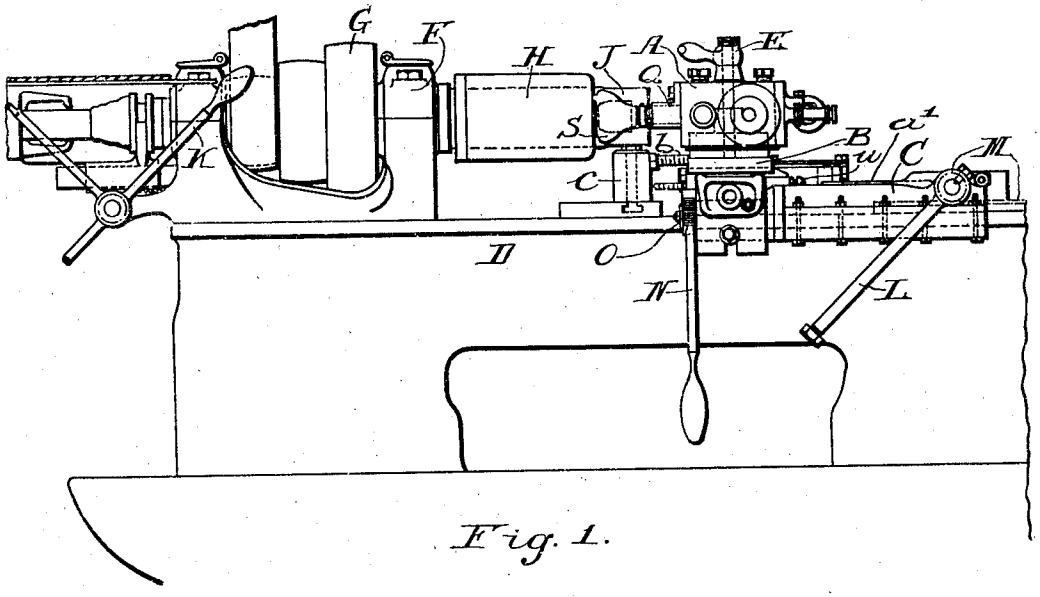


Fig. 1.

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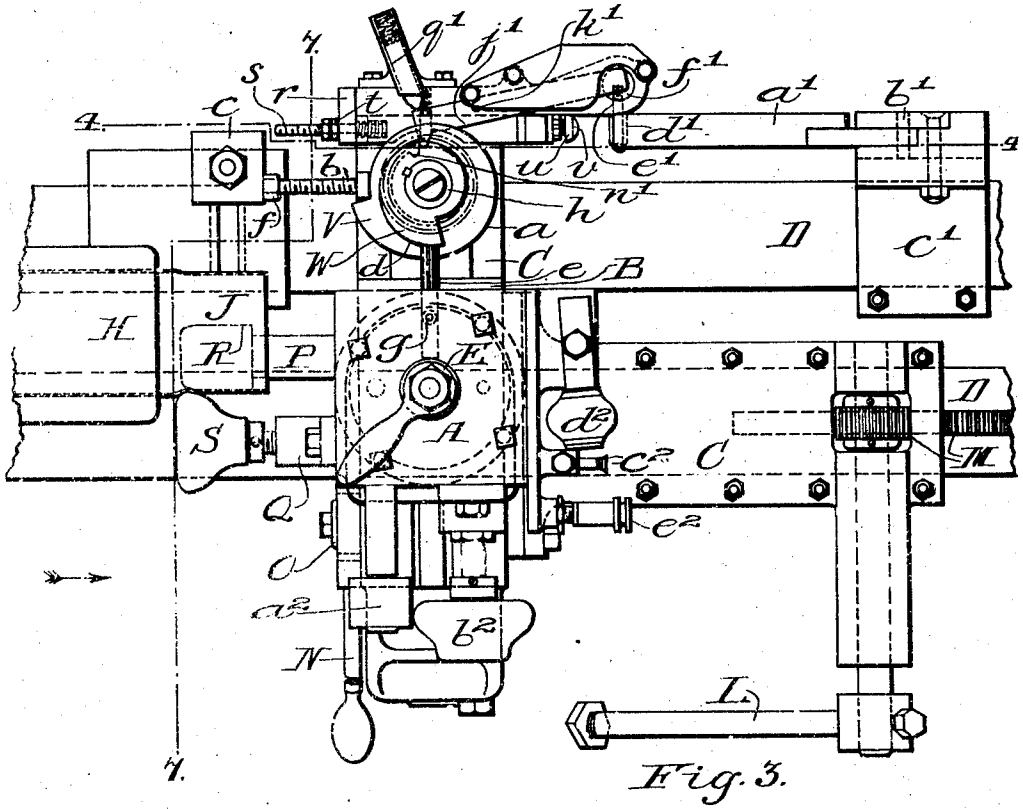


Fig. 3.

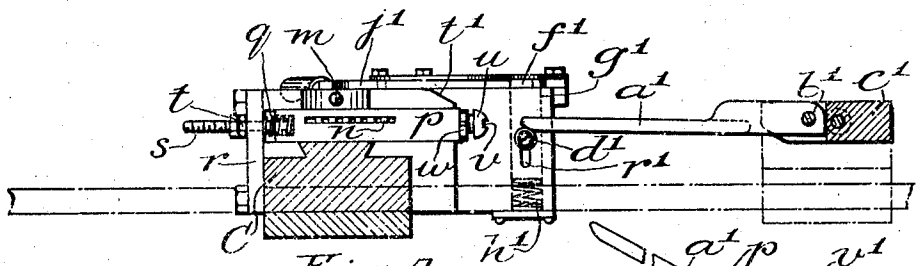


Fig. 4.

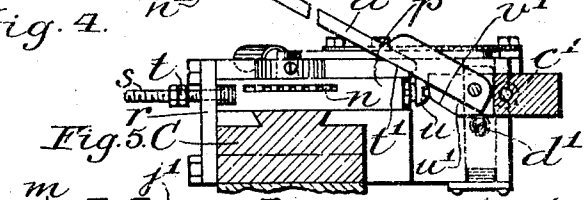


Fig. 5.C

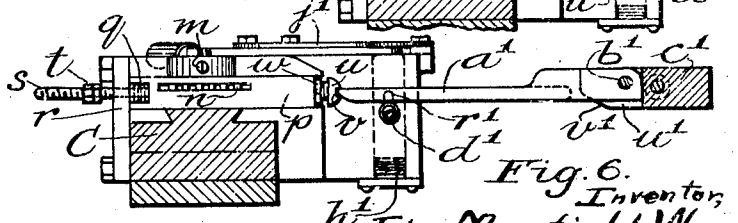


Fig. 6.

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MEANS FOR SPINNING METAL

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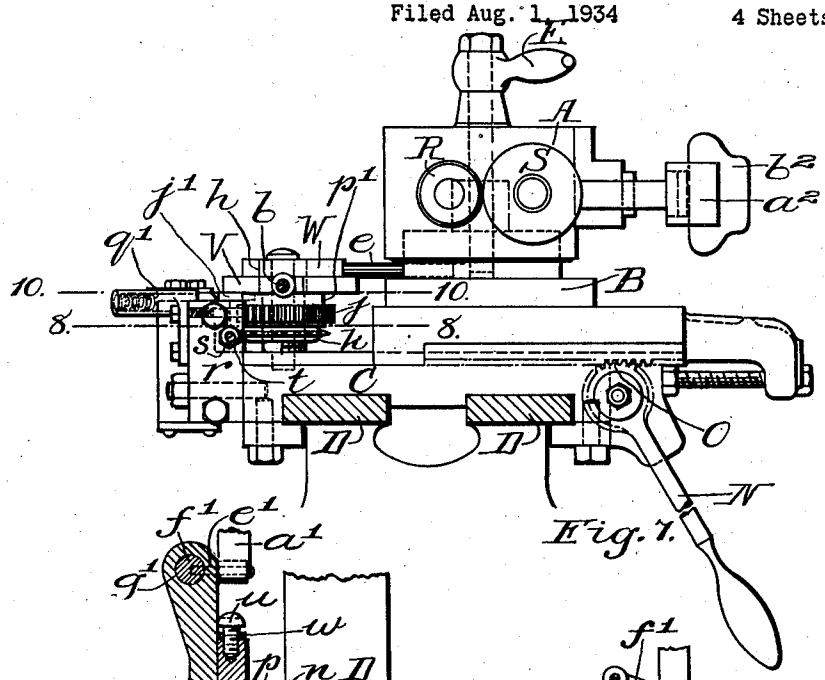


Fig. 7.

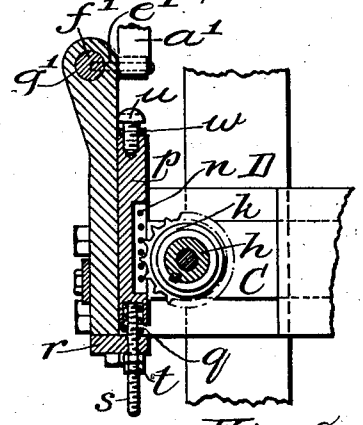


Fig. 8.

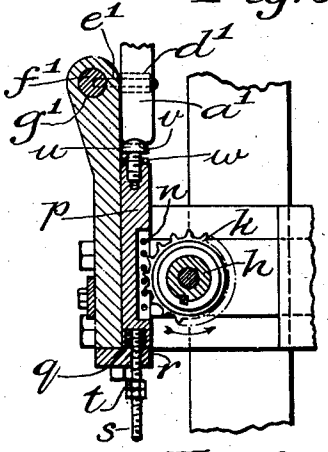


Fig. 9.

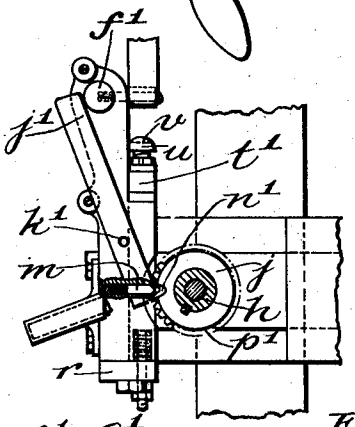


Fig. 10.

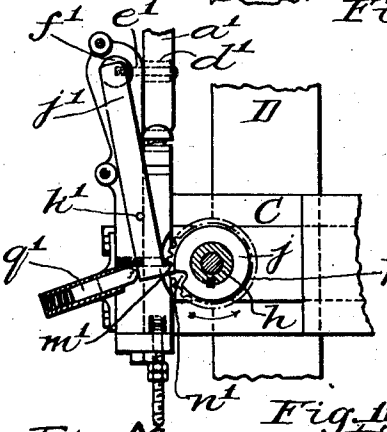


Fig. 11.

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MEANS FOR SPINNING METAL

Filed Aug. 1, 1934 4 Sheets-Sheet 4

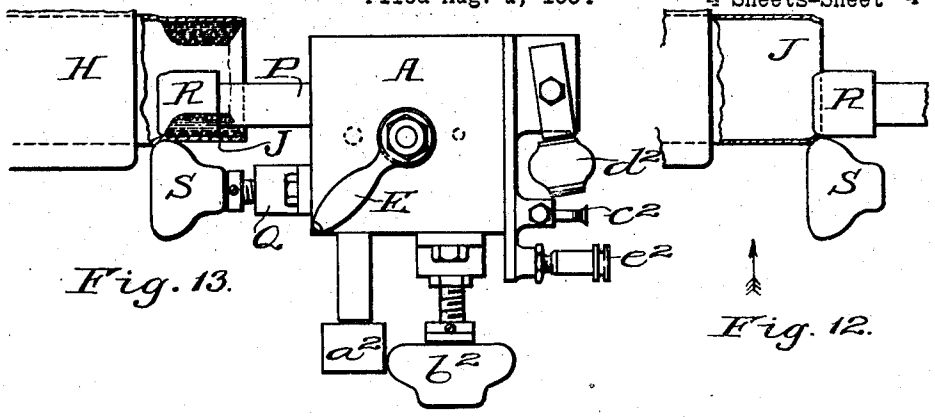


Fig. 13.

Fig. 12.

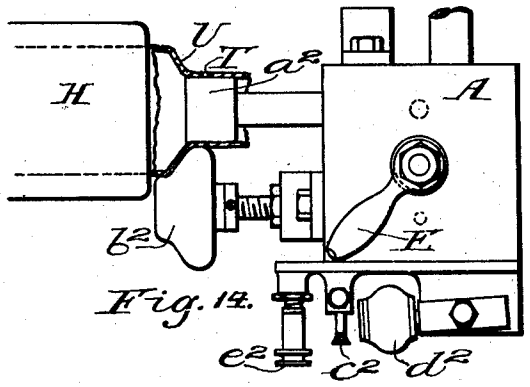


Fig. 14.

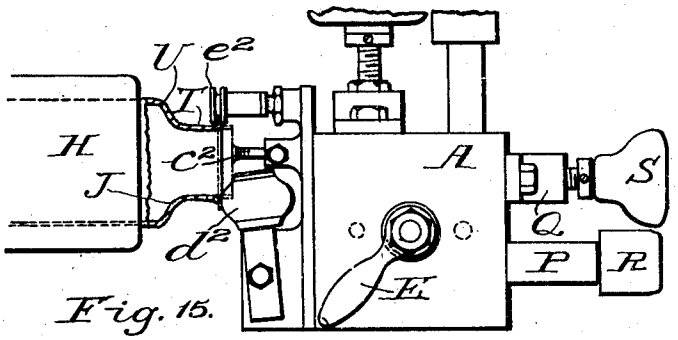


Fig. 15.

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Patented Dec. 3, 1935 2,022,797

UNITED STATES PATENT OFFICE

2,022,797

MEANS FOR SPINNING METAL

John Mansfield Wyer, Bradmore, England, assignor of one-half to The Midland Metal Spinning Company Limited, Wolverhampton, England

Application August 1, 1934, Serial No. 738,006
In Great Britain August 2, 1933

17 Claims. (Cl. 113—52)

The invention relates to means for forming the necks of soft sheet metal articles, being applicable more especially to one-piece aluminum vessels. Heretofore, in forming necks of sheet metal articles it has been usual to spin-in the mouth of the article with a spinning tool, the article being mounted in a suitable chuck and being rotated at a high speed. The process is one, however, which can only be performed by a skilled operator and requires a relatively large amount of time. It is, therefore, relatively expensive and there is the disadvantage that it cannot be ensured that the vessels produced do not vary in shape unless a section-chuck is used. The object of this invention is to provide a machine in which the spinning can be done quickly and accurately.

A machine constructed according to this invention comprises the usual head stock, a chuck for carrying the article to be operated upon, the latter being of course mounted in the chuck with its open end extending out therefrom, and also a carrier adapted to be moved transversely on a cross guide or saddle which in turn is adapted to be moved endwise on the bed of the machine. The invention is characterized by the provision that the carrier carries a pair of rolls or burnishing tools, one being an external roll or tool and the other an internal roll or tool, and that said rolls or tools are set to such a position radially of the machine that as they are moved along the work, or as one of them is so moved, they cause the metal of the vessel to be displaced radially. The rolls or tools are carried each in a mounting projecting forwardly from a turret or carrier mounted in a carriage in such a manner that it can be given longitudinal and transverse movement.

The amount by which the metal is displaced at each operation of the rolls or tools is hereinafter referred to as "the cut" since it somewhat resembles the cut of a tool on a lathe, but there is, of course, in this case, no actual cutting of the metal. The radial displacement is performed by a series of longitudinal traverses of the carrier; and, at the end of each return movement, further cut is put on. Preferably each forward traverse is shorter than the preceding traverse, whereby the wall of the vessel is caused to slope or curve inwardly or outwardly.

The displacement of the metal of the vessel operated upon may be in an inward direction to reduce its diameter, or in an outward direction to increase its diameter.

The length of each traverse is preferably governed by automatic stop means, such for instance as a rotating cam mounted on the saddle. A part of the cam surface engages against a fixed abutment of the machine, preferably on the head stock. In lieu of the cam surface, there may, however, be provided a number of projections of different lengths which engage with the abutment in turn, one in respect of each forward movement. The transverse movement of the carrier which produces the cut is preferably regulated by means of a second cam or series of projections, the varying surface of the cam or the projections engaging against an abutment of the carriage. The cams or projections may be moved by the backward movement of the saddle and this may be effected by a longitudinal spring-pressed slider which, on each rearward movement of the saddle, encounters an abutment of the machine bed; and means may be provided for moving such abutment out of position for subsequent operations where no variation of the cams is required and to allow the saddle to go well back to permit of the article being removed from the chuck and another article placed therein.

A convenient embodiment of the invention is described with reference to the drawings herewith, of which:—

Figure 1 is a front elevation of a machine for forming the neck of an aluminum flask, according to the invention.

Figure 2 is a plan view of the machine shown in Figure 1.

Figure 3 is a view, to an enlarged scale, to illustrate, in plan view, a portion of the machine shown in plan in Figure 2.

Figure 4 is a longitudinal section taken on the irregular line 4, 4, of Figure 3.

Figure 5 is a sectional view corresponding to Figure 4, but showing the carrier and saddle as in their extreme rearward position.

Figure 6 is a view corresponding to Figure 4 but showing the carrier and saddle in the rearward position to which they are brought between each cut.

Figure 7 is a vertical section taken on the irregular line 7, 7 of Figure 3 and looking in the direction of the arrow of that figure.

Figure 8 is a fragmentary sectional plan view, the section being taken in the plane indicated by the line 8, 8, of Figure 7. In this view the carrier and saddle are in their forward position.

Figure 9 is a view corresponding to Figure 8; but showing the carrier and saddle in the position to which they are brought at the end of each cut.

Figures 10 and 11 are plan views, partly in

section, to illustrate two positions of a tripping lever, the section being taken on the line 10, 10, of Figure 7.

Figure 12 is a fragmentary plan view, partly in section, to illustrate the first engagement of the rolls on the work.

Figure 13 is a fragmentary plan view, partly in section, to illustrate the position of the rolls at the end of the first cut. In this view subsequent cuts are shown by broken lines. This view also shows other tools on the carrier or turret for further operations.

Figures 14 and 15 are fragmentary plan views to illustrate two subsequent operations.

In these drawings, A is a carrier or turret of square form as seen in plan, and turnably mounted upon a carriage B sliding on a saddle C, which in turn, slides upon the bed D of the machine. The turret A carries, on three of its sides, operating tools which will be hereinafter described, and it is turned by the operator to bring the requisite tools into position, after which it is locked by a locking handle E in a manner already well known. Other tools for any other desired operation may be mounted on the fourth side of the turret.

F is the head stock of the machine, in which is journalled the mandrel (not shown) which carries the usual driving pulleys G and carries also a chuck H for carrying and supporting the work which, in this case, consists of an aluminum vessel J. K is a handle for opening and closing the chuck, but this forms no part of the present invention. L is a handle lever by means of which the saddle C is moved endwise through the medium of rack and pinion gear as indicated at M. N is a lever by which the carriage B is moved transversely upon the saddle C by rack and pinion gear indicated at O.

Projecting from one of the faces of the turret are two arbors P, Q, of which the arbor P carries an internal roll R while the arbor Q carries an external roll S. The first operation on the vessel is performed with these two rolls which are brought to such positions (see Figure 12) that initially the roll R lies a short distance inwards of the inner periphery of the article and the roll S is spaced away from the roll R by an amount which is not less than the thickness of the metal of the article. The result of this is that as the rolls are pressed forward by the endwise movement of the cross slide, under the action of the lever L, the metal of the article is trapped between them and carried radially inward and this reduces the diameter for the distance of the travel. The end of the travel is indicated in Figure 13. The rolls are then drawn back endwise to the starting position and this operation further smooths the work. The carriage is moved inward a slight distance in the direction of the arrow in Figure 12 during the last part of the backward movement, and on completion of the backward movement, the full amount for the new cut has been imparted to the carriage. Another cut is then taken on the forward movement, but this time the travel is shorter; and, at each succeeding cut, the travel is reduced. The several cuts are shown by broken lines in Figure 13, and finally the article has formed thereon the neck T, joining into the body of the vessel by the double curved shoulder U. The shape of the shoulder is determined by the several points at which the forward movement of the saddle is stopped, and by the several points at which the carriage is stopped when moved over the cross slide. Both of these sets of points are determined automatically by means of a pair of cams V and W, which are rigidly connected together and are mounted to turn on a vertical axis and in an anti-clockwise direction upon the bed of the saddle C, being impelled intermittently each time the cross slide is brought back after each of the several operations above described.

The forward movement of the saddle C is stopped by the engagement of the operative surface *a* of the cam V against the head of a set pin *b* which is screwed into a pillar *c* clamped on the bed of the machine. The transverse movement of the carriage B is stopped by the engagement, against the operative surface *d* of the cam W, of a peg *e* adjustably fitted into a socket of the carriage B and secured by a set screw *g*. The set pin *b* is adjusted as to length by screwing it in relation to the pillar *c*, after which it is locked by a lock-nut *f*.

Each of the cams V and W is keyed to a bush *h* (see Figures 8 to 11) and keyed to the same bush are a toothed drag wheel *j* and the centre member of a toothed sprocket free wheel *k* which, when turned anti-clockwise, drives the bush but turns freely upon it in the opposite direction. Engaging with the drag wheel *j* is a spring pressed plunger *m* (see Figure 10) to act as a drag to hold the wheel after each turning movement. The sprocket wheel *k* is turned by a roller rack *n* on a sliding piece *p* which slides in guides of the saddle and is constantly pressed in a rearward direction by a small coil spring *q* bearing rearwardly against the slider and forwardly against an abutment *r*. *s* is a screwed extension of the slider passing through the abutment *r* and having lock-nuts *t* which act as a stop to the rearward movement of the slider *p*. *u* is a set pin having a saw-cut head *v* and being adjustably screwed on to the rearward end of the slider *p* being locked by a lock-nut *w*. *a'* is a stop finger pivoted by a horizontal pivot axis *b'* to a bracket *c'* bolted on the machine bed. The finger is supported in such a manner that it cannot move down past the horizontal and is adapted to engage (when the saddle is moved back after performing a cut on the vessel J), with the saw-cut *v* in the set pin *u*. The first effect of this is to cause the slide *p* to move forward in relation to the saddle C, whereby the rack *n* imparts a turning movement, in an anti-clockwise direction, to the sprocket wheel *k* and consequently also to the cams V and W bringing them to a fresh position. The slide *p* is moved forward against the pressure of the coil spring *q* and is stopped by its forward end coming against the abutment *r* which consequently acts also as a stop to the rearward movement of the saddle.

A roller *d'* is mounted upon a horizontal pin *e'* screwed into a vertical plunger *f'* sliding in a vertical guide *g'* of the saddle C. The plunger *f'* is constantly pressed, in an upward direction by a coil spring *h'* and is normally held down by a trip lever *j'*, the outer end of which normally lies over the plunger *f'* (see Figure 11). The trip lever is pivoted at *k'* and has, at its inner end, a nose *m'* which, at one position of the drag wheel *j*, is adapted to engage in a notch *n'* formed in a shouldered down portion *p'* of the drag wheel *j*. Otherwise the nose rides upon the periphery of the shouldered down portion of the drag wheel *j*, and the inner end of the trip lever *j'* is constantly pressed into such engagement by a spring pressed plunger *q'*. When the notch *n'* comes opposite to the nose *m'* of the trip lever *j'*, it snaps thereinto and

the outer end of the lever moves away from over the plunger f' (see Figure 10) whereby the plunger can move up together with the pin e' and roller d', the movement being limited by the pin encountering the top of a slot r' through which it passes. The raising of the roller d' lifts the forward end of the finger a' so that, on the next rearward movement of the saddle, the finger slides over the screw u and over a slanting surface t' of the saddle (see Figure 5). The saddle may then be moved further back until the screw u comes against a stop u' on the bracket c'. The roller d' and plunger f' are returned to their normal position by the engagement of the roller d' with a slanting face v' on the stop u'. The encountering of the pin u with the stop u' gives a further angular movement to the sprocket wheel k and drag wheel j and cams V and W, whereby the nose m' is forced out of the notch n' and restored to the periphery of the shouldered-down portion p', and the outer end of the trip lever j' again covers the plunger f' whereby, when the saddle goes forward again, carrying forward the roller d' from under the stop u', the roller is held down, and the finger a' can come back to the horizontal and return to the position shown in Figure 4 when the saddle has been moved sufficiently far forward to perform the next series of rolling down operations.

The machine is operated as follows:—Assuming that the rolls R and S are in the position shown in Figure 12, the saddle is moved forward by means of the lever L to bring the tools R and S to the position shown in Figure 3. The various parts of the machine will then be in the position shown in Figures 1, 2, 3, 8, and 13. The first cut will then have been taken by the rolls R and S, having been kept in the correct position across the machine by means of the operating lever N, which moves the carriage B across until stopped by the finger e coming against the surface d of the cam W. In a similar manner, the saddle was moved forward during the cut by the lever L until the surface a of the cam V came against the set pin b. The saddle is then moved back by the lever L until the pin u encounters the finger a' (see Figures 6, 9 and 11). As above described, this limits the rearward movement of the saddle and also moves forward the slide p in relation thereto. This, during the last part of the rearward movement of the saddle, moves the rack and imparts a small angular movement to the sprocket wheel k and hence to the drag wheel j and cams V and W. The saddle meanwhile has been moved forward again by the operator to put on additional cut, because the pin e now encounters a part of the surface d which is of less diameter. The cut will also be shorter because the set pin b will encounter a portion of the surface a which is of greater diameter. Consequently each succeeding cut is of shorter length and the neck of the vessel is brought to the stage indicated by broken lines in Figure 13 and by full lines in Figures 14 and 15. As will be understood, the particular shape of the curve of the shoulder results from the particular shapes of the cams. If other shapes are desired, correspondingly shaped cams are substituted.

When the saddle is moved back after the last cut but one and the slide p is moved forward as before, it brings the notch n' opposite the nose m' so that the nose can snap into the notch. This causes the outer end of the trip lever j' to move from over the plunger f' as already described. The plunger does not immediately go up because the roller d' is under the finger a' and the latter is in the notch v of the screw u. As soon as the saddle is moved forward again, however, for the last cut, the roller d' lifts the finger a'; and, on the next rearward movement of the saddle, both the screw u and the slanting face t' ride under the finger and lift it. Hence the cams are not operated on this last rearward movement.

The rearward movement of the saddle is checked, by the operator, before the pin u reaches the stop u', and in this position, the turret is unlocked by the hand lever E and turned a quarter turn in a clockwise direction to bring, into operative position, a pair of planishing rolls a^2 b^2 (see Figure 14), the forward movement of the saddle being stopped by the cam V coming against the pin b because in the last cut there was no further movement of the cams. The saddle is again moved back but still not far enough for the pin u to encounter the stop u'. The turret is again unlocked and given another quarter turn in a clockwise direction. This presents the last set of tools consisting of a trimming tool c^2, a flanging roller d^2 and a curling tool e^2 (see Figure 15).

The operation on the work is now complete. The saddle is now moved back as far as it will go causing the pin u to encounter the stop u' and thus again rotate the cams as above described, bringing them to the starting position and resetting the trip lever j' over the plunger f' as already described, the latter being held down for such rear engagement because the roller d' is under the stop u' as above described. The turret is again unlocked and turned through 180 degrees to bring it to the starting position, and the work is released from the chuck and a fresh vessel inserted.

In lieu of moving forward the carriage B and the saddle C by hand levers, the cams may be so arranged that they perform such movements.

Having fully described my invention what I claim and desire to secure by Letters Patent is:—

1. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially.

2. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a pair of displacing rolls mounted on said carrier, one roll being external to the work and the other internal, said rolls being so set transversely of the machine, that as the saddle is moved endwise on the machine bed, they operate on the work to cause metal thereof to be displaced radially.

3. In a machine as claimed in claim 1, means whereby, after each operation or "cut", the carrier is moved transversely to put on further "cut" for the next operation, and means whereby the degree of such movement is automatically controlled.

4. In a machine as claimed in claim 1, a stop on said carrier, a cam turnably mounted on said

saddle, a cam surface of said cam with which said stop is adapted to engage and means whereby said cam is turned automatically through a suitable angle for each operation of the machine.

5. In a machine as in claim 1, means whereby the saddle is moved forward for each cut and means whereby the degree of such movement is automatically controlled for each successive cut, whereby the requisite shape of the work is obtained.

6. In a machine as in claim 1, a stop fixed in relation to the machine, a cam turnably mounted on said saddle, a cam-surface of said cam with which said stop is adapted to engage and means whereby said cam is turned automatically through a suitable angle at each operation of the machine.

7. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially, a stop on said carrier, a cam turnably mounted on said saddle, a cam surface of said cam with which said stop is adapted to engage, means whereby said cam is turned automatically through a suitable angle for each operation of the machine, a pinion with which said cams are drivingly connected, an endway sliding rack with which said pinion engages, and a stop on said machine with which said rack is adapted to engage, whereby said cams may be turned through the requisite angle at the end of each rearward movement of the saddle.

8. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially, a stop fixed in relation to the machine, a cam turnably mounted on said saddle, a cam surface of said cam with which said stop is adapted to engage, means whereby said cam is turned automatically through a suitable angle at each operation of the machine, a pinion with which said cams are drivingly connected, an endway sliding rack with which said pinion engages, and a stop on said machine with which said rack is adapted to engage, whereby said cams may be turned through the requisite angle at the end of each rearward movement of the saddle.

9. In a machine as defined in claim 7, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, and means whereby said finger may have its end removed from said path.

10. In a machine as defined in claim 8, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, and means whereby said finger may have its end removed from said path, a slot in a part of the rear face of the rack with which slot a flattened forward end of said finger is adapted to engage.

11. In a machine as defined in claim 7, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, means whereby said finger may have its end removed from said path, a spring pressed plunger, a sideway projection therefrom, said projection being adapted to engage against said finger to move it out of the path of said rack, and a trip lever normally holding said plunger against the force of its spring to keep said projection from moving said finger.

12. In a machine as defined in claim 7, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, means whereby said finger may have its end removed from said path, a spring pressed plunger, a sideway projection therefrom, said projection being adapted to engage against said finger to move it out of the path of said rack, a trip lever normally holding said plunger against the force of its spring to keep said projection from moving said finger, a cylindrical surface on a part turnably mounted on said saddle, said part being turned by said pinion, a notch in said cylindrical surface, a nose on said trip lever adapted normally to lie on said surface at which position of said trip lever it acts to hold said plunger against the force of its spring, but on turning of said cylindrical surface, said nose enters said notch causing said trip lever to release said plunger, whereby its projection moves said finger out of the path of the said rack.

13. In a machine as defined in claim 7, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, means whereby said finger may have its end removed from said path, a spring pressed plunger, a sideway projection therefrom, said projection being adapted to engage against said finger to move it out of the path of said rack, a trip lever normally holding said plunger against the force of its spring to keep said projection from moving said finger, a cylindrical surface on a part turnably mounted on said saddle, said part being turned by said pinion, a notch in said cylindrical surface, a nose on said trip lever adapted normally to lie on said surface at which position of said trip lever it acts to hold said plunger against the force of its spring, but on turning of said cylindrical surface, said nose enters said notch causing said trip lever to release said plunger whereby its projection moves said finger out of the path of the said rack, an inclined face at the rear of the machine with which said projection of said plunger engages on extreme rearward movement of the saddle, whereby said plunger is moved against the force of its spring to allow said trip lever to engage over said plunger.

14. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially, a stop on said carrier, a cam turn-

ably mounted on said saddle, a cam surface of said cam with which said stop is adapted to engage, means whereby said cam is turned automatically through a suitable angle for each operation of the machine, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, means whereby said finger may have its end removed from said path, and a stop at the rear of the machine with which said rack may engage on extreme rearward movement of the saddle, so that said cams may be turned through the requisite angle to reset them while said finger is out of the path of the said rack.

15. In a machine as defined in claim 7, a finger constituting said stop and being pivoted in relation to the machine, means whereby said finger is normally held with its end in the path of the rack, means whereby said finger may have its end removed from said path, a spring pressed plunger, a sideway projection therefrom, said projection being adapted to engage against said finger to move it out of the path of said rack, a trip lever normally holding said plunger against the force of its spring to keep said projection from moving said finger, a cylindrical surface on a part turnably mounted on said saddle, said part being turned by said pinion, a notch in said cylindrical surface, a nose on said trip lever adapted normally to lie on said surface at which position of said trip lever it acts to hold said plunger against the force of its spring, but on turning of said cylindrical surface said nose enters said notch causing said trip lever to release said plunger whereby its projection moves said finger out of the path of the said rack, and a stop at the rear of the machine with which said rack may engage on extreme rearward movement of the saddle so that said cylindrical surface may be turned to cause said nose on said trip lever to ride out of the said notch.

16. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially, means after each operation or "cut" to move the carrier transversely to put on further "cut" for the next operation, automatic stop means, and means for throwing said automatic stop means out of action for further operations of the machine.

17. In a machine for operating on a sheet metal vessel, a chuck for carrying the work, a carrier, a saddle on which said carrier is movable transversely and which is itself movable endwise on the machine bed, a displacing tool mounted on said carrier and an abutment tool, one tool being external to the work and the other internal, said tools being so set transversely of the machine that as the saddle is moved endwise they operate on the work to cause metal thereof to be displaced radially, means to move the saddle forward for each cut, means to automatically control the degree of such movement for each successive cut, and means, after a succession of forward travels of said saddle to throw out of action said means for controlling the alteration of the degree of said travel, for further operations of the machine.

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