Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 1

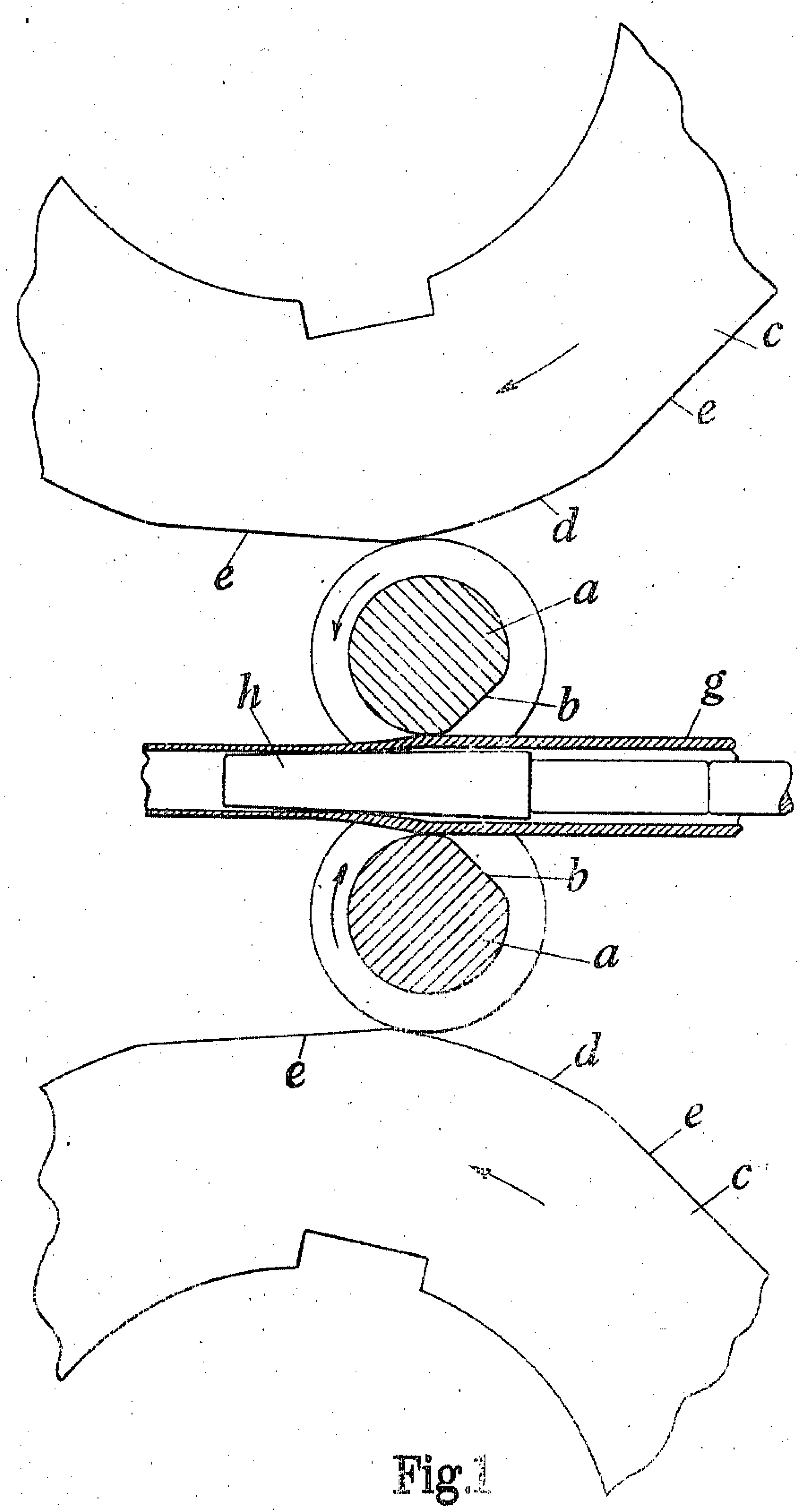


Fig.1

Inventor:
A. Norton

By: Glascock Downing & Seebold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 2

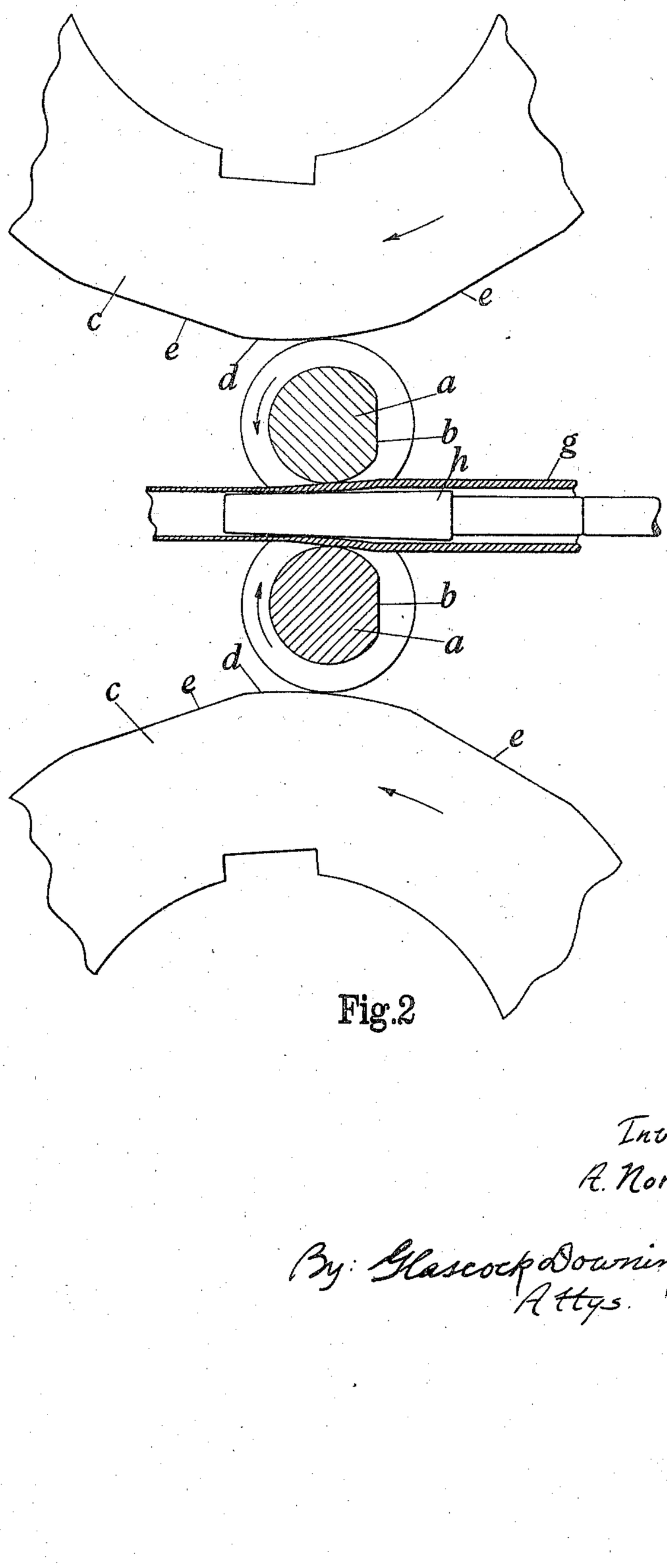


Fig.2

Inventor:
A. Norton

By: Glascock Downing & Seebold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 3

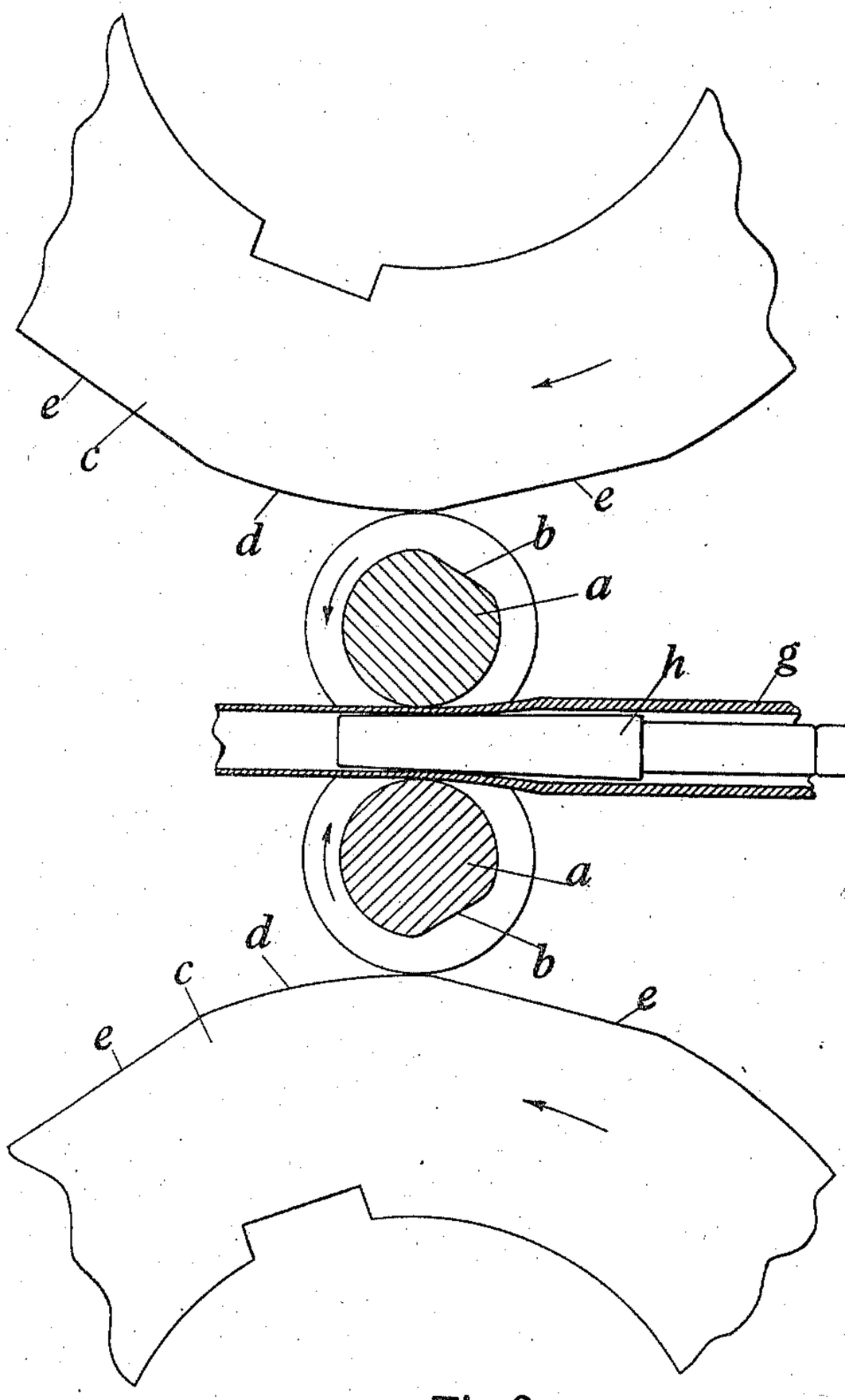


Fig.3

Inventor
A. Norton
By: Glascock Downing & Seebold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 4

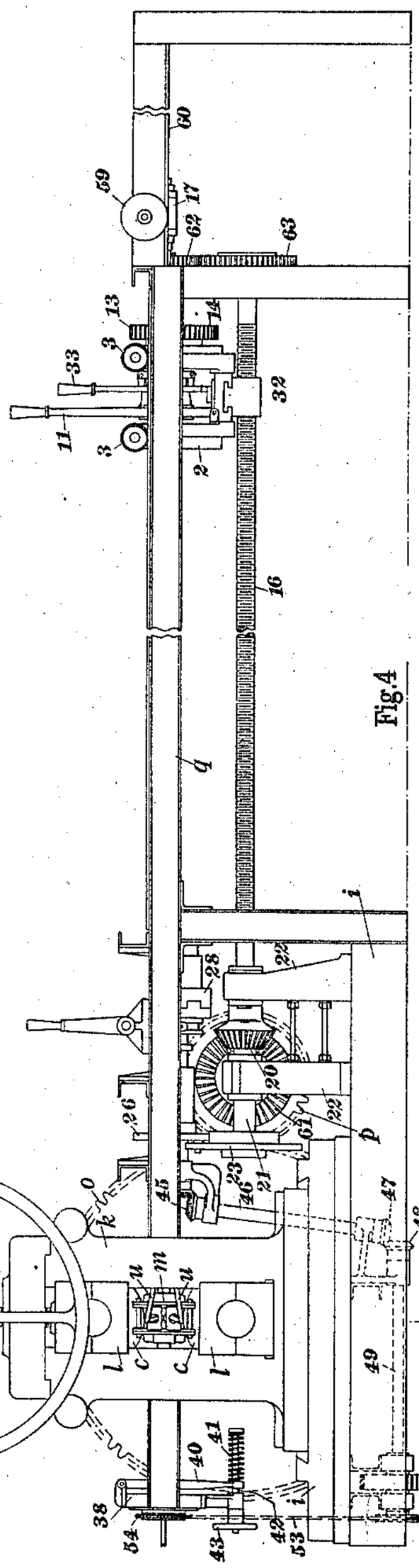


Fig.4

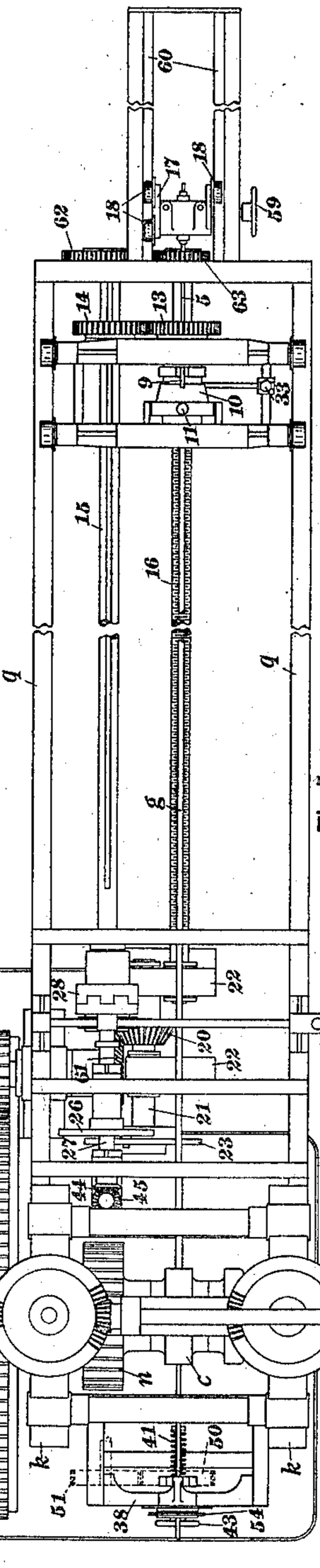


Fig.5

Inventor:
A. Norton
By: Glascock Downing & Seibold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 5

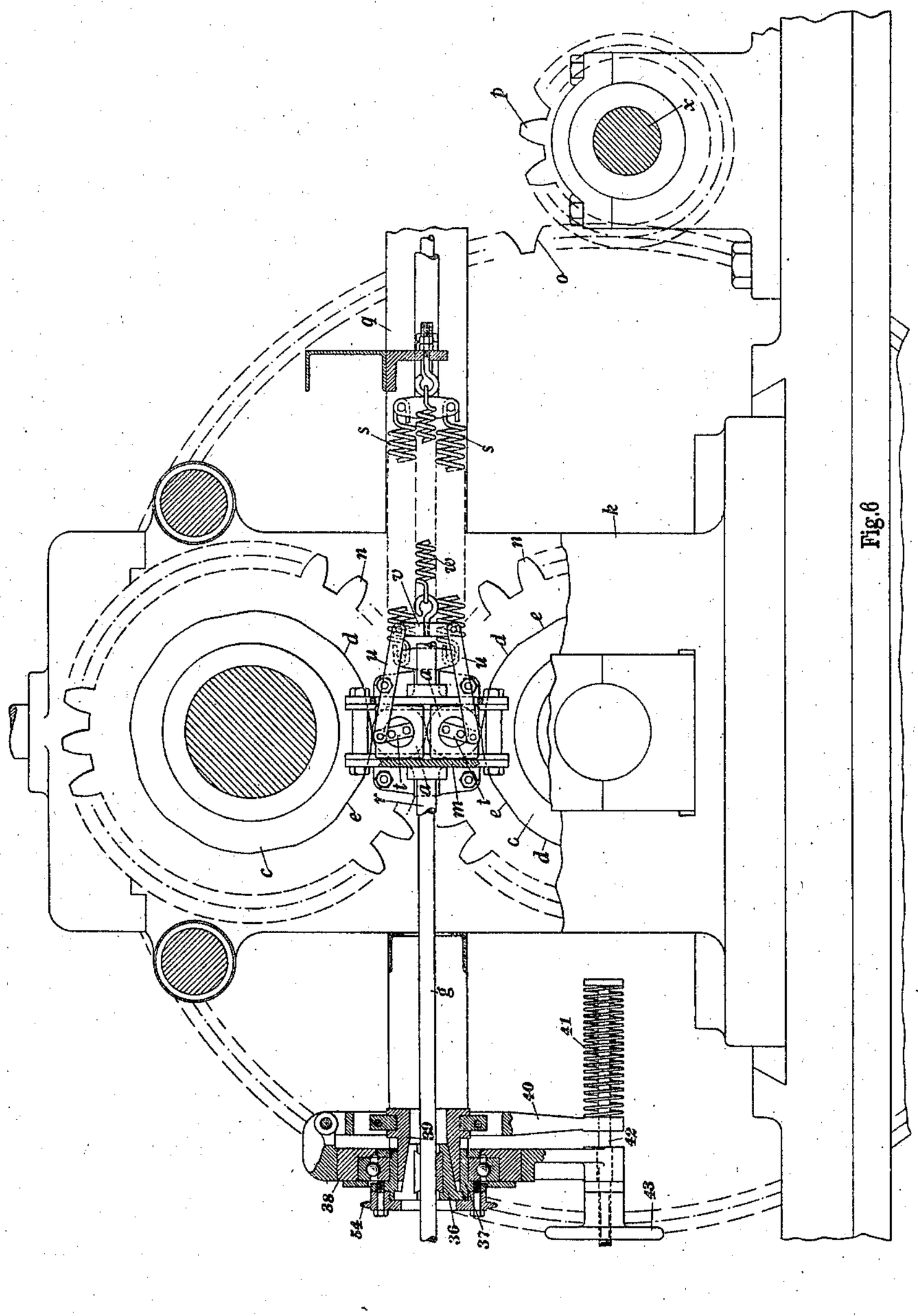


Fig. 6

Inventor:
A. Norton
By: Glascock Downing & Seibold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 6

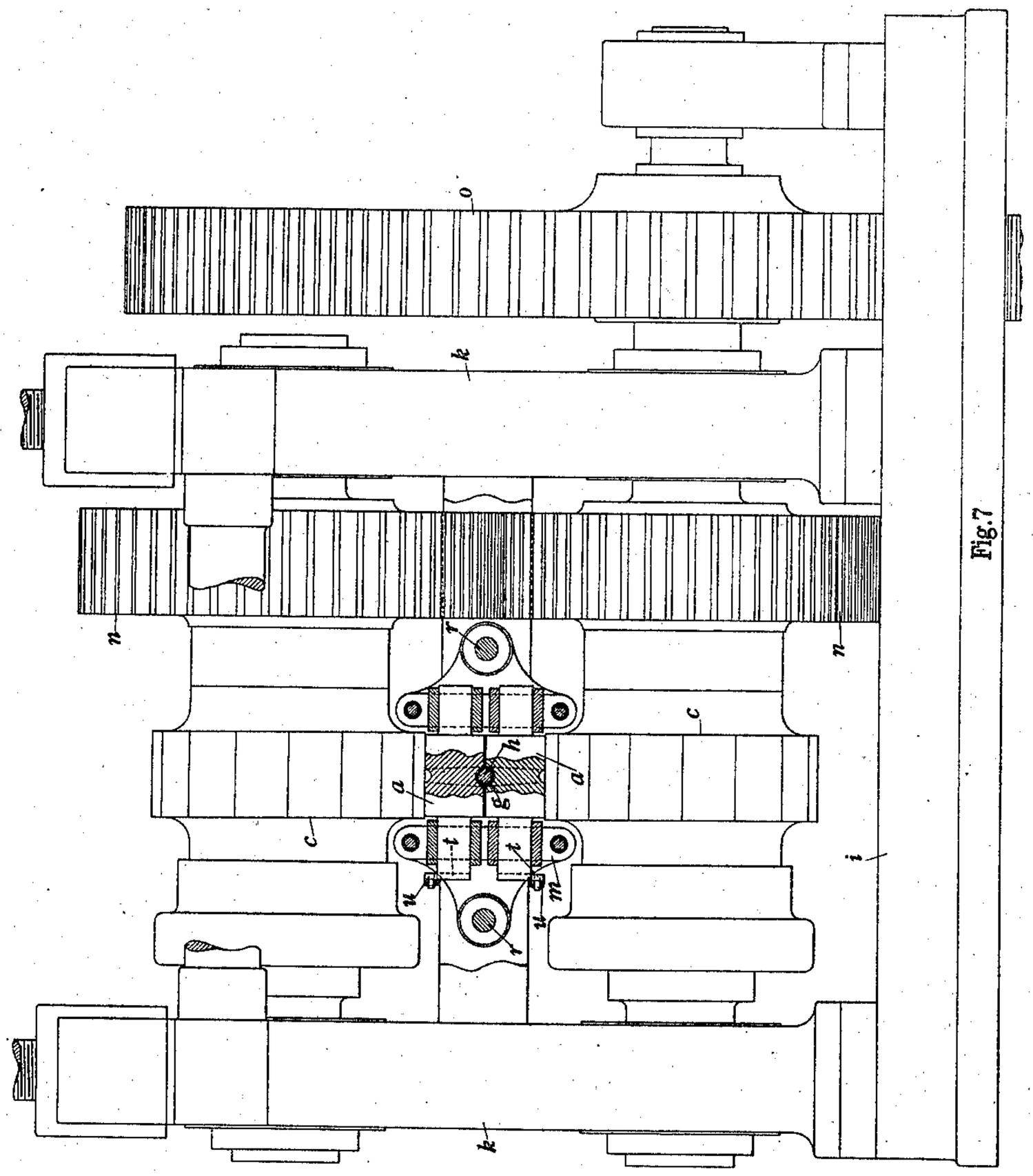


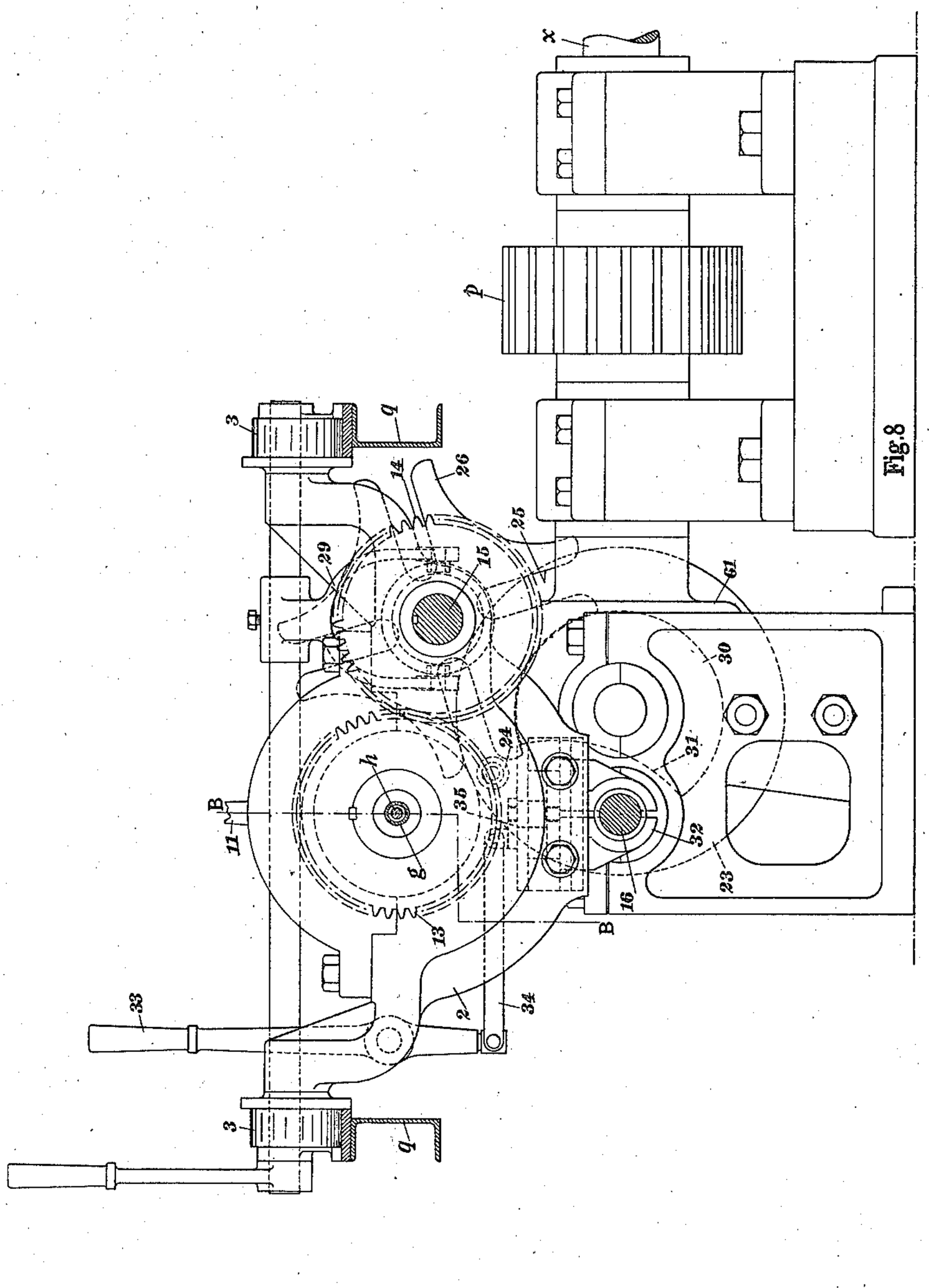
Fig.7

Inventor:
A. Norton
By: Glascock Downing & Seibold
Atty's.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 7



Inventor:
A. Norton
By: Glascock Downing & Seibold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 8

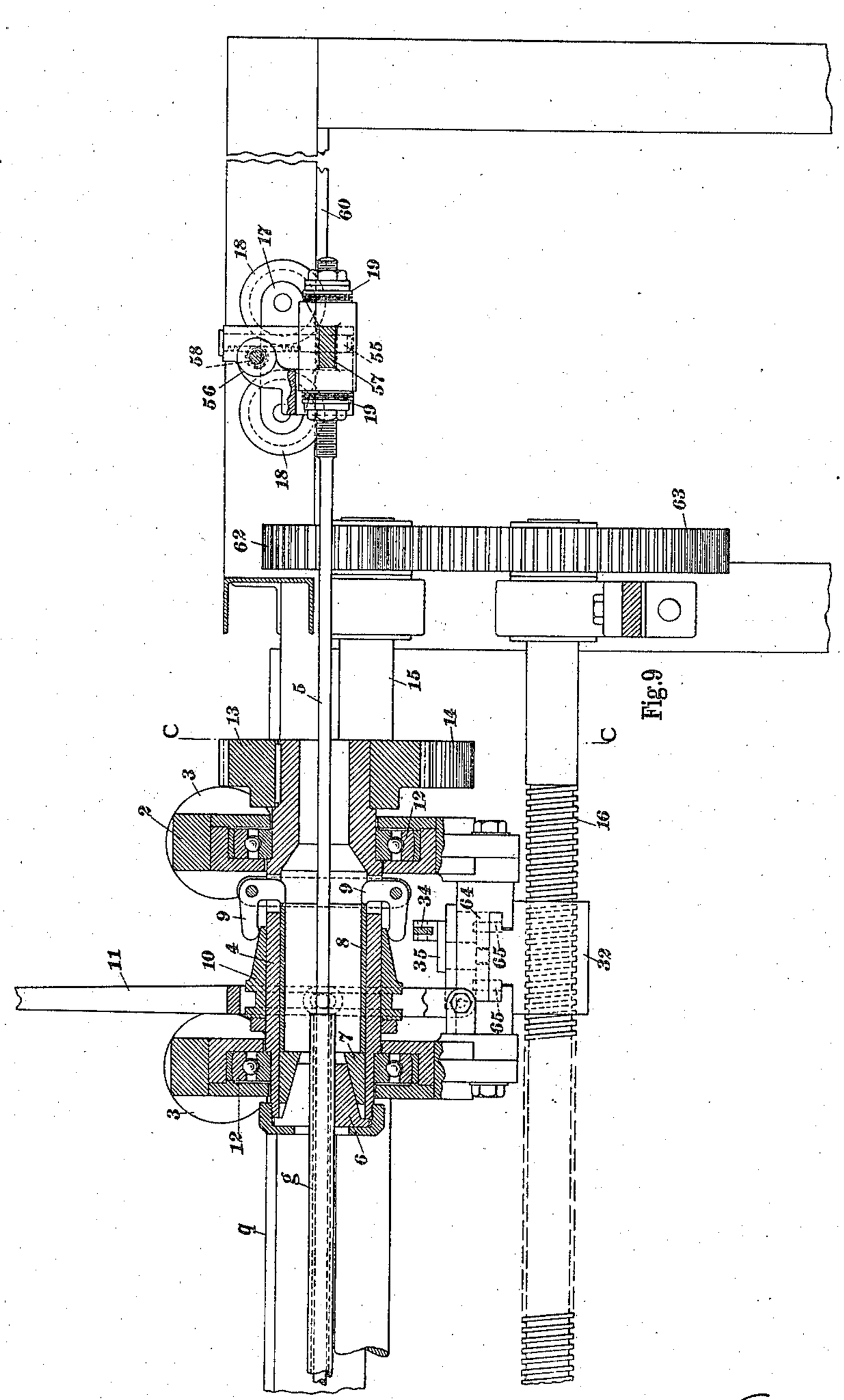


Fig.9

Inventor:
A. Norton
By: Glascock Downing & Seebold
Attys.

Aug. 2, 1938. A. NORTON 2,125,686

ROLLING MILL

Filed June 28, 1937 9 Sheets-Sheet 9

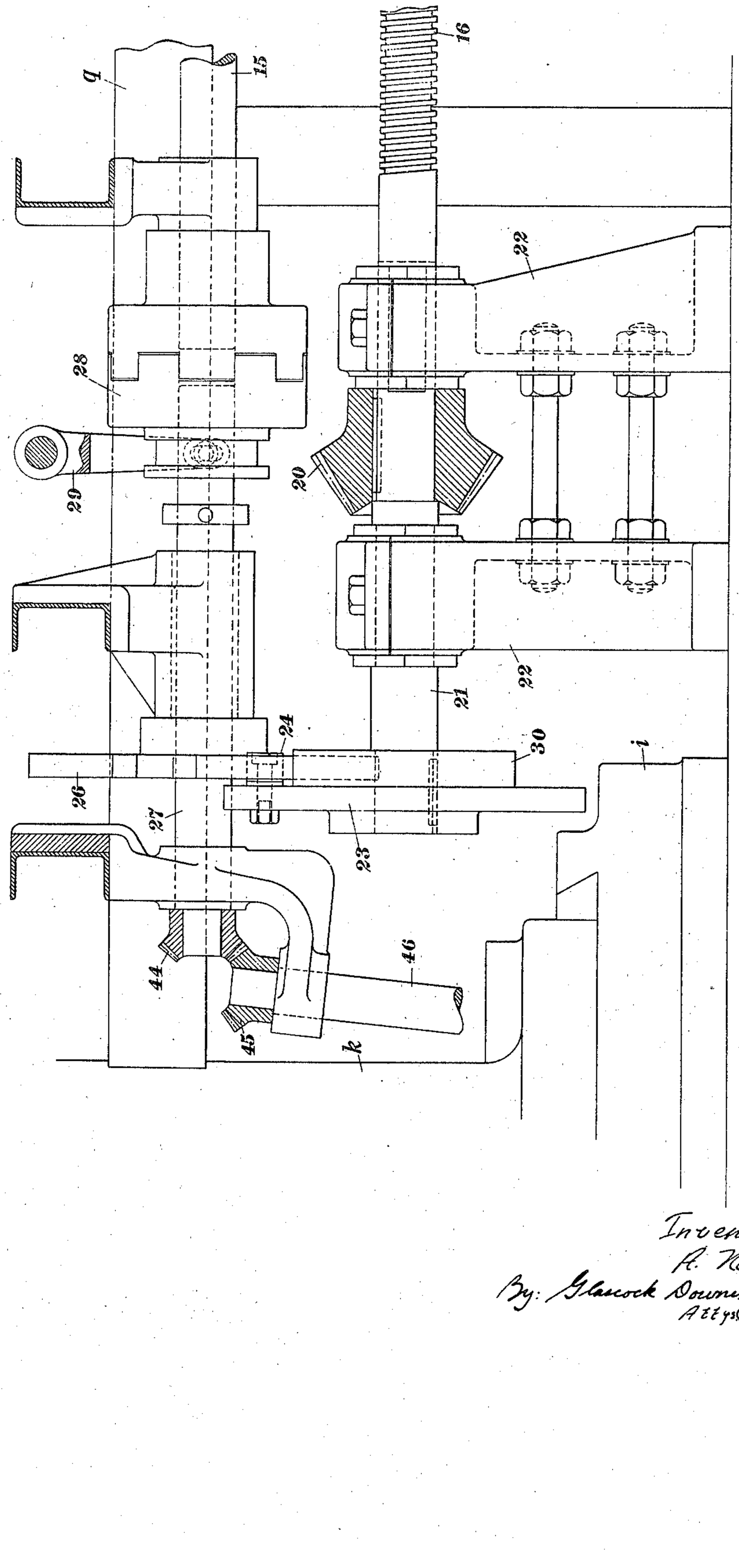


Fig. 10

Inventor:
A. Norton
By: Glascock Downing & Seebold
Attys.

Patented Aug. 2, 1938 2,125,686

UNITED STATES PATENT OFFICE

2,125,686

ROLLING MILL

Albert Norton, Birmingham, England, assignor to Tube Products Limited, Oldbury, Birmingham, England

Application June 28, 1937, Serial No. 150,817
In Great Britain July 4, 1936

12 Claims. (Cl. 80—14)

This invention has for its object to provide an improved machine for effecting reducing operations on metal tubes or rods.

The invention comprises the combination of die rollers forming the pass through which the work piece is to travel, driven supporting rollers which also serve to rotate the die rollers, and means for effecting reciprocatory movements of the die rollers relatively to the work piece and supporting rollers.

In particular the invention comprises the combination of die rollers, a reciprocatory carriage on which the die rollers are mounted, driven supporting rollers formed around their peripheries with alternately arranged working surfaces and flats or the like, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the flats or the like on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers.

Further the invention comprises die rollers of which each is formed with a peripheral groove, the width of which progressively varies from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece.

Also the invention comprises a pair of die rollers as above described each of which is pivotally connected at a convenient radial position to one end of a link, and the other end of each of the two links being pivotally attached to a spring loaded member, the purpose of the linkage and spring being to maintain the die rollers in proper co-relationship.

In the accompanying sheets of explanatory drawings:—

Figures 1, 2 and 3 are diagrams illustrating in different positions tube reducing rollers operating in accordance with the invention.

Figures 4 and 5 are respectively side elevation and plan of a tube-reducing machine embodying my invention.

Figure 6 is a sectional side elevation and Figure 7 a sectional front elevation of the die rollers, the supporting rollers, and their immediately associated parts, Figure 7 being taken on the line A.A Figure 4.

Figure 8 is a sectional end elevation of the tube feeding mechanism, this view being taken on the line C.C Figure 9. Figure 9 is a cross section on the line B.B Figure 8.

Figure 10 is a part sectional side elevation of a portion of the mechanism situated between the tube reducing rollers and the feeding mechanism.

All the views shown in Figures 6 to 10 are shown to a larger scale than Figures 4 and 5.

Referring to Figures 1 to 3 I have there illustrated diagrammatically the supporting and die rollers used in a machine embodying my invention, for reducing the diameter and thickness of a cold steel or other metal tube. The pass for the tube is formed by a pair of die rollers *a*. Each die roller is formed with a circumferential groove. Preferably this groove is made of varying width, so that it progressively increases in width from a narrow part which is approximately the same diameter as that to be produced on the tube, to a relatively wide part which is of approximately the same diameter as the original tube. This variation of width is clearly shown in Figure 7. The inactive portion of each die roller which joins the adjacent ends of the wide and narrow parts of the said groove is formed by a flat or recessed part *b*. The two die rollers are mounted on a carriage (not shown in Figures 1 to 3) which can reciprocate in the direction of the axis of the tube. The details of the carriage and the means for holding the two die rollers in the proper working relationship will be described later.

The die rollers are arranged between a pair of supporting rollers *c*. These are of considerably larger diameter than the die rollers and are geared together. Also the supporting rollers are driven from any convenient source of motion. On looking at Figures 1 to 3 (also Figures 6 and 7) it will be seen that the peripheral portion of each roller *c* which bears on the adjacent die roller *a* is formed by an alternating succession of parts *d*, *e*. Each part *d* forms a portion of the cylindrical surface of the roller, and is herein termed the working surface. Each part *e*, which is made of any convenient length and is usually rather greater than the part *d*, is flat, or recessed. The die rollers *a* are free to rotate about their axes on their carriage and are driven by the working surfaces *d* of the supporting rollers *c*.

The tube *g* to be reduced in diameter and wall thickness is supported internally by a mandrel *h*, this being secured to one end of a rod which extends backwards through the tube and is attached at its rear end to the frame of the machine.

Starting with Figure 1, the die rollers *a* are shown in the position which they occupy at the beginning of each of the successive reducing actions on the tube, and the forward end of the tube is shown in the reduced condition to which it has been brought by previous actions of the said die rollers. The initial condition of the tube is shown at the right hand side of the vertical centre line of Figure 1, and the finished condition at the left hand side. In the relative positions of the supporting rollers *c* and the die rollers *a* shown in Figure 1, a working surface *d* on each supporting roller has just entered into engagement with the outer periphery of the adjacent die roller, and the beginning of the working surface of each die roller rests upon the outer original surface of the tube. Due to the rotation of the supporting rollers and the frictional engagement of the parts *d* of the supporting rollers with the peripheries of the die rollers the latter are not only rotated but are also caused to move laterally to the left relatively to the stationary tube *g*, this lateral movement of the die rollers being also transmitted by the die rollers to the carriage on which they are mounted. During this movement the die rollers are, in addition, pressed towards each other and are caused to exert a squeezing action on the tube for effecting the required reduction of diameter and thickness. The relative positions occupied by the supporting and die rollers at about one half of the length of the travel of the die rollers are shown in Figure 2. This action continues until the parts *d* of the supporting rollers pass out of contact with the die rollers. This condition is shown in Figure 3 which shows the relative positions of the supporting and die rollers at the end of the travel of the die rollers. Immediately afterwards the pressure exerted by the supporting rollers on the die rollers is released, due to the fact that the flats *e* come adjacent to the die rollers, and consequently the carriage on which the die rollers are mounted is free to be returned quickly to the initial position shown in Figure 1, under the action of a spring or weight or other convenient means, the initial position being determined by any conveniently arranged stops. During this movement the die rollers move apart by rolling up the tapered part of the tube. On returning to the initial position shown in Figure 1, the die rollers engage a new part of the tube and immediately thereafter the next parts *d* of the supporting rollers engage the die rollers and the above described sequence of actions is then repeated. At each action the die rollers engage a small portion of the tube of original diameter, as shown in Figure 1, and reduce it as shown in Figures 2 and 3, and during each return movement of the die rollers a small forward feeding movement is given to the tube so that the die rollers can engage a new part. Preferably a rotational movement is also given to the tube for the purpose of preventing formation of ripples or other irregularities on the outer surface of the tube. The operation above described is continued until the whole of the tube has been treated.

In the example shown in Figures 1–3, the die rollers rotate through an angle of about 120°, the amount of rotation during each lateral movement being dependent on the length of each working part *d* of the supporting rollers. But the amount of angular movement given to the die rollers may be varied by appropriate alteration of the length of the parts *d*. When it is required to impart a larger angular movement to the die rollers than is shown in Figures 1–3, the length of the parts *d* on the supporting rollers is correspondingly increased.

By treating tubes in the manner above described I am able to effect large reductions of diameter and thickness in a very rapid and economical manner.

I will now describe a complete machine embodying my invention. Referring first to Figures 4 and 5 I mount upon a base *i* a pair of housings *k* provided with bearings *l* for the upper and lower supporting rollers *c*. Between these rollers are arranged the die rollers *a* which are carried upon a reciprocatory carriage *m*. The supporting rollers *c* are interconnected by gear wheels *n* and one of them is connected to a gear wheel *o* which is driven by a gear wheel *p* from any convenient source of motion. At one side of the housings *k* is arranged a horizontal framework *q* on which is mounted mechanism for imparting longitudinal feeding and rotational movements to the tube. Also there is arranged at the other side of the housings *k* a mechanism for supporting and rotating the forward end of the tube. It will be convenient to describe separately each of the main functional parts of the machine which are shown assembled in Figures 4 and 5, and this will be done with reference to the drawings shown in Figures 6 to 10.

Referring to Figures 6 and 7, the carriage *m* on which are mounted the die rollers *a* is carried on horizontal guide rods *r* and is freely slidable thereon. The carriage is moved towards the right of Figure 6 by means of a pair of strong springs *s*. These springs are anchored at their forward ends to the carriage and at their rear ends to the frame *q* above mentioned. In Figure 6 the carriage is shown for convenience in its forward position wherein the springs *s* are extended. As soon as the die rollers *a* are released by the supporting rollers *c* the springs *s* retract the carriage and the die rollers to the position relatively to the rollers *c* shown in Figure 1. It will be understood that the die rollers *a* are free to slide relatively to each other in the vertical direction on the carriage *m*, the movement of the die rollers towards each other being effected by the supporting rollers *c* in the manner above described, and the movement of the die rollers away from each other being effected by their rolling up the tapered part of the tube under the action of the springs *s* when released by the supporting rollers.

To keep the die rollers *a* in proper angular relationship with each other I secure to one end of each die roller a radial arm *t* and to the outer end of each arm I pivotally connect one end of a link *u*. The other ends of the links *u* are pivoted to the opposite ends of a cross bar *v* which at its centre is connected to a spring *w* anchored to the frame of the machine. During the forward travel of the carriage this spring *w* is extended and during the return of the carriage the spring *w* by its action on the rollers *a* through the parts *t*, *u*, *v*, ensures that the rollers *a* shall commence each successive squeezing and reducing action in the proper angular relationship shown in Figure 1.

The intermittent feeding forward of the tube is effected by the mechanism shown in detail in Figures 8, 9 and 10. Referring to these figures, and particularly to Figures 8 and 9, there is mounted upon the frame *q* above-mentioned a carriage **2** which is supported on the frame *q* by rollers **3** which latter can roll along the upper

horizontal side of the frame. On this carriage is mounted a rotatable hollow member 4 through which can pass the mandrel rod 5 and at the front end of which is mounted a chuck for gripping the rear end of the tube *g*. This chuck comprises a split conical gripping piece 6 which can be caused to grip the tube *g* by the action of an annular wedge 7. This latter is moved into the operative position by an internal bush 8 which is acted on by bell crank levers 9 the latter being movable by a sliding sleeve 10 which is actuated by a hand lever 11. The hollow body 4 is rotatably supported on the carriage 2 by bearings 12 and it is rotated by means of a gear wheel 13 secured to the rear end of the said hollow body 4. The gear wheel 13 engages with another gear wheel 14 (Figures 5, 8 and 9) which wheel is in feather-key connection with a longitudinal shaft 15 for imparting intermittent rotational movements to the tube. Intermittent longitudinal movements are given to the carriage 2 by a screw 16.

The mandrel rod 5 must be free to rotate with the tube, although it receives no longitudinal movement during the normal working of the machine. To satisfy this condition the rear end of the rod 5 is anchored to a carriage 17 supported by rollers 18 on a track 60 at the rear of the frame *q*. The connection between the rod 5 and the carriage 17 is effected by thrust collars 19, which hold the rod against endwise movement relatively to the carriage and at the same time allow it to rotate. The holding of the carriage 17 against endwise movement is effected by locking it to the track 60. For this purpose a vertical plunger 55 slidably supported in a fixed bracket 56 is adapted at its lower end to pass through an aperture in a cross member 57 of the carriage 17 and enter an aperture in the lower part of the bracket 56. A pinion 58 engaging teeth formed in one side of the plunger 55 is adapted to be actuated by a hand wheel 59 to move the plunger into and out of its locking position. To enable the mandrel to be inserted within a new tube length the carriage 17 is released from the track 60 by appropriate movement of the hand wheel 59 and then moved backwards along the track. After the tube and mandrel have been brought together the carriage is returned to its forward position for the purpose of bringing the forward end of the tube between the die rollers, and is then locked by the plunger 55.

The rotational movement of the shaft 15 and screw 16 is effected by the mechanism shown in Figures 4, 5, 8 and 10. On the driving shaft *x* which carries the pinion *p* above mentioned there is secured a bevel pinion 61 gearing with another bevel pinion 20. This latter is secured to a short shaft 21 carried by bearings 22, and on one end of this shaft 21 is secured a disc 23 from one side of which extends a roller 24. The roller 24 is adapted to engage each in succession of a number of radial slots 25 in the disc 26 secured to a shaft 27 arranged in line with one end of the shaft 15. The two shafts 27 and 15 can be coupled together by a clutch 28 which can be operated by a lever 29. By means of this mechanism the continuous rotation of the shaft 21 is converted into intermittent rotary movement of the shafts 27 and 15. The intermittent rotational movement of the shaft 15 is utilized by means of the gear wheels 13, 14 to rotate the chuck body part 4 above described. Also it is utilized by means of gear wheels 62, 63 mounted at the rear ends of the shaft 15 and screw 16 to impart intermittent rotational movements to the screw 16. The forward end of the screw is supported by the right hand bearing 22 shown in Figure 10. To hold the shaft 15 stationary during the intervals between the intermittent rotary movements the disc 23 is provided on one side with a disc-like boss 30 which can engage concave recesses formed in the periphery of the disc 26 between the radial notches 25. During the engagement of the roller 24 with a radial groove in the disc 26 the required rotation of the latter is permitted by a concave recess 31 formed in an appropriate part of the periphery of the boss 30. To enable the carriage 2 to return quickly to its rear position the nut 32 which connects the carriage to the screw 16 is made in two parts which can be separated by a hand lever 33 acting, through a link 34 and lever 35, on any convenient cam mechanism, such as, a rotary disc 64 connected to the lever 35 and having cam slots engaging pins 65 on the parts of the nut 32.

To support the relatively slender forward end of the tube I provide the support shown at the left hand side of Figures 4, 5 and 6, and to avoid the imposition of undesirable torsion on the supported part of the tube the said support is made to rotate at the same rate as the tube. Referring to Figure 6 it will be seen that the support comprises a plurality of friction pieces 36 which bear upon the exterior of the tube and form the pass through which the tube can slide. These friction pieces are carried in a rotatable ring 37 which is supported in a fixed housing 38. The pieces 36 are held in frictional engagement with the tube by an annular and rotatable wedge piece 39 which is held in its operative position by a lever 40 which is loaded by a spring 41. The pressure of the spring on the lever 40 can be adjusted or released by a screwed stem 42 carrying the spring and engaged by an internally screw threaded hand wheel 43. The intermittent rotation of the ring 37 is obtained from the shaft 27 above described. As will be seen in Figures 4 and 10, one end of this shaft has secured to it a bevel pinion 44 engaging another bevel pinion 45 on a shaft 46 and this latter transmits its motion through other bevel pinions 47, 48 to a shaft 49 on which is secured a wheel 50 gearing with a wheel 51 (Figure 5). The wheel 51 is secured to a sprocket wheel 52 which by means of a chain 53 is connected to a sprocket wheel 54 secured to the ring 37 thus imparting a rotational motion to the supporting pieces 36 at the same rate as the rotational motion imparted to the tube.

The support above described also serves an additional purpose. When the tube undergoing treatment approaches the end of the reducing operation, and can no longer be fed forward by the mechanism shown in Figure 9, the machine is stopped and the tube is detached from the gripping pieces 6 of the chuck. Another tube to be reduced is then placed on the rod 5 and secured by the said pieces 6, the forward end of this tube being arranged to bear against the short rear end of the tube still in the machine. The latter tube is fed forward intermittently by the pressure of the second, but seeing that it is no longer connected to the chuck gripping pieces 6, it has to be rotated by some other means, and this function is performed by the mechanism above described and shown in Figure 6.

The invention is not limited to the example above described as subordinate mechanical details may be varied. Thus instead of intermittently releasing the die rollers by arranging flats

on the supporting rollers I may provide means acting on the supporting rollers for intermittently releasing their pressure on the die rollers. Further instead of effecting the return of the die roller carriage by means of a spring as above described it may be returned by a weight, or by any convenient lever, cam or other mechanism suitably co-ordinated with the supporting rollers, but in all cases the die rollers are reciprocated relatively to the work piece and the supporting rollers, and their rotational movements are derived from the supporting rollers. Moreover, the required co-ordination of the die rollers can be effected by interengaging gear wheels mounted on the ends of these rollers, though the spring and linkage mechanism above described is preferred on account of its simplicity and convenience.

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

1. A machine for effecting reducing operations on tubes or rods, comprising the combination of die rollers forming the pass through which the work piece is to travel, driven supporting rollers which also serve to rotate the die rollers and to move them along the work piece, and means for returning the die rollers to their initial positions independently of the driven supporting rollers when the latter assume predetermined positions.

2. A machine for effecting reducing operations on tubes or rods, comprising the combination of die rollers forming the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted, driven supporting rollers formed around their peripheries with alternately arranged working surfaces and inactive surfaces, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers.

3. A machine for effecting reducing operations on tubes or rods, comprising the combination of a pair of die rollers forming the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted so as to be freely movable towards and away from each other, a pair of driven supporting rollers acting on opposite sides respectively of the die rollers and each formed around its periphery with alternately arranged working surfaces and inactive surfaces, gearing interconnecting the supporting rollers, means for effecting relative co-ordination of the die rollers, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers.

4. A machine for effecting reducing operations on tubes or rods, comprising the combination of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, driven supporting rollers which also serve to rotate the die rollers, and means for effecting reciprocatory movements of the die rollers relatively to the work piece and supporting rollers.

5. A machine for effecting reducing operations on tubes or rods, comprising the combination of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted, driven supporting rollers formed around their peripheries with alternately arranged working surfaces and inactive surfaces, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers.

6. A machine for effecting reducing operations on tubes or rods, comprising the combination of a pair of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted so as to be freely movable towards and away from each other, a pair of driven supporting rollers acting on opposite sides respectively of the die rollers and each formed around its periphery with alternately arranged working surfaces and inactive surfaces, gearing interconnecting the supporting rollers, means for effecting relative co-ordination of the die rollers, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers.

7. A machine for effecting reducing operations on tubes or rods, comprising the combination of a pair of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, a pair of driven supporting rollers which also serve to rotate the die rollers, means for effecting reciprocatory movements of the die rollers relatively to the work piece and supporting rollers, a pair of links pivotally connected at their corresponding ends respectively to the die rollers, these ends being spaced from the axes of the die rollers, and a

spring loaded member pivotally attached to the other end of each link and adapted to cooperate with the links to maintain the die rollers in proper co-relationship.

8. A machine for effecting reducing operations on tubes or rods, comprising the combination of a pair of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted, a pair of links pivotally connected at their corresponding ends respectively to the die rollers, these ends being spaced from the axes of the die rollers, a spring loaded member pivotally attached to the other end of each link and adapted to cooperate with the links to maintain the die rollers in proper co-relationship, a pair of driven supporting rollers formed around their peripheries with alternately arranged working surfaces and inactive surfaces, and means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, against the action of the said spring loaded member by the action of the working surfaces of the supporting rollers on the die rollers.

9. A machine for effecting reducing operations on tubes or rods, comprising the combination of a pair of die rollers each formed with a peripheral groove which varies in width progressively from a narrow part corresponding approximately with the diameter to be produced on the work piece to a relatively wide part corresponding approximately with the original diameter of the work piece, the die rollers being arranged so that their peripheral grooves co-operate to form the pass through which the work piece is to travel, a reciprocatory spring loaded carriage on which the die rollers are mounted so as to be freely movable towards and away from each other, a pair of links pivotally connected at their corresponding ends respectively to the die rollers, these ends being spaced from the axes of the die rollers, a spring loaded member pivotally attached to the other end of each link and adapted to co-operate with the links to maintain the die rollers in proper co-relationship, a pair of driven supporting rollers acting on opposite sides respectively of the die rollers and each formed around its periphery with alternately arranged working surfaces and inactive surfaces, gearing interconnecting the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, against the action of the spring loadings by the action of the working surfaces of the supporting rollers on the die rollers, and the rearward movements of the carriage being effected by the spring loadings.

10. A machine for effecting reducing operations on tubes or rods, comprising the combination of die rollers forming the pass through which the work piece is to travel, a reciprocatory carriage on which the die rollers are mounted, driven supporting rollers formed around their peripheries with alternately arranged working surfaces and inactive surfaces, means acting on the carriage for imparting rearward movements to the die rollers when they coincide with the inactive surfaces on the supporting rollers, the movements of the die rollers and carriage in the forward direction being effected, when the machine is in operation, by the action of the working surfaces of the supporting rollers on the die rollers, a carriage for the work piece, means for imparting intermittent longitudinal feeding movements to the work piece carriage, a chuck on the work piece carriage for gripping the work piece, and means for imparting rotational movements to the chuck simultaneously with the feeding movements of the work piece carriage.

11. A machine as claimed in claim 10 and comprising a mandrel-supporting rod, a carriage to which the rear end of the said rod is rotatably connected, and locking means for detachably securing the latter carriage against endwise movement.

12. A machine as claimed in claim 10 and comprising a rotational support for the forward end of the work piece, and means for imparting rotational movements to the said support concurrently with the rotational movements imparted to the chuck on the work piece carriage.

ALBERT NORTON.