Jan. 9, 1951 G. H. LARSSON 2,537,356

ROLLING MILL FOR THE PRODUCTION OF CONICAL TUBES

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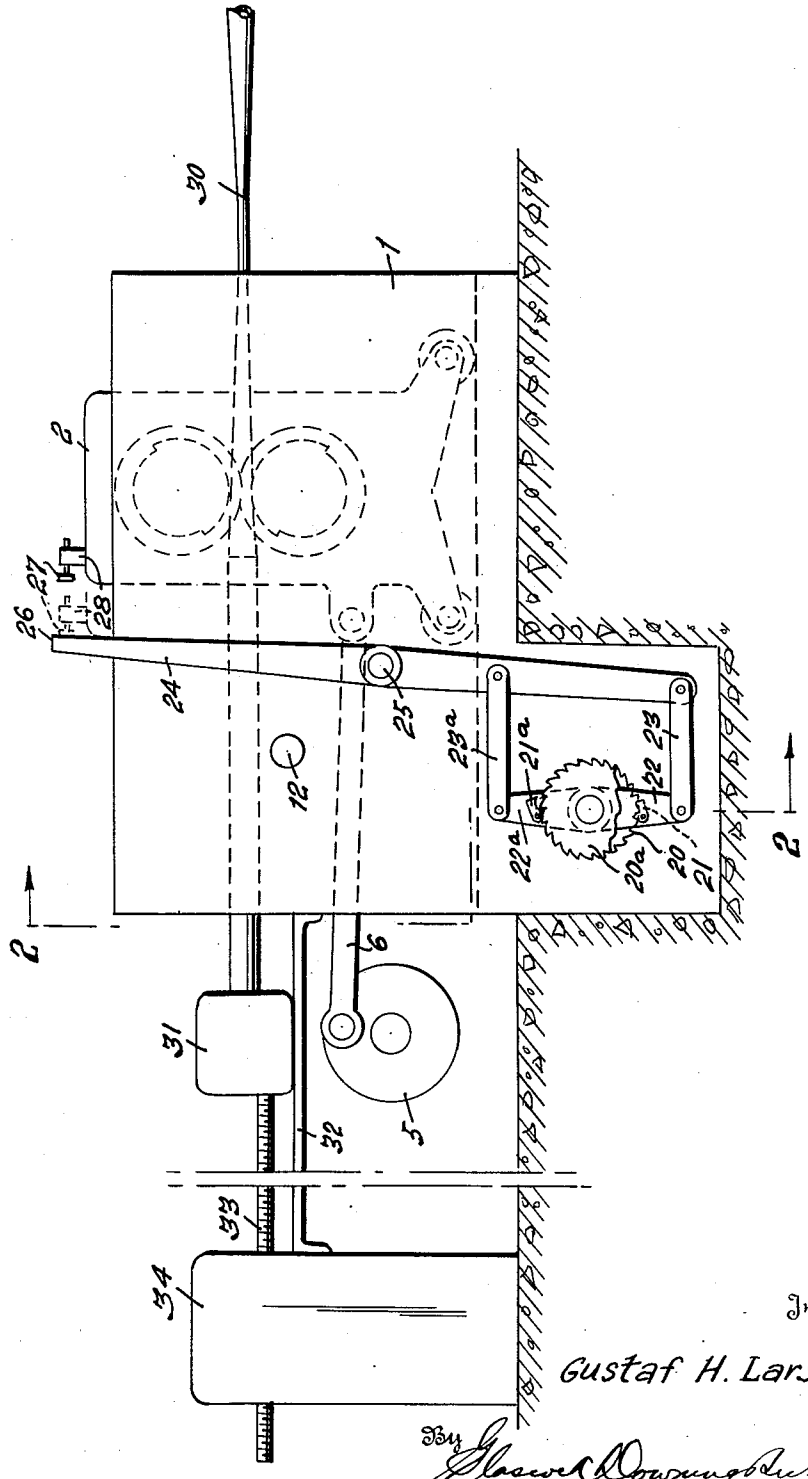
Fig. 1.



Inventor

Gustaf H. Larsson

By Glascock Downing & Seibold

Attorneys

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Fig. 2.

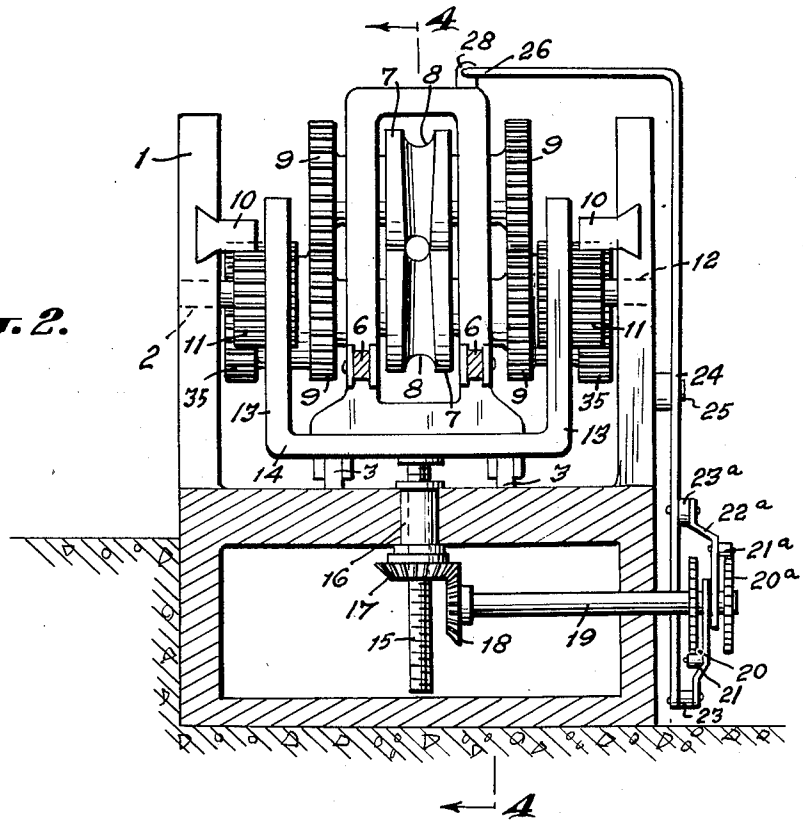
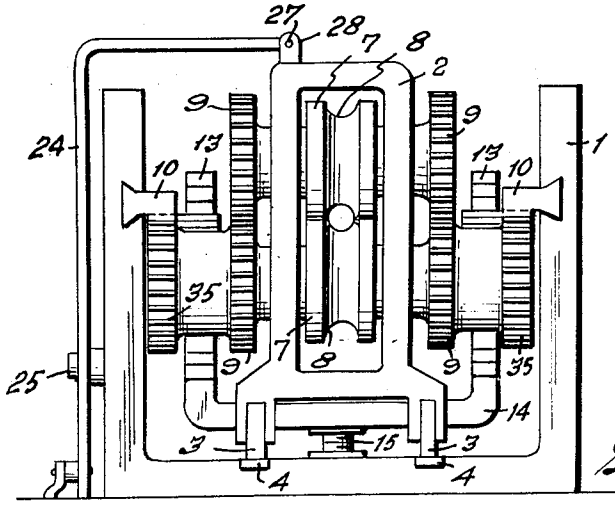


Fig. 3.



INVENTOR.
Gustaf H. Larsson
BY
Dissett Downing Little
Attorneys.

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ROLLING MILL FOR THE PRODUCTION OF CONICAL TUBES

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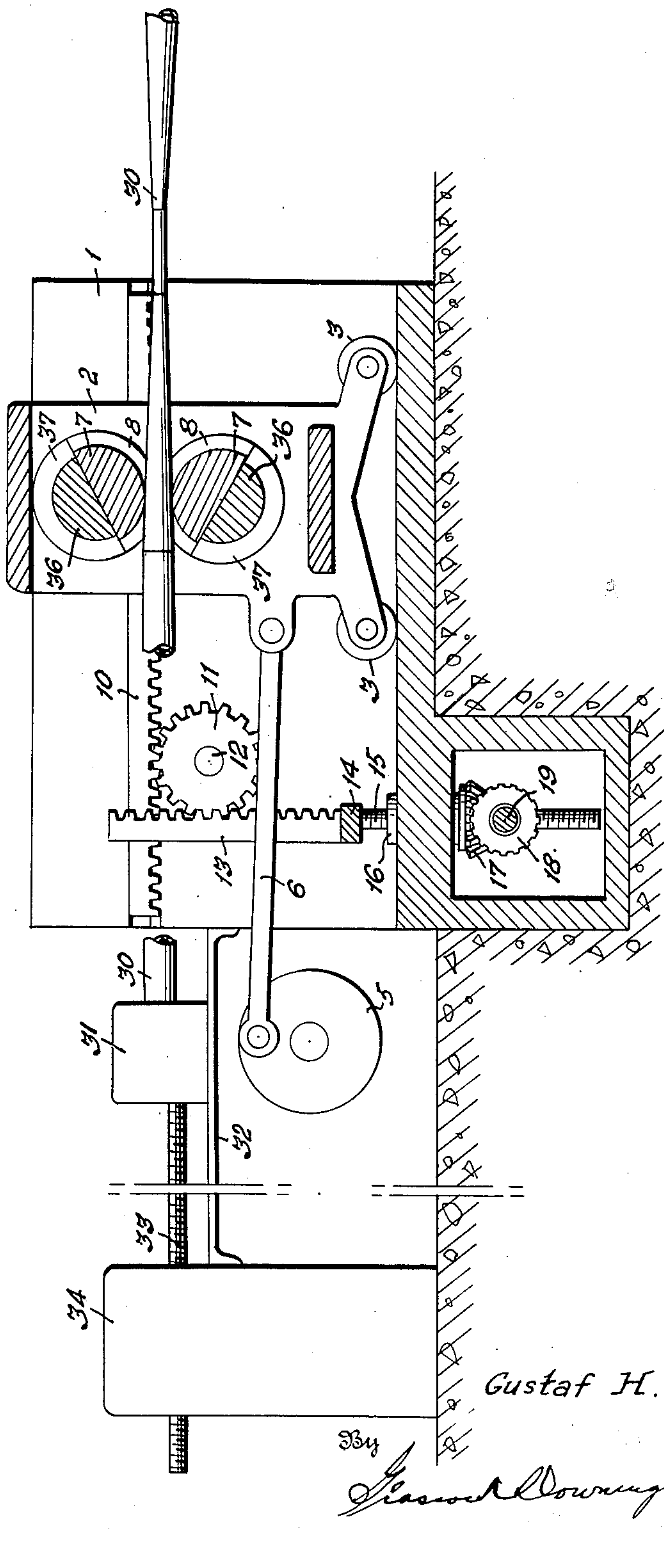
Fig. 4.



Inventor

Gustaf H. Larsson

By

Attorneys

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ROLLING MILL FOR THE PRODUCTION OF CONICAL TUBES

Gustaf Hjalmar Larsson, Alsten, near Stockholm, Sweden, assignor to See Fabriks Aktiebolag, Sandviken, Sweden, a corporation of Sweden

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5 Claims. (Cl. 80—14)

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The present invention relates to pilgrim rolling mills for the production of conical tubes, or tubes with conical portions, in a cold condition between roll segments provided with conical roll grooves, the said segments being mounted in a roll housing adapted to reciprocate in a stand, and being forcibly driven as the result of the reciprocating movement. In rolling mills of this kind the rolling process can be altered in such a way that the amount of conical taper on the tubes may be determined by adjusting the length of stroke of the roll housing.

According to the present invention which has for its object and arrangement for such rolling mills, the length of stroke is maintained constant, however, whilst on the other hand, the position of the roll segments is changed, whereby regulation is simplified in certain cases. The characteristic feature of the invention consists primarily in the fact that the members for the forcible driving of the roll segments are adjustably supported in the roll stand and are adapted to be adjusted by a control mechanism similarly supported in the stand and actuated by the roll housing through the reciprocating movement of the latter so that the angular location of the roll segments in the starting position is automatically changed thereby and the rolling process is controlled automatically by this means.

The invention will be more closely described with reference to the accompanying drawings which by way of example show one embodiment of the invention.

Fig. 1 is a side elevational view of a rolling mill for making conical tubes according to the invention.

Fig. 2 is a sectional view substantially along the line 2—2 in Fig. 1 and seen in the direction of the arrows, the tubular work piece being omitted.

Fig. 3 is an end view of the rolling mill of Fig. 1 seen from the right, the tubular work piece being omitted.

Fig. 4 is a partly elevational and partly sectional view substantially along the line 4—4 in Fig. 2 and seen in the direction of the arrows.

The rolling mill stand 1 supports a roll housing or carriage 2, which is adapted to be moved to and fro therein on rollers 3 along guide rails 4. Reciprocating movement is imparted to the carriage 2 by a crank disk 5 driven from a suitable power source (not shown) and connecting rods 6. In the carriage two horizontal roll journals 36 are mounted one above the other which are provided with detachable roll segments or dies

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7 in which tapering (conical) and eccentric working grooves 8 are formed. The ends of the two journals 36 extend on either side of the carriage and are provided with gears 9 meshing in pairs to secure coordination of the action of journals 36. On the ends of the lower journal 36 there is also mounted gears 35 which mesh with horizontal gear racks 10 supported in the stand 1. By this means the journals 36 are caused to rock in time with the reciprocation of the carriage 2.

The rear end of the tubular work piece or stock 30 is clamped in a chuck 31 slidably supported on a bed 32. The chuck 31 together with the stock 30 is intermittently fed forward a short, predetermined distance for each stroke of the carriage 2 by conventional means such as a screw spindle 33 actuated through suitable gearings accommodated in the housing 34. Operative connections (not shown) between said gearings and the reciprocating carriage 2 or its driving means are provided to ensure feeding when the carriage 2 is in its rear (left hand) position where the rolls have been turned so that the tube portion between them lies freely movable in the clearance grooves 37 which are made in the peripherical portions of the journals 36 that are opposite to the working grooves 8.

The structure hitherto described comprises the usual principal elements of a conventional pilgrim rolling mill which in operation will produce a reduced cylindrical tube from a tubular stock. Such operation is well known in the art and it is therefore deemed unnecessary to give an explanation thereof here.

To obtain the object of the present invention, a pilgrim rolling mill that will produce conical tubes or tubes with conical portion, the following changes and additions are made in the conventional device according to the embodiment of the invention shown in the drawings. The gear racks 10 which in the conventional device are fixed in the stand 1 are instead, according to the invention, slidably supported in the stand for movement in a longitudinal direction. As shown in Figs. 2 and 3 each rack 10 may have a lateral dovetail projection which engages a correspondly shaped guide groove in the adjacent side wall of the stand. The racks 10 are moved in either direction depending on the direction of rotation of two gears 11 which each is in mesh with its individual rack 10 and which are journaled on shafts 12 supported in the stand 1. The gears 11 are synchronously driven by means of two vertically movable rack members 13 engaging the same and extending upwards from a common

transverse member 14. The said transverse member is carried by a screw-threaded spindle 15 which is screwed into a bearing sleeve or nut 16 rotatably mounted in the stand base plate but held against axial movement therein. The lower end of the bearing sleeve or nut 16 is provided with or formed into a bevel gear 17 which is in mesh with another bevel gear 18 fixed on a horizontal shaft 19 mounted in the stand 1. Assuming the screw spindle 15 being left hand threaded, counterclockwise rotation of the shaft 19 and gear 18 as seen in Fig. 4 will thus cause upward movement of the rack members 13 which in its turn causes clockwise rotation of the gears 11 displacement of the racks 10 to the right and clockwise rotation of the lower journal 36 and counter-clockwise rotation of the upper journal 36, and obviously reverse rotation of the shaft 19 will result in reverse movements of all the members just mentioned. To effect rotation of the shaft 19 in timed relation to the reciprocation of the roll carriage 2 it is associated with two ratchet gears, one for each direction, which are actuated by the carriage. When as assumed the screw spindle 15 is left handed the ratchet gear for counter-clockwise rotation comprises a ratchet wheel 20 fixed to shaft 19 and having its teeth directed in a clockwise direction and a co-operating pawl 21 pivotally mounted on an arm 22 pivoted on the shaft 19. Similarly the ratchet gear for clockwise rotation comprises a ratchet wheel 20*a* fixed to the shaft 19 and having its teeth directed in a counter-clockwise direction and a co-operating pawl 21*a* pivotally mounted on an arm 22*a* pivoted on the shaft 19. Only one pawl 21 or 21*a* is made operative at a time by manual setting. To actuate the ratchet gears a lever 24 is provided which is pivotally mounted on a horizontal pin 25 carried by the stand 1 and which has its lower arm connected to the arms 22 and 22*a* by means of links 23 and 23*a* respectively. The other arm of the lever 24 extends upwards and is bent inwardly over the stand 1 to enter into the path of movement of a member on the carriage 2 near the end of its backward strokes. Said member comprises a lug 28 fixed to the top of the carriage and adjustably supporting a screw 27 which is adapted to co-operate with a stop 26 formed at the free end of the upper arm of the lever 24, to swing the lever in a counter-clockwise direction. The lever 24 is biased in a clockwise direction by means of a spring not shown in the drawings.

To produce a conical tube having decreasing cross section in the direction of feed, such as the portion shown in working position between the rolls in Figs. 1 and 4, the device operates as follows. Under this assumption and assuming as before the screw-spindle 15 being left hand threaded the pawl 21 should be in operative position in relation to its associated ratchet wheel 20 as will shortly be seen. Further it may be assumed that the crank disk 5 is driven counter-clockwise so that the figures show the roll carriage 2 in the middle of a backward stroke. During the continued rotation of the crank disk 5, well before the next quarter revolution is completed, the wide ends of the working grooves 8 in the dies 7 driven through the rolling of the gears 35 along the racks 10 (the upper one rotating counter-clockwise and the lower one clockwise) rolls off from the tube 30 thus leaving it freely movable in the clearance grooves 37 in the shafts 36. When the tube lies in the clearance grooves 37 but before the end of the backward stroke of the carriage 2 the adjustable screw 27 engages the stop 26 on the lever 24 and swings said lever counter-clockwise as it moves further to the left. At the end of the backward stroke the screw 27 has travelled to the position shown in dotted lines in Fig. 1 and the lever 24 is then in the position shown in full lines. The displacement of the lower arm of the lever 24 during its counter-clockwise movement is transmitted to the pawl carrying arm 22 through the intermediary of the link 23 and the latter arm 22 is thus also pivoted counter-clockwise, whereby the pawl 21 rotates the ratchet wheel 20 through a certain angle in the same direction. As described before, the counter-clockwise rotation of the ratchet wheel 20 will result in a corresponding rotation of the upper and lower die journals 36 in a counter-clockwise and clockwise direction respectively. This means that the wide ends of the working grooves 8 are moved farther away from the tube 30 than would be the case had the coersionary drive through the rolling of the gears 35 along the racks 10 due to the travel of the carriage 2 acted alone, or expressed in another way that the angles between the radii through the wide ends of the working grooves 8 and the line interconnecting the rocking centers of the dies 7 are increased in relation to the value they had at the start of the preceding forward stroke. The angular position of such radii at the end of the backward stroke of the carriage 2 constitutes the starting positions of the dies 7 for the next succeeding forward stroke of the carriage which commences as the crank disk 5 passes its left hand dead centre. At the end of the backward stroke the tube 30 is also fed forward an incremental length in the usual manner. The effect of this change in the forward stroke starting positions of the dies 7 is that during this forward stroke the dies have to move idly through a greater angle than during the preceding forward stroke before the working grooves 8 come into working engagement with the tube 30 and as the length of the stroke is unchanged the result is that at the end of this stroke the working section formed by the grooves 8 is slightly greater than that at the end of the preceding forward stroke and consequently the tube section last worked upon is correspondingly increased. During the first part of the forward stroke the lever 24 was swung clockwise by the action of its biasing spring and as the carriage 2 continues to reciprocate the described cycle of operation is repeated so that the result is a tube with steadily increasing cross section, the rate of increase differing from the taper of the working grooves 8. The device for changing the starting position of the dies 7 is arranged only to turn the dies 7 for each stroke an angle that is small as compared with the total angle the dies are rocked per stroke. The amount of change and thereby the taper of the tube produced may be regulated by adjusting the adjustable screw 27.

To produce a tube having an increasing cross section in the direction of feed, such as the tube portion shown to the right in Figs. 1 and 4, the ratchet gear 20*a*, 21*a*, 22*a* is put in action instead of the ratchet gear 20, 21, 22, whereby the device for changing the starting positions of the dies will operate in the direction opposite to that described above, as will be clear. The machine according to the invention is thus capable of producing a continuous tube having portions with increasing cross-sections in opposite directions.

Finally, it should be noted that the form of

construction described can be varied in many ways within the scope of the invention, and that the latter is not limited to cover only those members for the transmission of movement which, in accordance with the foregoing description, effect the adjustment of the roll segments, but any other suitable members for transmitting movement whatsoever which adjust the roll segments in the manner described above may be employed for this purpose.

I claim:

1. In a pilgrim rolling mill having a stand, a housing reciprocating therein, a pair of rolls rotatably mounted in said housing and having working grooves engaging the workpiece from opposite sides, means for feeding the workpiece before the start of each forward stroke of the reciprocating housing, gears rigidly connected to the rolls coaxially therewith and meshing with each other, racks mounted longitudinally in the stand and means connecting one of the rolls with said racks so that the rolls are forced to roll along the workpiece upon the reciprocating movement of the housing, said racks being adjustable longitudinally so as to give the rolls different angular positions at the start of each forward stroke and means for actuating said racks, said means being operated by the housing to cause an automatic adjustment of the racks at the return of the housing to its rear position.

2. In a pilgrim rolling mill having a stand, a housing reciprocating therein, a pair of rolls rotatably mounted in said housing and having working grooves engaging the workpiece from opposite sides, means for feeding the workpiece before the start of each forward stroke of the reciprocating housing, gears rigidly connected to the rolls coaxially therewith and meshing with each other, racks mounted longitudinally in the stand and means connecting one of the rolls with said racks so that the rolls are forced to roll along the workpiece upon the reciprocating movement of the housing, said gear racks being adjustable longitudinally so as to give the rolls different angular positions at the start of each forward stroke, and means for actuating said racks, said means being operated by the housing to cause an automatic adjustment of the racks

at the return of the housing to its rear position, said rack actuating means comprising a reversible driving mechanism connected with the racks for changing the direction of movement and thereby the adjustment thereof.

3. Pilgrim rolling mill as set forth in claim 2 in which said reversible driving mechanism consists of two ratchet gears operated by the housing.

4. Pilgrim rolling mill as set forth in claim 2 in which said reversible driving mechanism consists of two ratchet gears and in which a lever is pivotally mounted in the stand, one arm of said lever being actuated by the housing and the other arm actuating the two ratchet gears.

5. In a pilgrim rolling mill having a stand, a housing reciprocating therein, a pair of rolls rotatably mounted in said housing and having working grooves engaging the workpiece from opposite sides, means for feeding the workpiece before the start of each forward stroke of the reciprocating housing, gears rigidly connected to the rolls coaxially therewith and meshing with each other, racks mounted longitudinally in the stand and means connecting one of the rolls with said racks so that the rolls are forced to roll along the workpiece upon the reciprocating movement of the housing, said racks being adjustable longitudinally so as to give the rolls different angular positions at the start of each forward stroke, and means for actuating said racks, said means being operated by the housing to cause an automatic adjustment of the racks at the return of the housing to its rear position, said rack actuating means comprising gear wheels meshing with the racks and a driving mechanism actuating said gear wheels, said driving mechanism being reversible for changing the direction of movement and thereby the adjustment of the racks.

GUSTAF HJALMAR LARSSON.

REFERENCES CITED

The following references are of record in the file of this patent:

FOREIGN PATENTS

Number	Country	Date
521,611	Germany	Mar. 12, 1931