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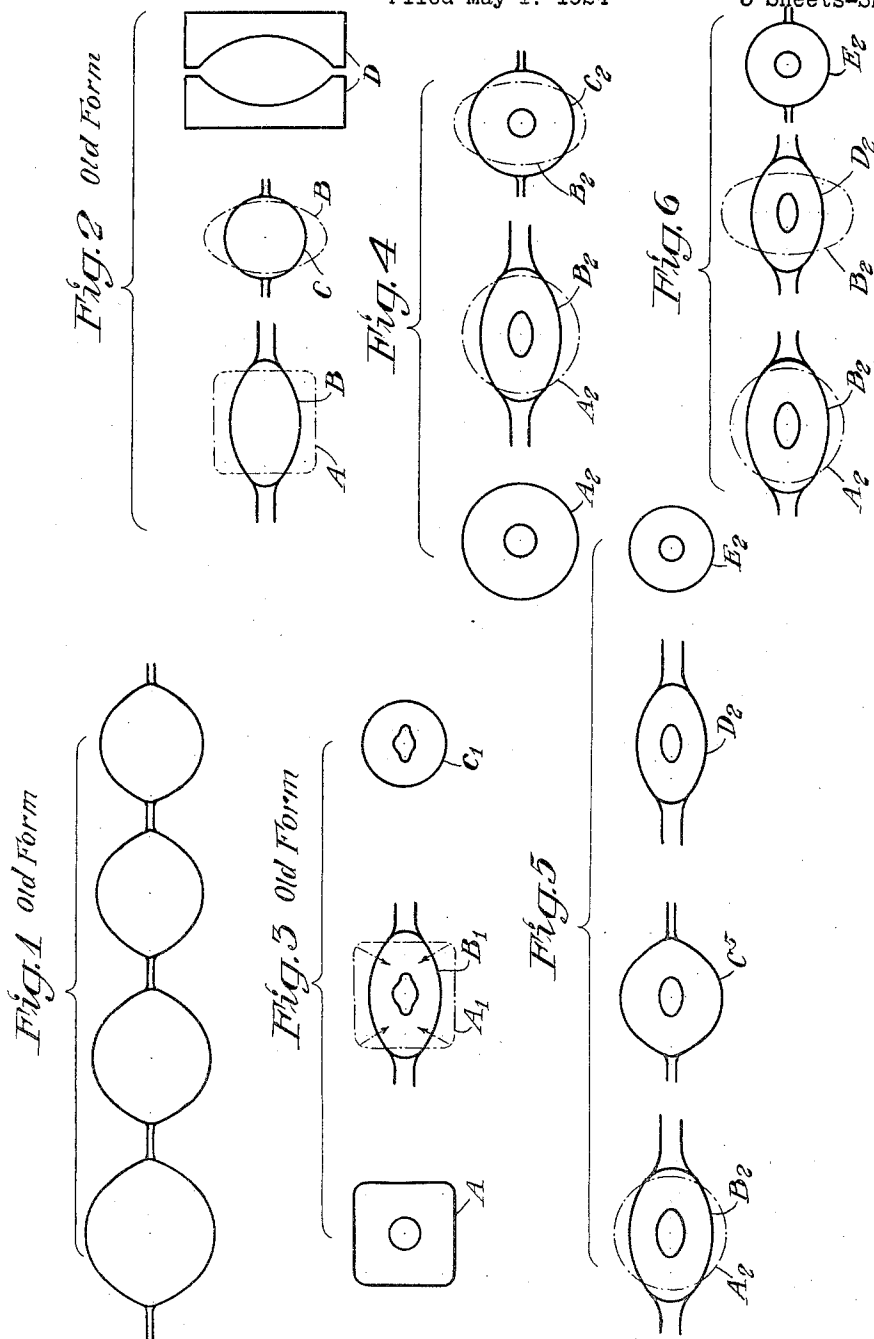
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METHOD OF ROLLING DOWN HOLLOW BODIES

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3 Sheets-Sheet 1



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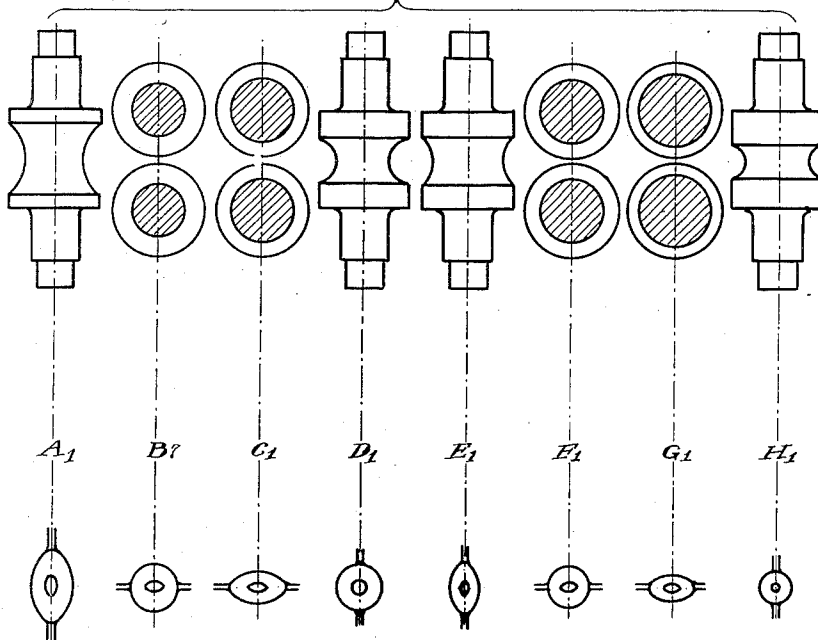
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Fig. 7



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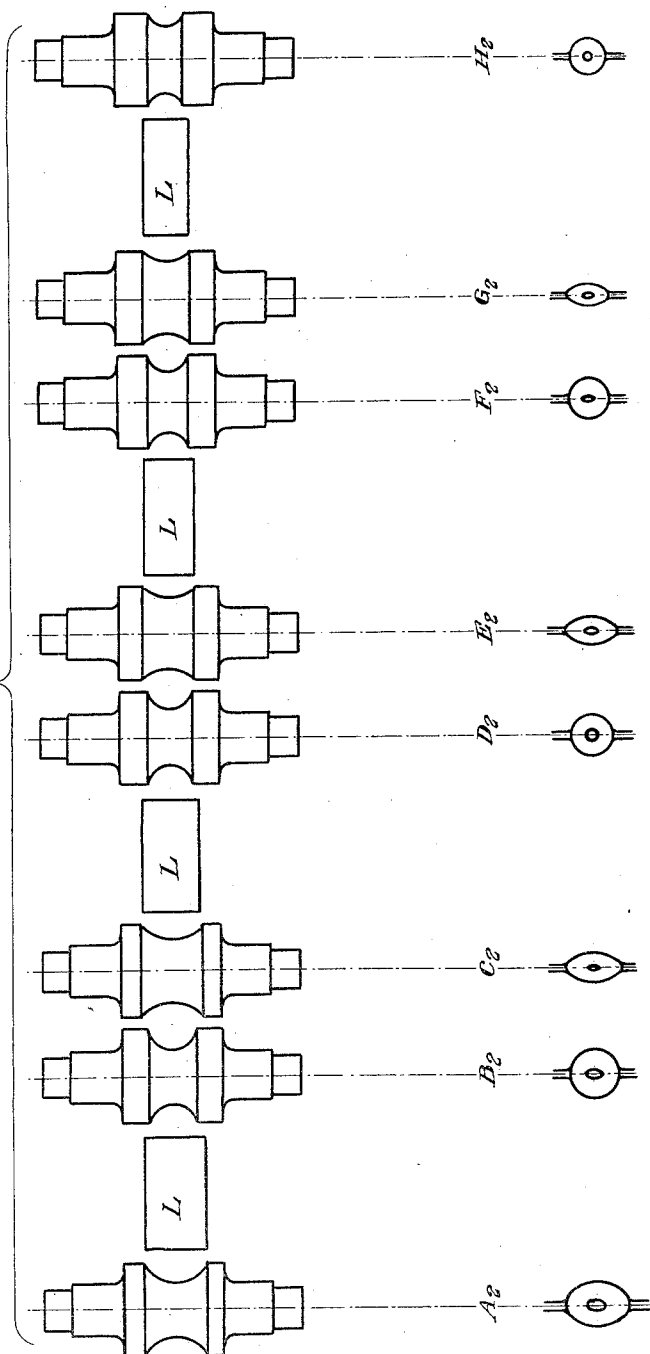
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Fig. 8



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UNITED STATES PATENT OFFICE.

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METHOD OF ROLLING DOWN HOLLOW BODIES.

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This invention relates to the rolling of hollow billets chiefly for obtaining hollow drill steel.

In the manufacturing of hollow drill steel the difficulty hitherto met mainly consists in attaining a circular cross section of the hollow or channel after the width of the billet has been reduced through rolling. Owing to new types of rock-drilling-machines the demands on the uniformity and roundness of the channel have risen to such a height, that it is only with the greatest difficulty that they may be satisfied through the method hitherto used. The usual method hitherto used in rolling down hollow billets generally consists in a round hollow billet being rolled down "manually" i. e. by means of round, somewhat flattened or slightly oval roll grooves, so that, while the billet passes from groove to groove, the longitudinal axis of the oval section always coincides with the shorter axis of the subsequent groove, the billet being held upright manually by means of tongs and thus prevented from turning. During the said operation the reductions must be slight, because, otherwise, the billet can not be kept in upright position during the rolling operation. If the billet would turn it would gain a more flattened shape and its tendency to turn in the subsequent groove would be still more obvious. Moreover, the channel becomes oval to such a degree, that it would then be impossible to impart to the same a circular shape.

The invention will be described in connection with the accompanying drawings in which:

Figure 1 is a diagrammatic view of a series of grooves of the old type.

Figures 2 and 3 are similar views to illustrate advantages and disadvantages in the known type.

Figure 4 is a diagrammatic view illustrating the rolling for manufacturing a body with round section, in accordance with the present invention.

Figure 5 is a similar view illustrating the means for rolling the body to produce an oval section.

Fig. 6 is a view similar to Fig. 5 with the exception that all of the grooves are of oval shape with the exception of the last groove of the series.

Fig. 7 illustrates a construction in which the series of grooves are arranged in groups in a so-called continuous rolling mill.

Fig. 8 illustrates a further arrangement in which all pairs of rolls are located horizontally.

In Fig. 1 of the accompanying drawings a known series of grooves of the said type is shown. The success of the rolling operation in the stated manner is entirely dependent on the skilfulness of the operators and besides the method requires a comparatively great staff. Moreover, the length of the ready article is very much limited, 5 to 6 meters generally being the maximum. For that reason one has proceeded in a different way for the rolling of ordinary solid round, hexagonal, octagonal, etc. billets and used the so-called oval rolling. The said method is illustrated in Fig. 2 for a circular end section. The rolling operation is started from a billet A, the cross section of which is square and which has been produced in any ordinary manner. The said billet is brought to the oval shape B by rolling in the manner shown by the said figure the reduction being thereby very great. The oval cross section of the billet is then brought into an upright position and is introduced into a guide D located close to the groove C and in front of the same, the said guide exactly enclosing the oval billet. The oval billet passes from the guide D into the circular groove C, in which it is brought to a circular sectional shape. Also in this stage of the rolling operation the reduction of the sectional area of the billet is great. The said guide D keeps the oval billet in upright position, i. e. prevents the same from turning, to which its tendency is very great. The method evidently, is entirely mechanical and requires no great skill of the operators during the proceeding of the operation, which permits rolling of articles of practically any length and having circular, hexagonal, octagonal or any similar cross sectional shape.

The method illustrated in Fig. 2 and applied to the rolling of hollow drill steel would, evidently, involve great advantages. However, there are some drawbacks, as will be perceived from Fig. 3. The section designated by A¹ may easily be attained. In the oval groove B¹ the square billet is subjected to the greatest pressure at its corners and in the directions indicated by the arrows. The amount of the pressure decreases toward the centre of the groove. This fact is perceived from the shape of the channel. The forcing of the corners in-

wards results in an angular shape of the channel. Besides, the ovality of the channel is not proportional to that of the section, the length of the short axis of the channel in relation to the longitudinal axis of the same being greater than is the case in the outer contour of the section. For that reason, as the section in the subsequent groove C^1 is converted into the circular shape, the channel will still have an angular shape instead of the desired circular cross section.

The present invention renders possible the removing of the said drawback. The invention chiefly consists in the rolling operation being started from a hollow billet, the section of which is circular or polygonal and attained in any manner, and which is rolled down without the use of a hard unchangeable mandrel, and in such manner that the billet first is converted into an oval or polygonal, oval-like shape and then into a circular or substantially circular or polygonal section by rolling the billet with the longitudinal axis of the oval or the polygonal section serving as the axis of pressure, the operation being then repeated a suitable number of times.

Fig. 4 shows the course of the rolling for manufacturing a body with round section. The starting section of the billet is a round section A^2 which has been obtained in any suitable manner. This billet is rolled down in the groove B^2 so as to form an oval section, the pressure being then greatest along the shortest axis of the oval groove and decreases proportionately at both sides. By this means the ovality of the channel and that of the outer contour of the section must be fully uniform. By bringing the oval section in upright position and by means of a guide (such as D in Fig. 2) introduce the same into a round groove C^2 it will thus generally be possible to obtain a round section and a circular channel. In the same manner the rolling may be continued down to any desired degree.

It has been found that in certain cases the reducing of the channel does not fully follow the reducing of the outer contour of the billet, so that in the round groove an exactly circular channel is not always obtained. This drawback may, however, be fully eliminated by this means that the round section obtained in the groove C^5 is once more introduced into an oval groove D^2 (Fig. 5) in such a manner that the sides of the billet which have been exposed to the greatest pressure C^5 will also receive the greatest pressure in D^2 , i. e. the section must not be turned, or, if the same be turned the turning must be 180° . The defect in the shape of the channel which may occur in B^2 or C^5 is then eliminated in D^2 or E^2 so that a section with a perfectly circular channel is obtained. In order to secure that the section

obtained in C^5 will in travelling through D^2 maintain the same pressure side as in C^5 the section may in C^5 be rolled down a little more than to round shape so as to get a slightly elliptical form. Thereby the billet with this section will travel in just the desired manner through D^2 . This groove system is shown in Fig. 5 and thus alternately consists of pairs of oval grooves and pairs of round or nearly round grooves.

The same result is obtained if the round grooves are omitted and the series consists only of oval shaped grooves with the exception of the last groove (Fig. 6).

The same method is applied in case of 6-edged, 8-edged or other polygonal sections.

The series of grooves shown in Fig. 5 may advantageously be located in a so called continuous rolling mill with several pairs of rolls arranged according to Fig. 7 the series of grooves being thus located by groups in the rolling mill. In the horizontal pair of rolls A^1 a hollow billet of round cross section is rolled down to oval section. The oval shaped billet thus obtained passes through a guide (not shown) into the vertical pair of rolls B^1 , where the same attains a round or similar section and then into the vertical pair of rolls C^1 , where it attains an oval section, the same pressure side being maintained here as in the foregoing pair of rolls. From there the billet passes into the horizontal pair of rolls D^1 , where it attains a round section. In passing through this pair of rolls the billet thus obtains a circular channel according to the above explanations. The rolling may thereafter be continued in a similar group of rolls E^1 , F^1 , G^1 , H^1 , and so on.

Another arrangement is shown in Fig. 8 where all pairs of rolls are located horizontally so that the billet after having travelled through the pair of rolls A^2 and there received an oval section is through a screw shaped guide L (schematically shown) turned through an angle of 90° so that the shortest axis of the oval will be paralld with the axis of the following horizontal pair of rolls B^2 . On travelling through this pair of rolls the billet attains a round or similar section and is then passed over to the following horizontal pair of rolls C^2 without being turned and is there rolled down so as to attain an oval section.

This method of using series of grooves arranged by groups in a continuous rolling mill offers several practical advantages for instance these that the pressure side is secured and that it will be easy to drive the rolls.

I claim:

1. The method of rolling hollow billets without a hard mandrel for producing hollow bodies with circular channel consisting in first rolling down said billet to a substan-

tially oval shape, then rolling down said oval shaped billet with the longer axis of the oval as the pressure axis to a substantially round shape, then rolling down the billet, 5 maintaining the same pressure axis as in the foregoing pass to produce an oval shape thereby augmenting the ovality of the hole, and then rolling down the billet with the longer axis as the pressure axis to produce 10 a round shape.

2. The method set forth in claim 1, con-

sisting in the further step that after the billet has received the oval section attained by the first step the said billet is rolled down to attain a slightly oval shape in order to 15 maintain the same pressure axis in the next groove, said procedure being repeated each time the billet has passed through an oval groove with the exception of the final groove.

In testimony whereof I have hereunto af- 20 fixed my signature.

GUSTAF ABRAHAM LINDGREN.