Feb. 1, 1938. F. A. BEST 2,106,866

METALWORKING MACHINE

Filed Oct. 15, 1934 2 Sheets-Sheet 1

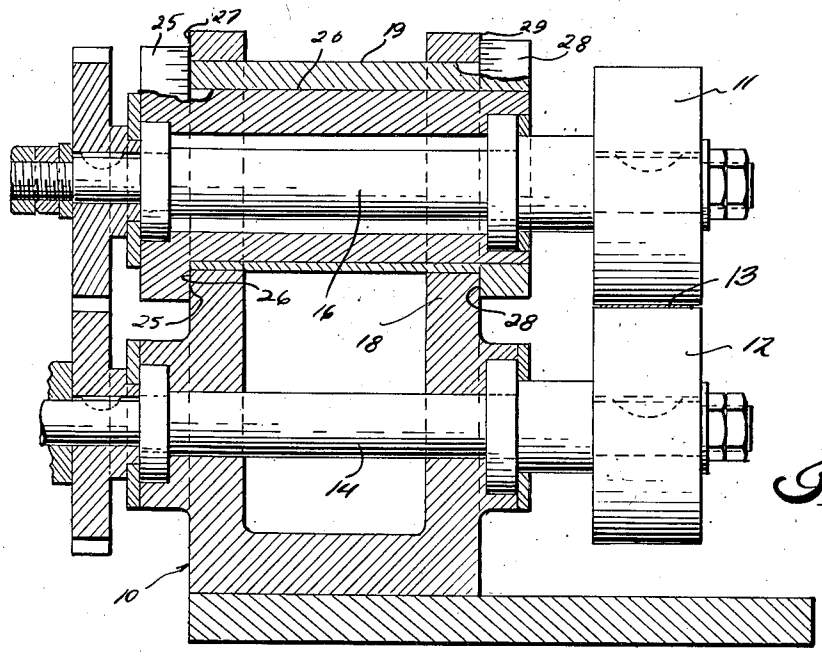


Fig. 3.

Fig. 1.

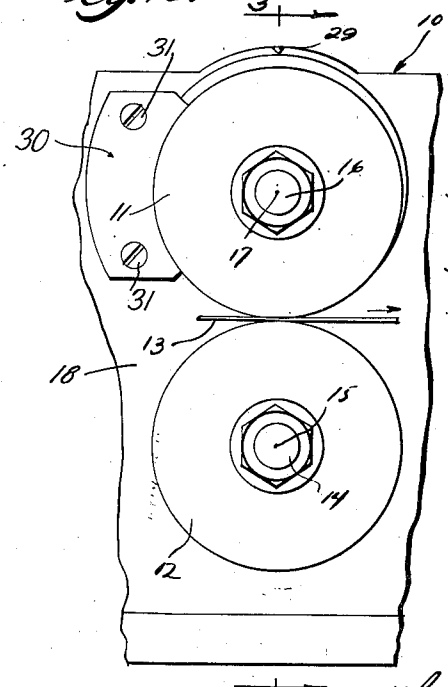
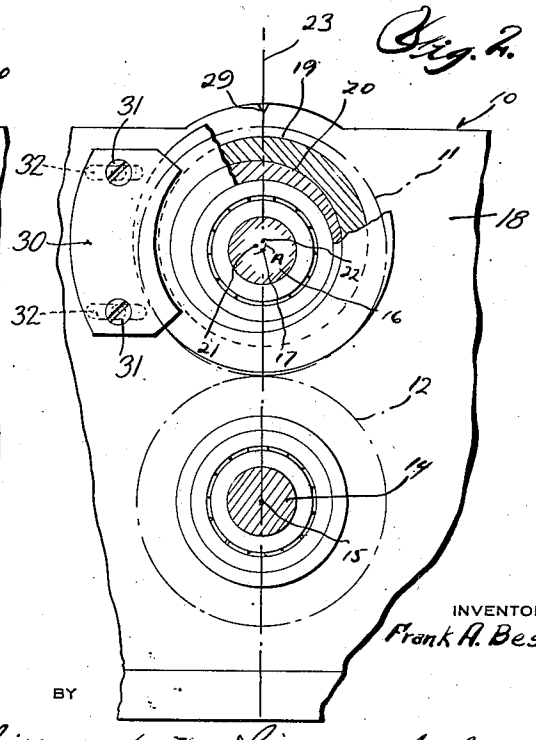


Fig. 2.



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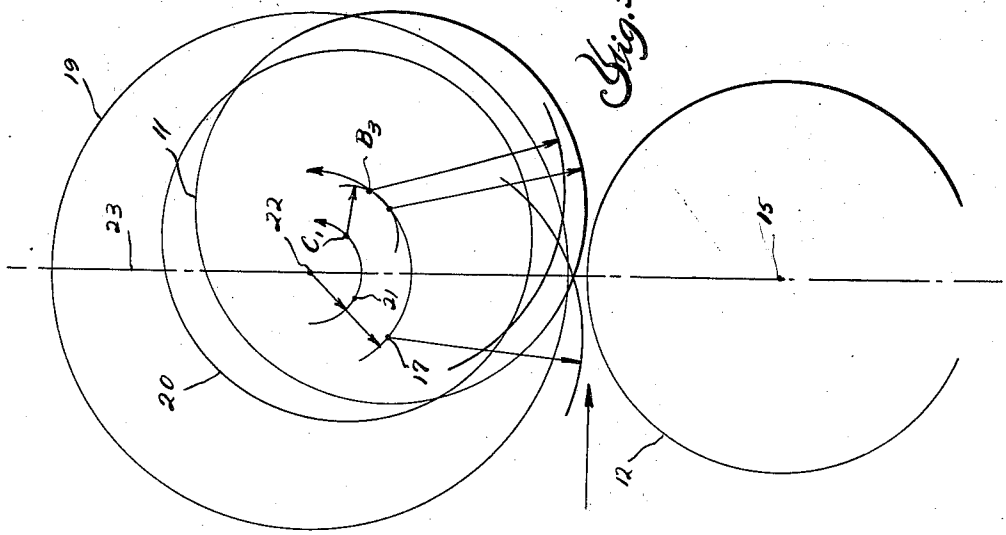
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Fig. 5.



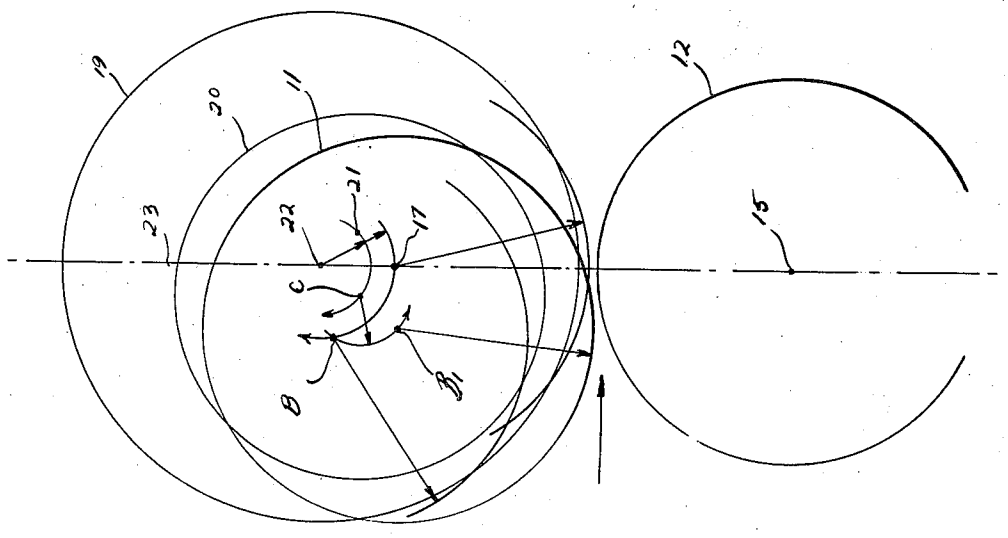


Fig. 4.

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METALWORKING MACHINE

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15 Claims. (Cl. 153—54)

This invention relates generally to forming apparatus and refers more particularly to improvements in apparatus of the character embodying forming rolls.

One of the principal objects of this invention resides in the provision of a rolling machine having opposed forming rolls and having means for adjusting the axis of one of the rolls in opposite directions to different positions around the axis of the other roll. This feature is of particular importance when it is desired to produce a straight strip of formed material from stock inherently having the tendency to curl in one direction or the other, since it permits counteracting this tendency by merely adjusting the axis of one of the rolls to one side or the other of the axis of the cooperating forming roll depending upon the direction the stock tends to curl. Although the foregoing feature finds particular utility when employed for the purpose specified above, nevertheless, it may also be used to advantage for actually forming curvatures in the stock during the rolling operation.

Another object of this invention resides in the provision of forming apparatus having means cooperating with the means set forth in the preceding paragraph for varying the clearance between the peripheries of the rolls to accommodate stock of different gage.

Still another advantageous feature of this invention resides in the provision of forming apparatus wherein the shaft for the adjustable roll is journaled in an inner eccentric rotatably mounted within an outer eccentric having a fixed axis of rotation. With this arrangement the space between the peripheries of the rolls may be varied without displacing the axis of the adjustable roll with reference to the axis of the cooperating forming roll by merely rocking the eccentrics predetermined distances in opposite directions depending upon the relative throws of the eccentrics. Moreover, the foregoing construction offers the possibility of displacing the axis of the adjustable roll in advance of, or in rear of a line perpendicular to the axis of the cooperating roll to bend the stock in one direction or the other by moving one eccentric relative to the other.

A further feature of this invention consists in the provision of forming apparatus of the type previously set forth having means for indicating the several adjustments of the eccentrics so that these settings may be recorded and duplicated whenever the occasion arises.

The foregoing, as well as other objects, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a fragmentary side elevational view of a rolling machine equipped with forming rolls mounted in accordance with this invention;

Figure 2 is a view similar to Figure 1, having certain parts broken away in order to show the eccentrics for adjusting the upper roll;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 1; and

Figures 4 and 5 are diagrammatic views illustrating different possible adjustments of the upper roll relative to the lower roll.

Referring now more in detail to the drawings, it will be noted that I have shown in Figure 1, a portion of a rolling machine 10 having an upper roll 11 and having a lower roll 12 cooperating with the upper roll to form a space between the peripheries of the rolls of sufficient dimension to accommodate a strip of stock 13. As will be more fully hereinafter set forth, the space between the peripheries of the two rolls may be varied to accommodate different gage stock by actually displacing the axis of the upper roll 11 toward or away from the axis of the roll 12.

In detail, the lower roll 12 is fixedly secured to a drive shaft 14 having a fixed axis of rotation 15 and the upper roll 11 is fixed to a shaft 16 operatively connected in any suitable manner to the drive shaft 14 for rotation thereby. The axis 17 of the shaft 16 is normally arranged in a common vertical plane with the axis 15 of the shaft 14, but the mounting for the shaft 16 is such as to permit movement of the axis 17 toward or away from the axis 15 and to one side or the other of the common vertical plane previously set forth. As shown in Figure 2, the shaft 16 is journaled in the frame 18 of the rolling machine through the medium of a pair of eccentrics 19 and 20. The inner eccentric 20 forms a bearing for the shaft 16 and is journaled within the outer eccentric 19 for rotation about its center 21 shown in Figure 2 as spaced a predetermined distance from the axis 17 of the shaft 16. The outer eccentric 19, on the other hand, is journaled in the frame 18 for rotation about its center 22 spaced the same distance from the center 21 of the inner eccentric 20 as the latter center is spaced from the axis 17 of the shaft 16. Thus it will be seen that both of the eccentrics have the same throw and are capable of rotation relative to each other and to the shaft 16. It will also be apparent that rocking the inner eccentric 20 relative to the outer eccentric moves the axis 17

of the shaft 16 about the center 21 of the inner eccentric and rocking the outer eccentric relative to the inner eccentric effects a movement of the axis 17 of the shaft 16 about the center 22 of the outer eccentric.

Assuming that the eccentrics are in the relative positions shown in Figure 2, wherein the periphery of the roll 11 contacts with the periphery of the roll 12 and that it is desired to provide a clearance between the peripheries of the rolls, the inner eccentric 20 is moved in a counter-clockwise direction causing the axis 17 of the shaft 16 to move upwardly about the center 21 of the inner eccentric and thereby carry the roll 11 in a direction away from the roll 12. For the purpose of illustration, it will be assumed that the inner eccentric has been adjusted to the extent required to locate the axis 17 at the point designated in Figure 2 by the character A. Thus it will be noted that in moving the axis 17 of the shaft 16 upwardly in the manner specified above, this axis is also carried to the right of the common vertical plane 23 passing through the axis 15 of the lower roll, and in order to return the axis 17 to a position in this plane and at the same time maintain a clearance between the peripheries of the rolls, the outer eccentric 19 is rocked in a clockwise direction causing the point A, representing the axis 17, to move toward the plane 23 about the center 22 of the outer eccentric. Inasmuch as the center 22 is located in the vertical plane 23 in spaced relation to the center 21 and in view of the fact that the axis of the shaft 16 rocks about the center 22 upon rotating the outer eccentric, it necessarily follows that the axis 17 will return to the plane 23 at a point spaced above the position it occupied before executing the adjustment.

The two eccentrics are provided with calibrations identified by suitable indicia so that the foregoing as well as other adjustments may be exactly duplicated whenever desired. In detail, the inner eccentric 20 is provided with a radially extending flange 25 at one end abutting a portion of the machine frame designated by the reference character 26 and having a number of identified calibrations thereon registrable with a point of indication 27 permanently fixed on the machine frame. The outer eccentric 19 is provided at the opposite extremity with a similar flange 28 also having identified calibrations thereon registrable with a point of indication 29 permanently fixed on the machine frame in the same manner as the point of indication 27.

As previously stated, the eccentrics may also be adjusted to provide a rolled strip of stock curved in either of two directions, or to counteract any tendency for the stock to curl downwardly or upwardly and thereby secure a substantially straight strip of rolled stock. In the event it is desired to actually curl the stock upwardly or to counteract any tendency for the stock to curl downwardly, the axis 17 of the upper roll shaft 16 is moved to the left of the vertical plane 23 as viewed in Figure 4. This is accomplished by moving the outer eccentric 19 in a clockwise direction the extent necessary to locate the axis 17 to the left of the plane 23, and for the purpose of illustration it will be assumed that the axis 17 has been moved by the outer eccentric to the point indicated by the reference character B on Figure 4. Thus it will be apparent that in shifting the axis 17 to the point B, this axis is actually raised and the clearance between the peripheries of the rolls is increased. It will also be observed that shifting the axis 17 to the point B by rocking the outer eccentric 19 in the manner specified above, also changes the position of the center 21 of the inner eccentric to the point C indicated in Figure 4 of the drawings. If it is desired to secure the same clearance between the peripheries of the rolls in the position B of the axis 17 as previously obtained before this axis was actually adjusted to the position B, the inner eccentric 20 is moved in a counter-clockwise direction to lower the axis 17 from the position B to the position B_1. Inasmuch as the axis 17 may be moved to any one of a number of positions about the center C, it necessarily follows that various clearances may be provided between the peripheries of the rolls.

Assuming now that it is desired to move the axis 17 to a position on the opposite side of the plane 23, the outer eccentric 19 is rotated about its center 22 in a counter-clockwise direction to the position thereof shown in Figure 5, wherein the resulting position of the center 21 of the inner eccentric is indicated by the character C_1, and the position of the axis 17 is indicated by the character B_3. The inner eccentric 20 may then be rocked in either a clockwise or counter-clockwise direction to lower or raise the axis 17 depending upon the clearance it is desired between the peripheries of the rolls. The extent of relative movement of the eccentrics necessary to locate the axis 17 in either of the previously described positions may be recorded from the calibrations on the eccentrics and duplicated whenever desired.

The eccentrics are held in their adjusted positions by means of clamps 30 suitably secured to the machine frame 18. In detail, the clamp at the front of the machine engages the flange on the outer eccentric and is secured to the adjacent portion of the frame 18 of the machine by means of clamping devices 31 extending through elongated slots 32 in the machine frame 18. The character of the slots is such as to permit the required lateral displacement of the clamp when the outermost eccentric is adjusted. The clamp at the rear of the machine is secured to the machine frame in the same manner as the clamp previously described and engages the flange on the inner eccentric to prevent accidental rotation of the latter.

Although in the previous description only several specific adjustments of the upper forming roll 11 have been described in detail, it will be apparent that by relatively moving the eccentrics, any one of a great many adjustments of the axis of the upper roller shaft 16 may be secured. It should also be understood that the lower roll may also be carried by eccentrics similar to those employed in mounting the upper roll without departing from the scope of this invention.

What I claim as my invention is:

1. In a rolling machine, a pair of opposed forming rolls having parallel axes arranged in a common plane, means for adjusting the axis of one of the rolls to alternatively position the same on opposite sides of the original plane passing through the axes of the rolls to bend the stock in one direction or another, means cooperating with the means aforesaid to vary the distance between the peripheries of the rolls irrespective of the relative positions of the axes of the rolls with respect to said plane, and means for indicating the relatively adjusted positions

of the aforesaid means permitting these positions to be recorded and duplicated when desired.

2. In a rolling machine, a pair of opposed forming rolls having parallel axes arranged in a common plane, said rolls having the peripheral surfaces thereof spaced a predetermined distance from each other, means for selectively shifting the axis of one roll to opposite sides of the normal plane of the axes while maintaining the predetermined distance aforesaid between the peripheral surfaces, said means also operable to shift the roll aforesaid to vary the space between the peripheral surfaces of the rolls.

3. In a rolling machine, a pair of opposed forming rolls having the peripheral surfaces thereof spaced a predetermined distance from each other, means consisting of interfitting eccentrics for selectively shifting the axis of one roll to opposite sides of the normal plane of the axes of the rolls while maintaining the predetermined distance aforesaid between the peripheral surfaces, said means also operable to shift the roll aforesaid to vary the space between the peripheral surfaces of the rolls.

4. In a rolling machine, a pair of opposed revoluble forming rolls having parallel axes arranged in a common plane, and a supporting bearing for one of the rolls comprising interfitting eccentrics relatively rotatable to selectively position the axis of the latter roll on opposite sides of the common plane aforesaid, and to vary the space between the peripheries of the rolls.

5. In a rolling machine, a pair of opposed work engaging rolls having parallel axes arranged in a common plane and having their peripheral surfaces spaced a predetermined distance from each other for the reception therebetween of the work, a drive shaft for one of said rolls having a fixed axis of rotation, a second shaft for the other roll operatively connected to the drive shaft for rotation thereby, and a mounting for the second shaft permitting movement of the axis thereof toward or away from as well as to one side or the other of the axis of the first shaft, said mounting including a frame and a pair of relatively rotatable eccentrics, one of said eccentrics being journaled within the second eccentric and forming a bearing for the second shaft, and the second eccentric being journaled in the frame aforesaid.

6. In a rolling machine, a frame, a pair of opposed work engaging rolls adjacent said frame having parallel axes arranged in a common plane and having their peripheral surfaces spaced a predetermined distance from each other for the reception therebetween of the work, a drive shaft for one of said rolls, a second shaft for the other roll operatively connected to the drive shaft for rotation thereby, and a mounting for the second shaft including relatively rotatable inner and outer eccentrics permitting movement of the axis of said second shaft toward or away from the axis of the first shaft as well as to one side or the other thereof, said outer eccentric being mounted directly in the frame, and the inner eccentric being mounted in said outer eccentric.

7. In a rolling machine, a frame, a pair of opposed work engaging rolls at one side of said frame having parallel axes arranged in a common plane and having their peripheral surfaces spaced a predetermined distance from each other for the reception therebetween of the work, a drive shaft for one of said rolls, a second shaft for the other roll operatively connected to the drive shaft for rotation thereby, and a mounting for the second shaft permitting movement of the axis thereof toward or away from the axis of the first shaft as well as to one side or the other thereof, said mounting including a pair of relatively rotatable eccentrics, one of said eccentrics being journaled within the second eccentric and forming a bearing for the second shaft, the second eccentric being journaled in the frame, and said eccentrics and frame having registrable calibrations for adjustment identification purposes.

8. In a rolling machine, a frame, a pair of opposed work engaging rolls at one side of said frame and having parallel axes arranged in a common plane and having their peripheral surfaces spaced a predetermined distance from each other for the reception of the work, a drive shaft for one of said rolls, a second shaft for the other roll operatively connected to the drive shaft for rotation thereby, a mounting for the second shaft permitting movement of the axis thereof toward or away from the axis of the first shaft as well as to one side or the other thereof, said mounting including a pair of relatively rotatable eccentrics, one of said eccentrics being journaled within the second eccentric and forming a bearing for the second shaft, the second eccentric being journaled in the frame, and adjustable clamping devices carried by said frame and engageable with the eccentrics to hold the latter in adjusted position.

9. In a rolling machine, a frame, a pair of opposed work engaging rolls adjacent said frame having parallel axes arranged in a common plane and having their peripheral surfaces spaced a predetermined distance from each other for the reception therebetween of the work, operatively connected shafts for said rolls, one of said shafts being journaled in said frame, and a mounting for the second shaft including interfitting rotary eccentrics, one of said eccentrics being journaled in said frame, and the second eccentric being journaled in the first eccentric and forming a bearing for the second shaft.

10. In a rolling machine, a frame, an eccentric journaled in said frame, a second eccentric journaled in the first eccentric, the throw of said eccentrics being substantially the same, a shaft journaled in the second eccentric, a second shaft journaled in said frame in substantially parallel relation to the first shaft and having a fixed axis, and opposed forming rolls carried by said shafts.

11. In a rolling machine, a frame, a pair of opposed forming rolls adjacent said frame, a shaft for one of said rolls journaled in said frame and having a fixed axis, and means for adjusting the axis of the second roll in opposite directions to different positions around the axis of the first roll, including an eccentric journaled in said frame, a second eccentric journaled in the first mentioned eccentric, and a shaft for the second roll journaled in the second eccentric.

12. In a rolling machine, a frame, a pair of opposed forming rolls adjacent said frame having the peripheral surfaces thereof spaced a predetermined distance from each other, one of said rolls being adjustable relative to the second roll, a shaft for the second roll journaled in said frame and having a fixed axis, and means for varying the space between the peripheries of said rolls without displacing the axis of the adjustable roll with reference to the axis of the second roll including an eccentric journaled in said

frame, a second eccentric journaled in the first eccentric, and a shaft for the first roll journaled in the second eccentric.

13. In a rolling machine, a frame, a pair of opposed forming rolls adjacent said frame having the peripheral surfaces thereof spaced a predetermined distance from each other, one of said rolls being adjustable relative to the second roll, a shaft for the second roll journaled in said frame and having a fixed axis, and means for varying the space between the peripheries of said rolls without displacing the axis of the adjustable roll with reference to the axis of the second roll including an eccentric journaled in said frame, a second eccentric journaled in the first eccentric, a shaft for the first roll journaled in the second eccentric, and means on the eccentrics and frame for indicating the adjustment of the first roll relative to the second.

14. In a rolling machine, a frame, a pair of opposed forming rolls adjacent said frame having the peripheral surfaces thereof spaced a predetermined distance from each other, one of said rolls being adjustable relative to the second roll, a shaft for the second roll journaled in said frame and having a fixed axis, and means for varying the space between the peripheries of said rolls without displacing the axis of the adjustable roll with reference to the axis of the second roll including an eccentric journaled in said frame, a second eccentric journaled in the first eccentric, a shaft for the first roll journaled in the second eccentric, means on the eccentrics and frame for indicating the adjustment of the first roll relative to the second, and means for holding said first roll in adjusted position relative to the second roll including adjustable means on the frame engageable with said eccentrics.

15. In a rolling machine, a frame, a pair of opposed forming rolls adjacent said frame having the prepiheral surfaces thereof spaced a predetermined distance from each other, one of said rolls being adjustable relative to the second roll, a shaft for the second roll journaled in said frame and having a fixed axis, and means for varying the space between the peripheries of said rolls without displacing the axis of the adjustable roll with reference to the axis of the second roll including an eccentric journaled in said frame, a second eccentric journaled in the first eccentric, a shaft for the first roll journaled in the second eccentric, and means for holding said first roll in adjusted position relative to the second roll including adjustable means on the frame engageable with said eccentrics.

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