

July 16, 1946.

W. H. WINEMAN

2,404,201

BIT SHARPENING MECHANISM

Filed Nov. 11, 1943

2 Sheets-Sheet 1

Fig. 2.

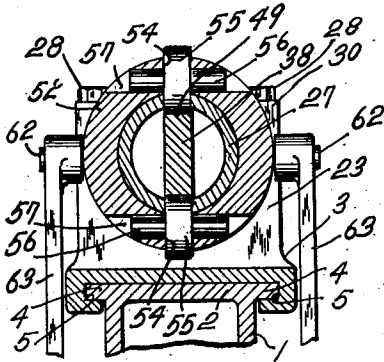


Fig. 1.

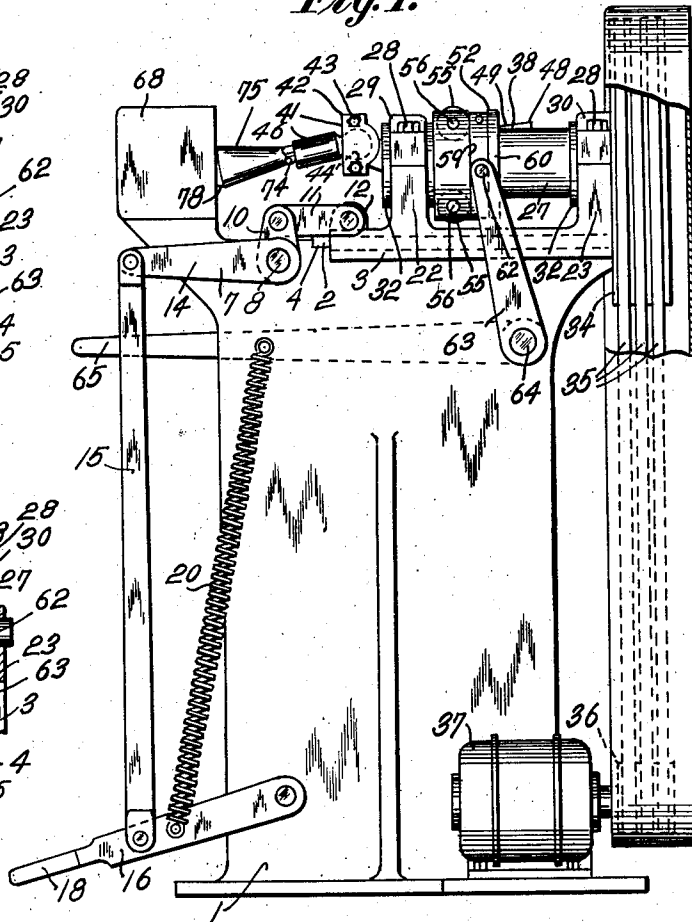


Fig. 3.

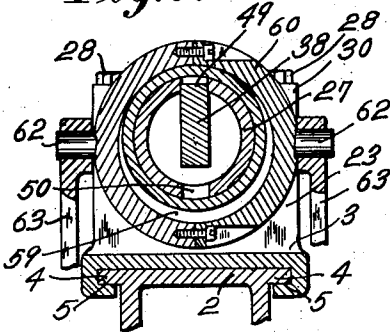


Fig. 4.

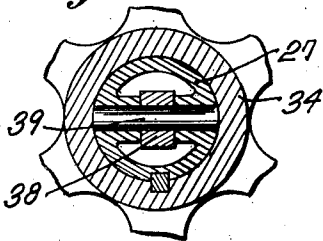


Fig. 6.

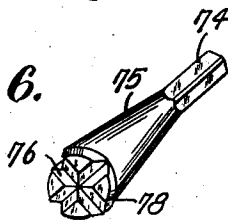
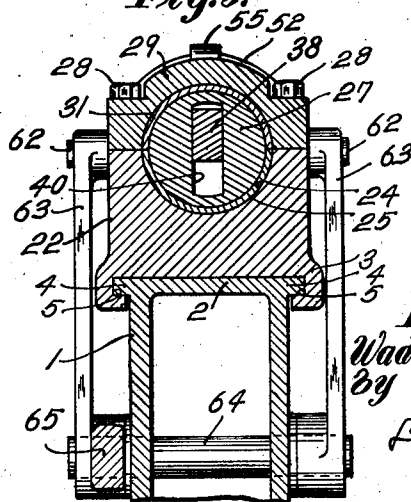


Fig. 5.



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Fig. 7.

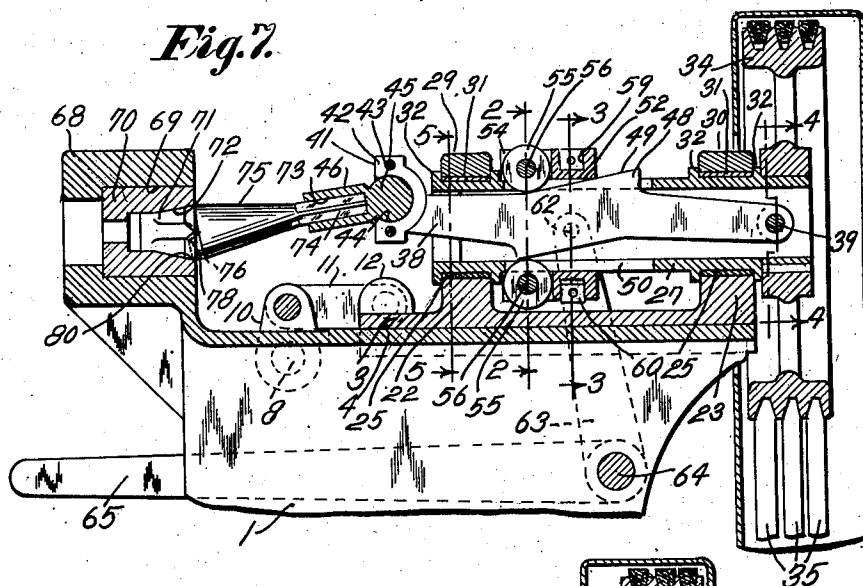
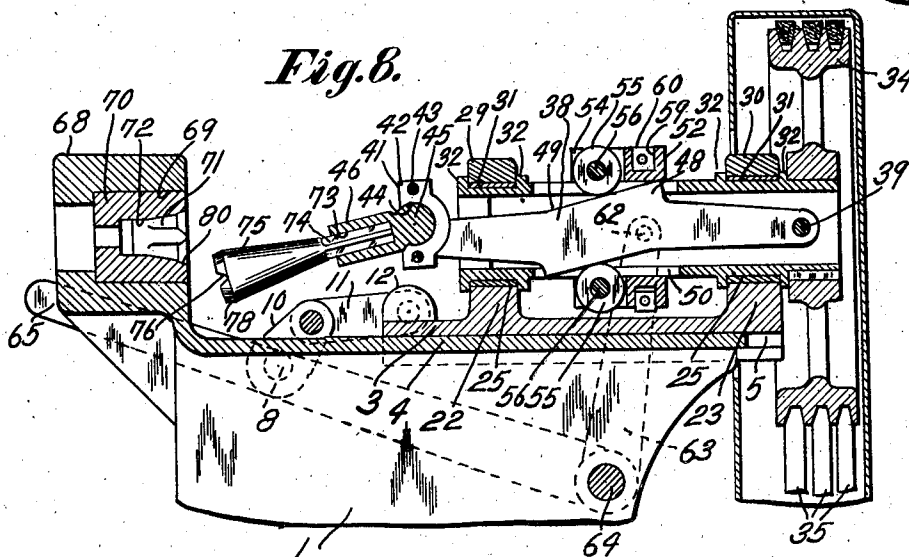


Fig. 8.



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UNITED STATES PATENT OFFICE

2,404,201

BIT SHARPENING MECHANISM

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Application November 11, 1943, Serial No. 509,869

21 Claims. (Cl. 76-5)

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My invention relates to mechanisms for forming metallic articles, and more particularly to mechanisms adapted especially for forming cutting edges on drill bits.

In drilling rock by means of impact tools it is a common practice to employ detachable drill bits having cutting edges which become dull as the drilling progresses but which may be resharpened a number of times before the bit needs to be discarded. It is also necessary to resharpen integrally formed bits after relatively short periods of use. As the cutting edges wear away and become dull the outer ends of the cutting edges also become rounded over, causing the bit to lose its gauge. In resharpening the drill bit the cutting edges should be formed so that they extend to the outer periphery of the bit, otherwise sufficient clearance for the bit will not be produced and a binding of the bit will take place. If the cutting edges of a detachable bit are sharpened by grinding them, as it has been the common practice to do, the amount of metal removed before the cutting edges extend to the periphery of the bit is such that the bit can be sharpened only a few times before it must be discarded. If the cutting edges are subjected while hot to a rolling action which forces metal from the less worn portions of the edges to the portions where the wear is greater and, at the same time, forms the desired cutting edge, it will be seen that the life of the bit is materially increased.

It is proposed, in a preferred embodiment of the invention, to support a suitable forming die member so that its axial center line assumes various angular positions relative to the axial center line of a bit which is supported in a stationary position. In other words, the forming die member is caused to nutate about a point in the axial center line of the bit. Means are provided for swinging the end of the die member remote from the bit in a circular path while the die member and the bit are forced firmly into engagement with each other, or at least one is forced firmly against the other. It will be seen that the same results may be obtained in various ways, for instance the die member may be moved to various angular positions in a fixed plane while the drill bit and the die member are caused to rotate about their respective axes, or, if desired, the die member may be held in a stationary position while the drill bit is moved through various angularly related positions.

It is an object of my invention to provide an improved mechanism for forming portions of an implement. Another object is to provide an im-

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proved mechanism for forming and sharpening the cutting edges of a rock drill bit. Still another object is to provide an improved implement forming mechanism which operates to form the implement by forcing metal radially of the latter with a rolling action. Yet another object is to provide an improved hot rolling mechanism for forming the cutting edges of a drill bit by subjecting the cutting portions to a pressure moving radially of the cutting edges. A further object is to provide an improved bit forming mechanism having a wobble or nutating member which is adapted to subject the cutting portions of the bit to a pressure which is applied at points moving radially of the cutting edges. These and other objects will appear more fully in the course of the following description.

In the accompanying drawings, I have for purposes of illustration shown one embodiment which my invention may assume in practice.

In these drawings,

Fig. 1 is a side elevation of a bit forming mechanism embodying my invention.

Fig. 2 is an enlarged cross sectional view taken on the plane of the line 2-2 of Fig. 7.

Fig. 3 is an enlarged cross sectional view taken on the plane of the line 3-3 of Fig. 7.

Fig. 4 is an enlarged cross sectional view taken on the plane of the line 4-4 of Fig. 7.

Fig. 5 is an enlarged cross sectional view taken on the plane of the line 5-5 of Fig. 7.

Fig. 6 is a perspective view of the bit forming member.

Fig. 7 is an enlarged longitudinal vertical sectional view of a portion of the bit forming mechanism shown in Fig. 1.

Fig. 8 is a view like that of Fig. 7 but showing parts in different positions.

In the illustrative embodiment of my invention there is shown a vertical hollow, generally rectangular-shaped base 1 having a platform 2 on which a carriage 3 is reciprocally mounted. Formed along the sides of the platform are flanges 4 which extend into guideways 5 in the carriage for holding the latter on the platform and limiting its movements to reciprocations in a path lying in horizontal planes and extending longitudinally of the base 1. Suitable means are provided for moving the carriage 3 along the platform 2, and this means, as shown herein, includes a bell crank lever 7 pivotally supported by a shaft 8 carried by the side walls of the base 1. The lever 7 has a short arm 10 connected by a link 11 to a lug 12 formed on the forward end of the carriage 3, and a long arm 14 connected

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by a link 15 to a lever 16 which is pivotally connected at one end to the lower portion of the base 1. The lever 16 extends outwardly beyond its connection to the link 15 and has an outer portion 18 adapted to be engaged by the foot of the operator for effecting a swinging of the bell crank lever 7 in a counterclockwise direction and a movement of the carriage 3 to the left, as viewed in Fig. 1. A spring 20 is connected at one end to the base 1 and is connected at its other end to the lever 16 at a point between the ends of the latter. When the operator's foot is removed from the lever 16, the spring 20 causes the lever 16 to swing upwardly about its pivotal connection to the base and move the carriage 3 to the right along the platform 2. It will be understood that any suitable fluid actuated means or any other appropriate mechanical means may be provided, if desired, for moving the carriage 3 along the platform 2.

The carriage 3 is provided adjacent its ends with upstanding portions 22 and 23, and each of these portions has a cradle 24 receiving a bearing portion 25 which rotatably supports a tubular shaped member 27. Attached to the upper ends of the portions 22 and 23, as by bolts 28, are caps 29 and 30, each having a bearing portion 31 fitting over the member 27 and holding the latter for rotation on a fixed axis. Formed integral with the member 27 at opposite sides of the carriage portions 22 and 23 are annular flanges 32 which coact with the portions 22, 23 and their caps 29 and 30 for holding the member 27 against axial movement relative to the carriage 3. Suitable means are provided for rotating the member 27, and this means, as shown herein, comprises a pulley 34 fixed to the outer end of the member 27 and connected by belts 35 to a pulley 36 fixed to the power shaft of a motor 37. While no such means is shown it will be evident that a clutch may be provided in the drive for the member 27 instead of controlling this drive by a switch in the power line to the motor 37.

Extending longitudinally through the tubular shaped member 27 and connected to the latter so that it will rotate as said member rotates is an arm 38 which is pivotally connected at one end to the member 27 at a point 39 adjacent the rearward end of the latter. The other end of the arm extends beyond the forward end of the member 27, and the arm is guided, as by wall portions 40 formed on the member 27 near its forward end, so that it may swing within the tubular member 27 about the pivot point 39, but still must rotate with this member. At the free end of the arm is an enlarged portion 41 to which a caplike element 42 is connected, as by bolts 43, and the portion 41 and the element 42 have recesses which cooperate to form a ball socket 44 which is adapted to receive a ball-shaped portion 45 formed on one end of a chuck member 46. Formed along opposite sides of the arm 38, as shown in Figs. 7 and 8, are projecting portions 48 having cam surfaces 49 inclined to the axis of the arm and lying in planes which are parallel to each other. The tubular member 27 is provided with slots 50 opening through its side walls and extending longitudinally thereof for receiving the portions 48.

Slidably mounted on the tubular member 27 is a collar 52 having diametrically opposite radial slots 54 which are adapted to receive rollers 55 for engaging the cam surfaces 49, and the rollers 55 are supported by pins 56 extending through

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openings 57 in the collar, as shown in Fig. 2, and extend into the slots 50. Surrounding the collar is an annular groove 59 receiving a shipper ring 60, and pins 62 extending radially from the shipper ring are engaged by shipper arms 63 connected to a shaft 64 supported by the base 1. A manually operable lever 65 is connected to the shaft 64 for rotating the latter and effecting a sliding of the collar 52 along the member 27 through the action of the shipper arms 63 and the shipper ring 60. When the collar 52 is at the left-hand end of the tubular member 27, as shown in Fig. 7, the arm 38 is held by the rollers 55 so that its free end is spaced angularly from the axis of the member 27. As the collar 52 is moved from its position shown in Fig. 7 toward the right, the free end of the arm 38 is moved nearer to the axis of the member 27, and may move to a position to bring the center of the ball 45 into the same straight line with the axis of rotation of the tubular member 27.

Projecting upwardly from the base 1 is a block portion 68 having a bore 69 receiving a member 70 which is adapted to support a drill bit 71, in axial alinement with the tubular member 27, in a socket 72, as shown in Figs. 7 and 8. The drill bit shown herein is of the winged type known as a cross bit in which the cutting edges extend diametrically of the bit at right angles to each other, but it will be understood that this mechanism is adapted to form cutting edges on other types of bits. The socket 72 will be found to hold the bit 71 against turning on its axis; and it will be understood that the simple mechanism shown is merely illustrative of suitable clamping and receiving means for the heated bits to be sharpened; and, if desired, vice mechanisms having suitable bit supporting dies may be used, these mechanisms being like those used on ordinary drill sharpeners for supporting the heated bits during abutting. See for example, the patent to Wineman 2,063,968.

The chuck member 46 is provided with a recess 73 which is adapted to receive the polygonal shank 74 of a die 75 having, at its free end, V-shaped cross grooves 76 for forming the cutting edges on the bit. The bottoms of the grooves 76 are curved slightly toward the periphery of the die 75 so as to obtain a point of contact between the die and the drill bit moving radially of the bit uniformly with the variations in the angular displacement of the die relative to the drill bit. The periphery of the die adjacent its forward end is beveled in its portions between the grooves 76, as shown at 78, and these beveled portions are adapted to engage a beveled surface 80 on the member 70 for limiting movement of the die transversely of the face of the bit.

In the operation of the mechanism described, a heated drill bit is placed in the support member 70 facing the die 75. The operator then supports the die in a position to engage the drill bit and presses down on the lever 16 moving the carriage 3 to the left as viewed in Fig. 1 until the free end of the die is pressed firmly against the drill bit. The motor 37 is then started to rotate the tubular member 27 and the arm 38. The collar 52 is caused to rotate with the tubular member 27 due to the engagement of the rollers 55 with the sides of the slots 50 in the member 27. As the member 27, the arm 38 and the collar 52 rotate, the shipper arms 63 are actuated by the lever 65 to effect a sliding of the collar along the tubular member. The movement of the collar 52 along the tubular member causes the rollers 55

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to roll along the cam surfaces 49 and swing the arm 38 about its pivot point 39. When the arm is swung to its outermost position, as shown in Fig. 7, the die 75 is caused to wobble at such an angle or nutate through such a path that pressure is applied successively to the cutting edges of the bit at their outermost ends. Of course when the orbit traversed by the ball joint is smaller, there is nonetheless work done on the bit. When the collar 52 is moved rearwardly along the member 27, the arm 38 is swung toward the axis of the member 27 decreasing the wobble or range of nutation of the die and causing it to engage the cutting edges of the bit nearer the center of the latter. Of course, as the angle of the axial center line of the die to the axial center line of the work increases, the carriage 3 is fed forward to maintain contact with and pressure on the bit.

As a result of my invention there is provided an improved mechanism for forming the cutting edges on drill bits. It will be seen that a gradual change in the angular positions of the die causes pressure to be applied to the bit at points moving gradually radially of the latter. Due to the curvature of the forming grooves on the die, the contact area between the surfaces on the bit and the die are comparatively small for any angular position of the latter. Since the contact areas are small at any time, the pressure required to shape the edges is comparatively small. The radial movement of the points of contact results in a rolling action which forces metal in the direction of the points, forcing metal from the less worn portions to the portions where the wear is greater. Other advantages of the invention will be clearly apparent to those skilled in the art.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, adjustable means for supporting one of said members so that it may be positioned with its axial center line in different angular positions relative to said axial center line of the other of said members while the die member engages the work to be formed, and means for actuating said one of said members while its angular position of adjustment remains fixed with respect to said axial center line of said other member so that the axial center line of said one member generates a surface conforming to that of a cone.

2. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, adjustable means for supporting one of said members so that it may be positioned with its axial center line in different

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angular positions relative to said axial center line of the other of said members while the die member engages the work to be formed, and means for actuating one of said members so that the point of engagement between the work and said die member is caused to move about said axial center line of said die member while the angular position of said one member remains fixed with respect to the axial center line of said other member.

3. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, means for moving said die member firmly into engagement with the work to be formed, adjustable means for supporting said die member so that its axial center line assumes different angular positions relative to said axial center line of said support member, and means for actuating one of said members so that the point of engagement between the work and said die member is caused to move in a path about said axial center line of said die member while the angular position of said latter member remains fixed with respect to the axial center line of said support member.

4. In an apparatus of the character described, in combination, a work support member, a forming die member engageable with the work, means for adjustably supporting said die member so that its axial center line assumes different angular positions relative to the axial center line of said support member and embodying means for holding said die member in its adjusted position with respect to the axial center line of said support member, means for moving said die member into engagement with the work, and means for actuating one of said members so as to effect a movement of the point of engagement between the work and said die member in a fixed path about said axial center line of said die member.

5. In an apparatus of the character described, in combination, a work support member, a forming die member engageable with the work, means for adjustably supporting said die member so that its axial center line assumes different angular positions relative to the axial center line of said support member, means for moving said die member into engagement with the work, and means for actuating said die member when the latter is held in any one of its different angular positions so as to effect a movement of the point of engagement between the work and the die member in a fixed path about said axial center line of said die member.

6. In an apparatus of the character described, in combination, a work support member, a forming die member, means for adjustably supporting one of said members so that the angle formed by the axial center line of said die member with the axial center line of said work support member may be varied and embodying means for holding said one member in its adjusted position, means for moving one of said members so as to effect an engagement between the work and said die member, and means for actuating one of said members when said die and support members are held in any one of their different relative angular positions so as to effect a movement of the point of engagement between the work

and said die member in a path about said axial center line of said die member.

7. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, means for supporting said die member in engagement with the work and with its axial center line in different angular positions relative to said axial center line of said support member, and means for moving the end of said die member remote from the work in a circular path when said die member is held fixed in any one of its different angular positions.

8. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, means for supporting said die member at a point spaced from the work while the latter is engaged by said die member, means for adjusting bodily said supporting means so that said axial center line of said die member assumes different angular positions relative to said axial center line of said support member, and means for moving said supporting means in a circular path while the angular position of said die member is maintained fixed with respect to the axial center line of said support member.

9. In an apparatus of the character described, in combination, a work support member, a forming die member having a working face adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, means for supporting said die member with its working face in engagement with the work, means for adjusting said supporting means so that said axial center line of said die member assumes different angular positions relative to said axial center line of said support member, and means for moving said supporting means in a direction longitudinal of said axial center line of said support member while said die member is held fixed in its adjusted angular position with respect to the axial center line of said support member.

10. In an apparatus of the character described, in combination, a work support member, an elongated die member having a working face at one end engageable with the work, a rotatable member supported with its axis perpendicular to the face of the work, a supporting arm pivotally connected at one end to said rotatable member, means for operatively connecting the other end of said supporting arm to said die member at the end of the latter remote from the work, said connecting means permitting rotation of said supporting arm relative to said die member, means for swinging said supporting arm about its pivotal connection to said rotatable member, and means for rotating said rotatable member.

11. In an apparatus of the character described, in combination, a work support member, a forming die member engageable with the work, a rotatable tubular member supported with its axis perpendicular to the face of the work, a

supporting arm extending through said tubular member and pivotally supported at one end by the latter, means for operatively connecting the other end of said supporting arm to said die member at a point spaced from the work, means slidably mounted on said tubular member and engaging said supporting arm for swinging the latter about its pivot, means for sliding said last mentioned means along said tubular member, and means for rotating said tubular member.

12. In an apparatus of the character described, in combination, a work support member, an elongated die member having a die portion at one end engageable with the face of the work and movable relative thereto for effecting metal flow to form the surfaces of the work, an element supported for rotation on an axis perpendicular to the face of the work, means for moving said element axially relative to the work, supporting means pivotally connected to said element to swing relative thereto and operatively engaging at points spaced from its pivot the other end of said die member in a manner to permit relative rotation between said supporting means and said die member during rotation of said element, and means for rotating said element.

13. In an apparatus of the character described, in combination, a work support member, a forming die member having a die portion engageable with the work, an element supported for rotation on an axis perpendicular to the face of the work, means for moving said element axially relative to the work, supporting means for said die member including an elongated member pivotally connected at one end to said element and operatively connected at its other end through a universal joint to said die member, and means for rotating said element.

14. In an apparatus of the character described, in combination, a work support member, a forming die member having a die portion engageable with the work, an element supported for rotation on an axis perpendicular to the face of the work, means for moving said element axially relative to the work, supporting means for said die member including an elongated member pivotally connected at one end to said element and operatively connected at its other end through a universal joint to said die member, means for swinging said elongated member about its pivotal connection to said element during rotation of the latter, and means for rotating said element.

15. In an apparatus of the character described, in combination, a work support member, a forming die member having a die portion engageable with the work, an element supported for rotation on an axis perpendicular to the face of the work, means for moving said element axially relative to the work, supporting means for said die member including an elongated member pivotally connected at one end to said element and operatively connected at its other end to said die member, means for swinging said elongated member about its pivotal connection to said element, said last mentioned means including cam surfaces on said elongated member and means movable axially of said element and carrying rollers coacting with said cam surfaces, and means for rotating said element.

16. In a forging machine, means for supporting a winged work piece, a die having a working face provided with grooves of a cross section fully to receive the extremities of the wings on

said work piece when said wings have been formed to the desired shape, means for causing nutation of said die about a point in the same line with the axial center line of said work piece, and means for varying the conical angle of nutation, the face of said die being curved to compensate for the varying angle of the die as the extent of its nutation changes.

17. In a forging machine, a bit supporting device having a bit receiving socket, a rotating die actuating member alined with the center line of said bit supporting device, a universal joint carried by said rotating die actuating member and having means for displacing it towards and from the axis of rotation of the latter, die supporting means carried by one part of said universal joint, a die having its forward end loosely receivable in said bit receiving socket, and means for advancing said die actuating member towards said bit supporting device as the distance between the universal joint and the axis of rotation of said actuating member increases.

18. In an apparatus of the character described, in combination, a stationary work support member, an elongated die member having a working face at one end adapted to engage the work at points spaced from the axial center line of the die member distances varying with the angle formed between said axial center line and the axial center line of said support member, means loosely supporting the other end of said die member and adjustable to position said die member with its axial center line in different angular positions relative to said axial center line of said support member, and means for moving said supporting means to cause the portion thereof which supports said other end of the die member to move in a circular path about said axial center line of said support member while said die member is held against rotation about its own axial center line by reason of its engagement with the work, said adjustable means being adjustable at the will of the operator during movement of said supporting means in said circular path.

19. In an apparatus for forming the wings and cutting edges of a rock drill bit, a support for the drill bit, a forming die having surfaces for forming portions of the wings and the cutting edges on the wings of the drill bit, means for supporting said forming die in operative forming relation with respect to the drill bit with the axial center line of said die disposed at an angle relative to the axial center line of

the drill bit, means effective when said die is supported by said supporting means in operative forming relation with the drill bit to move said die to cause its axial center line to trace a path lying in a surface of a cone, and means operative during aforesaid movement of said forming die for changing the angular relation of the axial center line of said die with respect to the axial center line of the drill bit to vary the forming action of said die on the drill bit.

20. In an apparatus for forming the wings and cutting edges of a rock drill bit, a support for the drill bit, a forming die having surfaces for forming portions of the wings and the cutting edges on the wings of the drill bit, means for supporting said forming die in operative forming relation with respect to the drill bit with the axial center line of said die disposed at an angle relative to the axial center line of the drill bit, means effective when said die is supported by said supporting means in operative forming relation with the drill bit to move said die to cause its axial center line to trace a path lying in a surface of a cone, means operative during aforesaid movement of said forming die for changing the angular relation of the axial center line of said die with respect to the axial center line of the drill bit to vary the forming action of said die on the drill bit, and means for moving said forming die in an axial direction relative to the drill bit concurrently with the change in angle of said die with respect to the drill bit thereby to maintain said die in operative forming relation with respect to the drill bit.

21. In a forging machine, the combination comprising a work support, a die member having a die portion at one end, a rotatable support coaxial with said work support, supporting means pivotally mounted on said rotatable support to swing relative thereto and pivotally connected to the other end of said die member, means for adjusting said supporting means into different angular positions about its pivot relative to said rotatable support to vary the inclination of said die member with respect to the axial center line of the work, and means for rotating said rotatable support and said supporting means to cause the axial center line of said die member to move in a path lying in the surface of a cone, said adjusting means being operable at will during rotation of said rotatable support and said supporting means to change the inclination of said die member.

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