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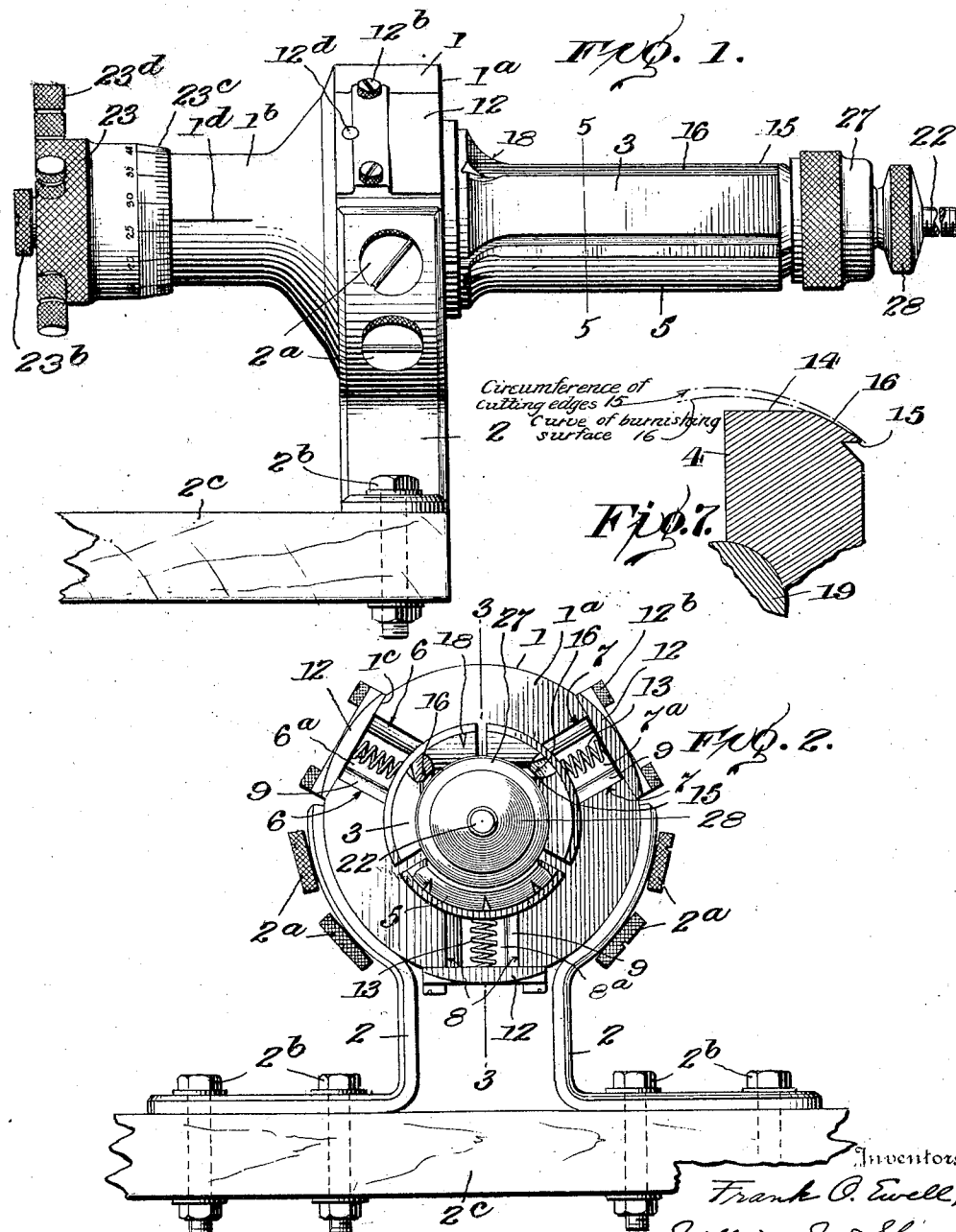
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F. O. EWELL ET AL

ADJUSTABLE REAMER

Filed April 6, 1922

2 Sheets-Sheet 1



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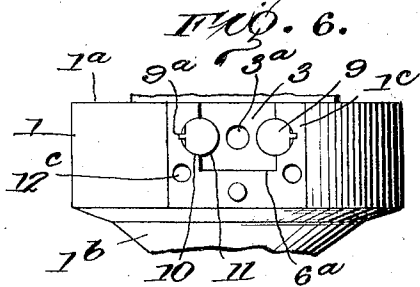
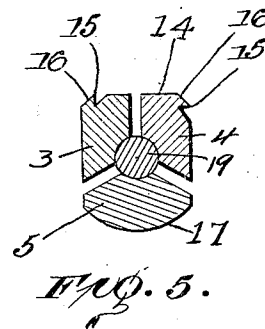
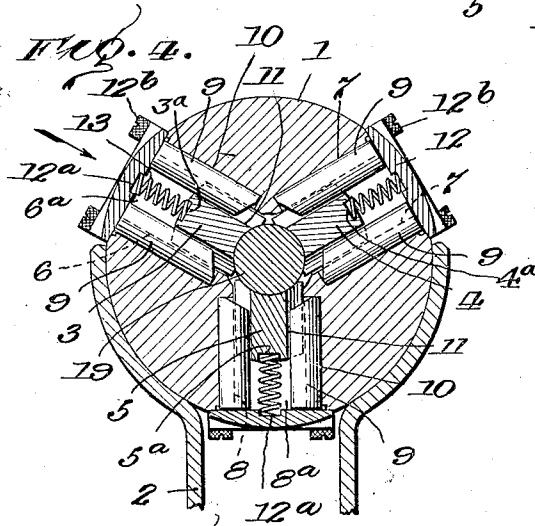
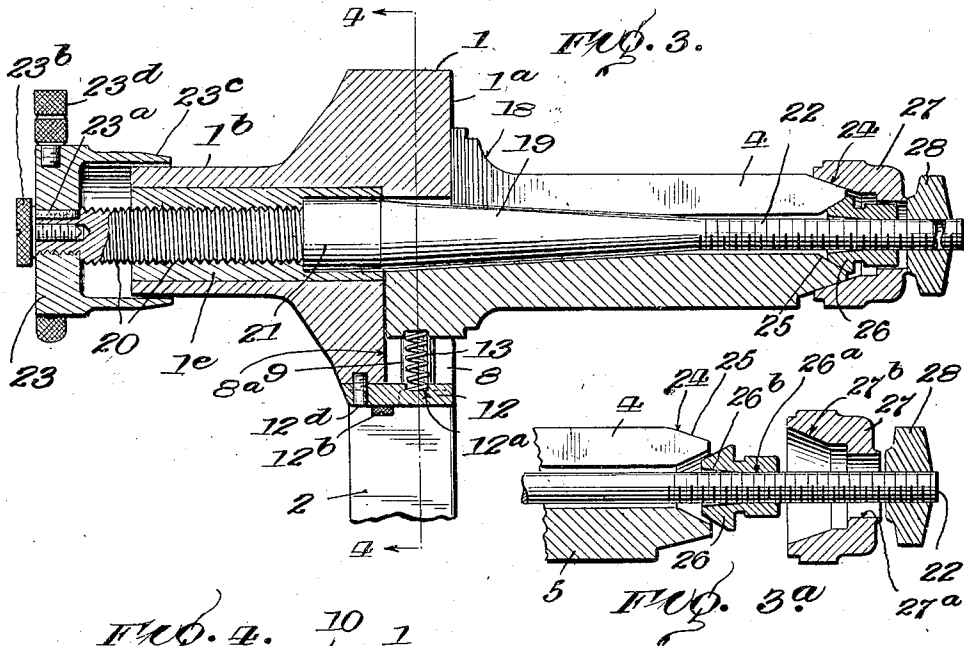
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UNITED STATES PATENT OFFICE.

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ADJUSTABLE REAMER.

Application filed April 6, 1922. Serial No. 550,082.

This invention relates to tools and machines for cutting and polishing circular bearings and is directed particularly to an improved tool for treating connecting rod bearings.

One feature of the invention includes the combination of a reamer and burnisher in which the parts are adjustable. This is particularly useful as a fixed bench tool.

Another feature includes the arrangement in a device of the type described of adjustable and expansible arms extending from a fixed mounting, which mounting also carries the adjusting mechanism.

Another feature relates to the adjustment of the arms equally from a common center, the arms having cutting and polishing surfaces on the outer portions and lengthwise of the arms.

The above features and additional advantages of the invention are described and claimed in the following specification and claims, and illustrated in the accompanying drawing, in which:—

Figure 1 represents a side elevation of the tool mounted on a bench, illustrating the fixed head in the central portion, the combined reamer and broacher surfaces at the right, and the adjusting mechanism at the left;

Figure 2 is a front view in elevation looking directly at the center of the tool;

Figure 3 is a longitudinal sectional view of the tool taken on the line 3—3 of Figure 2;

Figure 3^a is a modified view of the parts shown in Figure 3 illustrating the parts in the loosened position with the arms ready for adjustment.

Figure 4 is a sectional view taken on the line 4—4 of Figure 3;

Figure 5 is a sectional view of the adjustable arms taken on the line 5—5 of Figure 1;

Figure 6 is a side view of the head portion with the retaining plate removed, looking in the direction of the arrow in Figure 4; and

Figure 7 is an enlarged fragmentary, cross sectional view of one of the cutter arms shown in section in Figure 5 and illustrating the respective position of the cutting edge and the burnishing surface.

Like reference numerals refer to like parts in the various figures.

Referring in detail to the drawings, 1 indicates the fixed head portion having a front face 1^a, and a rearwardly extending boss 1^b projecting as a cylindrical portion. Supporting means for rigidly securing the head 1 to a work bench is indicated at 2 by legs or braces fastened to the under side of the head 1 by fastening screws 2^a and secured by suitable bolts 2^b to a horizontal support 2^c. Adjustable cutter arms 3, 4, and 5 are mounted in the head 1 and project from the face 1^a in a parallel arrangement. These arms, as shown in Figure 5, are formed as sectors positioned about a central member which will be further described, and they are capable of adjustment radially and equally from this central member. The head 1 is provided with a series of radially extending slots, corresponding in number to the number of the arms, and in this case identified by the numerals 6, 7, and 8, in which are mounted the respective cutter arms 3, 4, and 5. The side walls of each slot in the figures are indicated by the numerals 6, 7, and 8, and the back wall is indicated by the numerals 6^a, 7^a, and 8^a. The slots are shown as having square corners, and the corresponding portion of the cutter arms is preferably formed to have a fairly close sliding fit with the walls of the slot. The arms are thus firmly and rigidly mounted in the head and project from one face thereof, and in other words, from one extreme side wall thereof, and the arms are thus supported at one end only by and project from the walls of the slots in the face. This is in contrast to known types of radial movable cutters, such as pipe cutters or expanders, wherein the movable parts are slidable in a slot, the walls of which embrace both ends and possibly also the side portions of the movable parts. Obviously the walls of the slot might have some other shape and this is immaterial so long as the cutter arms are firmly mounted therein for radial adjustment. The parallel arms must remain parallel in all adjustments for the reason that they are thus firmly held for radial movement only. The device includes particular means for providing for ease in

adjustment of the arms and also for renewing the parts which may become worn by frequent adjustment of the arms in the slots.

This means includes the use of a series of keyway members 9 which are substantially circular in cross section and which are positioned one on either side of the cutter arms within the slots. These members 9 are inserted in substantially the following manner. A half round groove is formed in the side wall of the slot and within the head portion, as indicated at 10, and a corresponding half round groove is formed in the arm portion, as indicated at 11. Together these grooves form a keyway which is round and which is capable of receiving the cylindrical pin 9. The half round keyways may be formed by drilling a hole when the cutter arm is in position in its slot. Each key member 9 has a laterally extending lug 9^a engaging a corresponding depression in the member 1 to prevent the key members from turning. Whenever wear of the parts tends to loosen the connection between the cutter arms and the key members, the key members may be renewed and lost motion eliminated. A retaining plate 12 is provided to bridge each of the slots and to prevent the removal of the pins 9, and to limit the extreme radial movement of the cutter arms. These retaining plates 12 have depressions on their inner faces indicated at 12^a which are substantially between the respective pairs of key members 9. A corresponding depression is formed in each of the cutter arms between the respective pairs of key members as indicated at 3^a, 4^a, and 5^a. In each pair of depressions is mounted a spring 13 which thus extends in a position substantially parallel to the key member in each slot. This spring 13 normally exerts a pressure on the cutter arm and tends to keep it in its central position and against the central actuating shaft, as will be described. Suitable fastening screws 12^b are provided for securing the plates on the head 1, and the head 1 may be provided with a flattened portion 1^c adjacent each slot if the under face of the plate member 12 is provided with a corresponding plane surface, as illustrated in the drawings. The head 1 has screw threaded openings 12^c for the reception of the fastening screws 12^b, and it also has a pin 12^d which is adapted to fit into a corresponding hole in the plate to assist in the proper and ready positioning of the plate over the slot opening.

The peculiar shape of the cutter arms will be understood by referring to the sectional views 3 and 5. The cutter arms 3 and 4 are substantially identical in shape, and each has on it two relatively flat faces 14 which are not cutting faces and are not intended to come into contact with any surface treated. Cutting edges are indicated at 15, and these

are similar to known forms of reamer cutting edges in that they extend lengthwise. The present arrangement has radially adjustable arms, each provided with a cutting edge. Each arm has a burnishing surface 16 which serves to smooth and polish the metal treated whenever the work is moved clockwise, which is in a reverse direction from the usual reaming movement and which is counter-clockwise looking at Figure 2. This burnishing surface 16 extends from the cutting edge to the left end with a gradually decreasing curved surface which is less than that of the curve of the path of travel of the cutting edge. The cutter arm 5 has no cutting edge 15, but has its entire outer surface curved and smooth, as indicated at 17. The surface 17, mentioned in the claims as a work-engaging surface, extends lengthwise of the arm 5 and substantially the full length thereof. Each of the arms 3, 4 and 5 have cutting portions 18 formed on the curve next adjacent the head end of the arms, which cutting portion is a radial reamer for treating the curved edges of bearings. Each of the cutter arms has a shoulder in engagement with the face 1^a of the head portion, which shoulder is merely a continuation of the arm on either side of the slot opening.

Actuating means for adjusting the position of the arms 3, 4, and 5 is provided by a central shaft 19 which has a tapered portion extending from the head 1 in engagement with a corresponding tapered surface on the central side of each of the cutter arms. The opposite end of the shaft 19 is provided with screw threads 20 in engagement with corresponding threads in the head, and movement of the threaded portion serves to advance or retract the conical portion 19. Between the portions 19 and 20 is an intermediate cylindrical portion 21 which is fitted into a corresponding circular bearing portion in the head, and which serves to maintain the alinement of the actuating shaft with respect to the head and arms. The extreme end portion of the shaft 19 is provided with screw threads 22, on which are mounted the fastening means for securing the free ends of the cutter arms, as will be described. The rear end or threaded end of the shaft is provided with a grip or handle portion 23 which is keyed at 23^a to the shaft 19, and which is provided with a fastening screw 23^b, thus effectively preventing relative rotation or endwise movement of the part 23 with respect to the shaft. The grip portion 23 has a forward portion 23^c formed as an annular shell adapted to encircle the cylindrical surface of the part 1^b, and also adapted to receive thereon calibrations to assist in the accurate adjustment of the parts. On the cylindrical outer surface of the portion 1^b is provided a length-

wise extending line 1^d, which serves as an index for use with the calibrations on the part 23^c. Extension gripping means is provided by the screws 23^d fitted into the grip portion 23 and thus constituting a star wheel.

In order that wear may be eliminated and lost motion prevented, the shaft 19 is provided with a removable sleeve 1^e, which is fitted into the head portion 1 from the rear end thereof. This portion 1^e contains the threads for engagement with the thread 20 and the cylindrical bearing surface in which the portion 21 slides.

The parallel cutter arms extend from the head and terminate with substantially free ends. Fastening means for securing the free ends in any predetermined position is provided by the following combination of parts. The ends of the cutter arms 3, 4 and 5 are tapered down sharply providing the inclined surface 24 on each arm. The inside of each arm is likewise tapered down from the outer end inwardly providing corresponding inner inclined surfaces 25 on each arm. On the threaded portion of the shaft is a cone shaped nut 26 having the small end thereof adapted to fit into the inner inclined faces of the cutter arms. This nut 26 has a rear portion 26^a which is screw threaded to the threaded portion of the shaft, and a forward portion 26^b which is not screw threaded, but is provided with a cut away portion next to the shaft so as to enable it to move along the shaft and to project part way over the tapered portion of the member 19. This nut 26 is thus adapted to support the free ends of the cutter arms against movement centrally. Locking means for holding the free ends of the cutter arms firmly against the conical nut 26 is provided by an annular cup shaped member 27, which is loosely fitted over the threads 22 of the shaft 19 and has a central opening 27^a. It also has an inclined face 27^b on the inner surface thereof which slopes outwardly and which is adapted to rest on the inclined faces 24 of the cutter arms. A locking nut 28 is screw threaded to the portion 22 of the shaft and is adapted to hold the annular member 27 firmly against the outer ends of the cutter arms and to press them against the conical nut 26. Adjustment outwardly of the parallel arms is effected solely by means of the manipulation of the grip member 23 operating through the cam of the shaft 19. The springs 13 tend to return the arms centrally and hold them against the shaft 19. The arms cannot move from the parallel position because they are securely held in the radial slots 6, 7 and 8. To adjust the arms outwardly, it is necessary that the cup shaped member 27 and its locking nut 28 be loose and free from the ends of the arms. To adjust the arms centrally, it is equally nec-

essary that the cone shaped nut 26 be withdrawn so that the arms may close freely to the desired position, after which the nut 26 may be returned to snugly support the ends of the arms, and then the member 27 and the nut 28 may clamp the ends of the arms against the nut 26. The nut 26 and the parts 27 and 28 should not be used to distort the arms from their parallel positions. Thus, the radial distance from the axial center of the actuating shaft 19 to the cutting edge 15 is greater than the distance from the same center to the surface 16, or to any point on the arm removed from the cutting edge. In Figure 7, there is represented an exaggerated enlarged fragmentary view of a portion of Figure 5, illustrating the arm 4 and showing the curve of the burnishing surface 16, which coincides at the cutting edge with the circumference which passes through the cutting edge 15. It will be understood that these lines marked respectively "circumference of cutting edges 15" and "curve of burnishing surface 16" are used to illustrate how the cutting edge 15 is farther from the axial center of the arm 19 than points on the surface 16 are from the axial center of 19. The distance from the circumferential curve to the member 19 is constant, but the distance from points on the burnishing surface 16 to the member 19 varies, and becomes increasingly less, as points are selected on the surface further away from the cutting edge 15.

The manner of using the tool will now be explained. A circular bearing, such as a connecting rod bearing mounted in a connecting rod, is moved endwise over the outer end of the cutter arms and the arms are then expanded to the proper operating position by manipulation of the grip member 23. The purpose of this tool is to reduce the metal in any babbitt or other bearing when the latter is moved in a counter clockwise direction about the cutter arms, presuming that the operator stands facing the side 1^a of the head member 1. The cutting effect is obtained by means of the knife edges 15 on the cutter arms 3 and 4, sufficient clearance being allowed so that the bearing metal will not be cut, torn or pulled, but will be formed into a hardened, smooth, cylindrical surface. This is caused not only by the angle in which the edge 15 is cut into the arm but also to the fact that the portion 16 of the arm, directly behind the edge or the heel of the cutting edge, is in contact with the Babbitt metal holding it down and cutting it without tearing or pulling and also compressing it to some extent. In other words, the effect is the same as if a broach had been used. Then, after the arms have been expanded a few thousandths of an inch, the bearing is moved in a clockwise direction, bringing into use

the smooth surfaces 16, and there is produced a burnished effect on the bearing metal. No other subsequent treatment is necessary before placing the bearing on its journal. The arms may then be contracted and the bearing slipped off of the end of the arms.

It is important to note the difference between a hand scraped bearing and the effect produced by the tool of this invention. The use of a hand scraping process leaves a comparatively soft spongy surface which must be hardened and seated by actual contact with the journal while in operation, and subsequently the bearing should be adjusted in order to make it fit properly. With the use of this tool, however, the bearing metal has been seated and the surface glazed to such an extent that the bearing should not require adjustment after operation. The glaze produced on the surface of the bearing by the use of this tool is a live, compressed glaze and not a dry, hard, brittle glaze such as is ordinarily produced when a bearing is burned in with oil.

One of the chief advantages of the use of this tool is the amount of time saved in fitting bearings. In practice it has been found that a set of four connecting rod bearings have been fitted in fifty minutes, as compared to the usual five to ten hours required in fitting hand scraped bearings. The wearing of the bearing produced by the use of this tool is not as rapid as that common to hand scraped bearings.

It is obvious that by means of different sized sets of cutter arms this tool will be capable of use in a wide range of different size bearings.

Many of the features set forth in this application are not claimed herein, being the invention set forth in the copending application, Serial No. 756,744 of Ewell and Shuey. We claim:

1. A tool comprising a head portion, a plurality of expansible cutter arms mounted in said head portion and adjustable radially, said arms being parallel to each other and having parallel cutting portions extending lengthwise thereof, an actuating shaft for adjusting said arms mounted in said head and movable therein and having a tapered portion in contact with and movable lengthwise of said cutter arms, and fastening means for locking the extreme free ends of said parallel cutter arms in any predetermined position.

2. A tool comprising a head portion, a plurality of expansible cutter arms mounted in said head portion and adjustable radially, said arms being parallel to each other and having parallel cutting portions extending lengthwise thereof, an actuating shaft for adjusting said arms mounted in said head and movable therein and having a tapered portion in contact with and movable length-

wise of said cutter arms, and fastening means for locking the extreme free ends of said parallel cutting arms in any predetermined position, said fastening means comprising a conical member adjustable lengthwise on said actuating shaft and adapted to support the free ends of said cutter arms against compression, and adjustable clamping means for holding said free ends against said conical member.

3. A tool comprising a head portion, a plurality of expansible cutter arms mounted in said head portion and adjustable radially, said arms being parallel to each other and having parallel cutting portions extending lengthwise thereof, an actuating shaft for adjusting said arms mounted in said head and movable therein and having a tapered portion in contact with and movable lengthwise of said cutter arms, the free ends of said parallel cutter arms next adjacent said shaft being tapered inwardly, and fastening means comprising a conical member adjustable lengthwise on said actuating shaft and adapted to engage the tapered portion of the free ends of said cutter arms and support said arms against compression.

4. A tool comprising a head portion, a plurality of expansible cutter arms mounted in said head portion and adjustable radially, said arms being parallel to each other and having parallel cutting portions extending lengthwise thereof, an actuating shaft for adjusting said arms mounted in said head and movable therein and having a tapered portion in contact with and movable lengthwise of said cutter arms, and fastening means for locking the extreme free ends of said parallel cutter arms in any predetermined position, said fastening means comprising a conical member screw threaded on said shaft for lengthwise adjustment and adapted to support the free ends of said cutter arms against compression, said conical member having the central opening therein tapered outwardly at the end next adjacent the small end of the cone and the opposite end provided with screw threads engaging corresponding threads on said shaft.

5. A tool comprising a head portion, a plurality of expansible cutter arms mounted in said head portion and adjustable radially, said arms being parallel to each other and having parallel cutting portions extending lengthwise thereof, an actuating shaft for adjusting said arms mounted in said head and movable therein and having a tapered portion in contact with and movable lengthwise of said cutter arms, the free ends of said parallel cutter arms next adjacent said shaft being tapered inwardly toward said shaft and said arms having the outer surface tapered at the ends toward said shaft, a supporting cone mounted on said shaft and adapted to engage said inner tapered por-

tion, and adjustable clamping means for holding said free ends against said cone comprising an annular member loosely encircling said shaft and having an inner face adapted to engage and firmly hold the outer surfaces of the tapered ends of said arms, and a locking member in threaded engagement with said shaft adapted to engage said annular member and hold it against said arms. 10

In testimony whereof we affix our signatures.

FRANK O. EWELL.
WILLIAM MEADE SHUEY.
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