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Kniff

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[54] **EXCAVATING TOOL ARRANGEMENT**

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[52] **U.S. Cl.** ..... **299/88**, 37/142 R, 175/413, 299/91

[51] **Int. Cl.** **E21c 35/18**

[58] **Field of Search** .. 175/413, 354; 299/86, 91–93, 299/88; 37/142 R, 142 A

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Attorney, Agent, or Firm—Melvin A. Crosby

[57] **ABSTRACT**

An excavating tool arrangement including a bit having a cylindrical shank received in a correspondingly shaped hole in a support block with the forward end of the bit protruding forwardly from the block and being substantially rectangular when viewed from above and greater in width from side to side than in heighth from top to bottom. The bit is keyed to the block in a predetermined oriented position and the leading edge of the working end of the block may be chisel shaped or may be provided with hard wear resistant inserts mounted therein. The described bit may be employed alone for excavating operations or it may be employed in combination with other bits which are symmetrical about a longitudinal axis and terminate in points and which are mounted in blocks that may be identical with the blocks supporting the first mentioned excavating bit.

19 Claims, 6 Drawing Figures

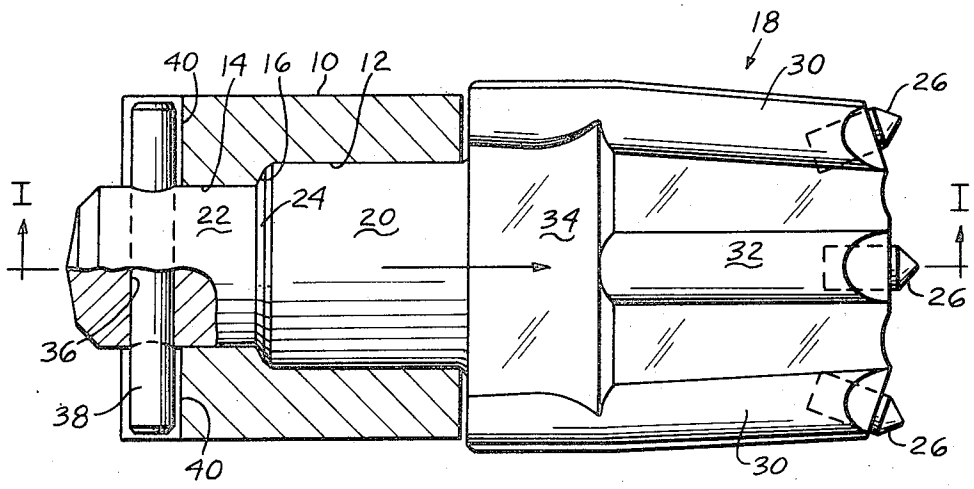


FIG-1

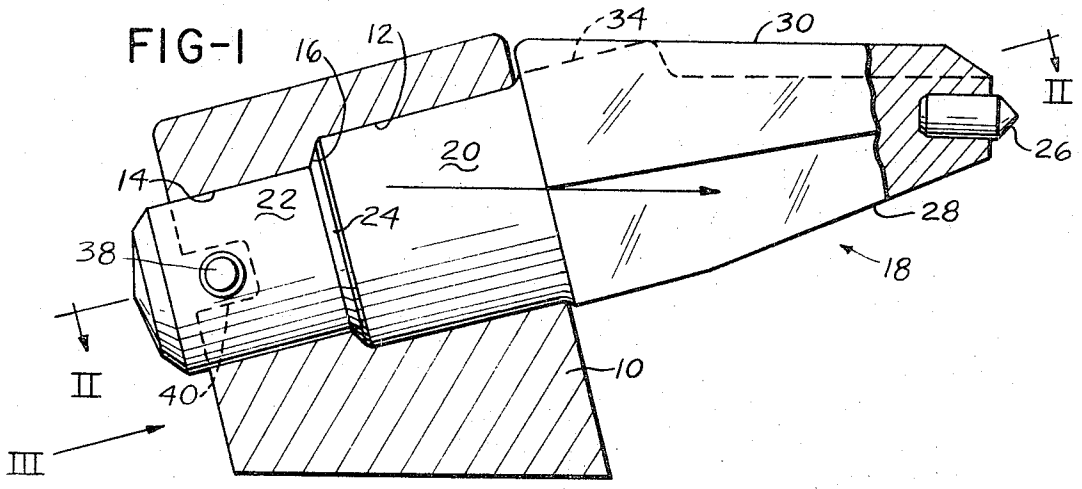


FIG-2

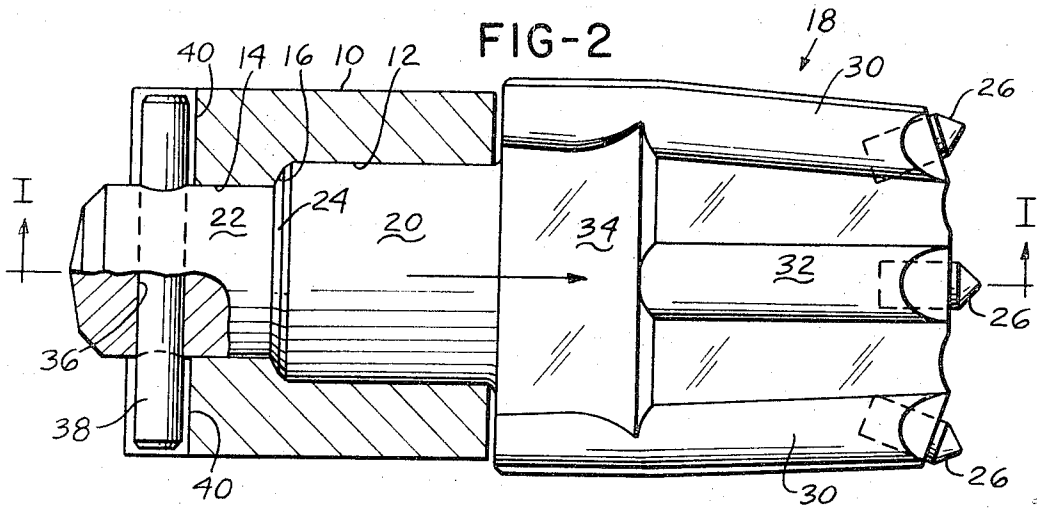


FIG-3

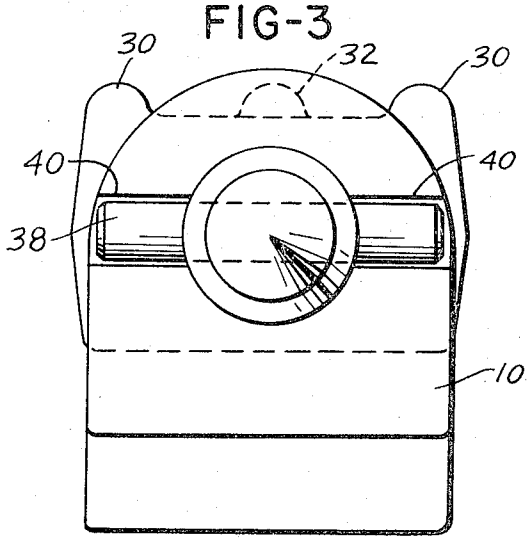


FIG-4

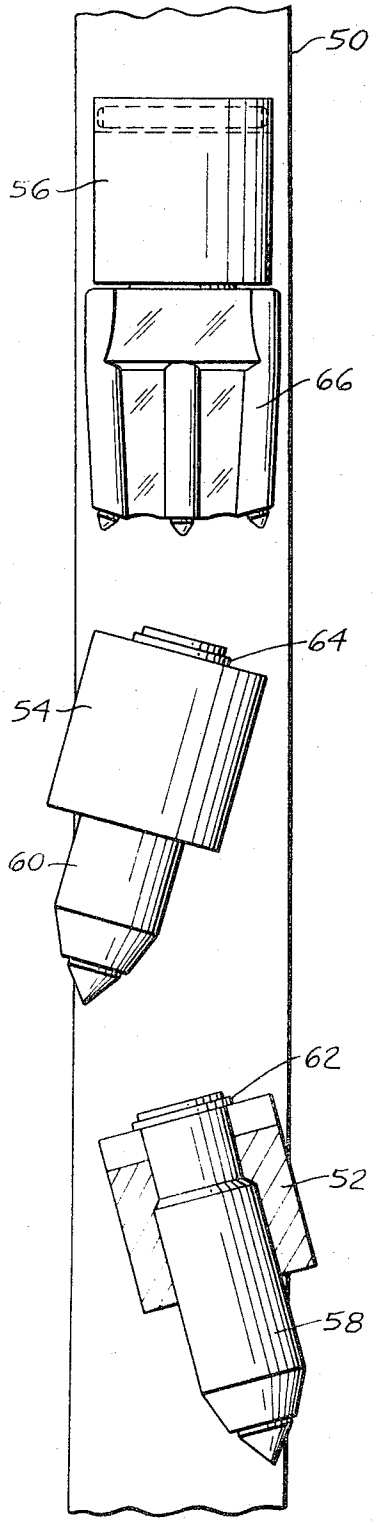


FIG-6

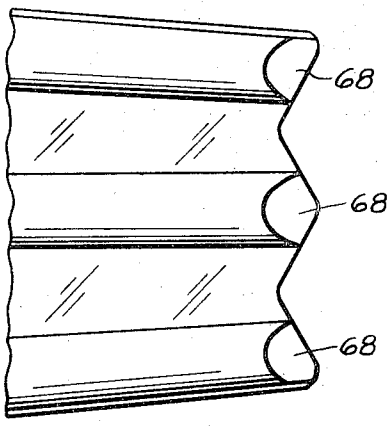
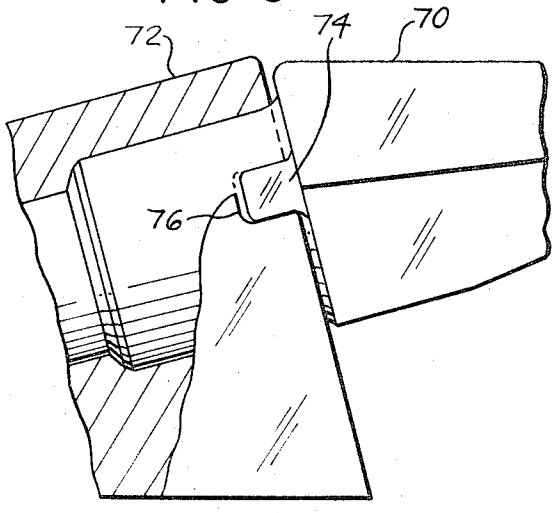


FIG-5



EXCAVATING TOOL ARRANGEMENT

The present invention relates to excavating tools and is particularly concerned with a bit of novel configuration and adapted for use in formations other tnan hard rock formations and also for use in connection with moving loose material taken by other bit elements.

Excavating tools are well known and are employed for reducing formations, which may include hard rock formations, for ditching operations and in other instances.

There is a tendency in connection with excavating tools to construct the tools to operate satisfactorily under the most extreme conditions which means that the tools are quite often constructed with the idea in mind that they will have to reduce rocks and other hard formations. Tools of this nature generally have bits with hard sharp points thereon so that the hard formations can readily be broken up thereby.

However, in a great many instances, the material to be reduced either does not contain a great deal of rock or else the rock is rather easily broken as, for example, in the case of shale and the like. Under such circumstances, it is as important to move the material away from the place where it is taken off the formation as it is to reduce the formation in the first place.

For example, in connection with ditching operations, a relatively narrow cut is made in a formation, and it is important to remove the material from the cut in order to expose it to receive pipes and the like. Trenching operations are similar to ditching operations except that the cut is somewhat wider and it is important also in respect of ditching operations efficiently to remove the material taken from the cut to expose the space for receiving pipes and the like.

With the foregoing in mind, a primary objective of the present invention is the provision of a bit especially constructed and arranged to perform not only cutting operations but also to perform material conveying operations in connection with excavating procedures.

Another object is the provision of a bit of the nature referred to which is adapted for being mounted in a substantially conventional block made to receive other types of tools as well.

A still further object is the provision of an excavating tool arrangement which presents a combination of bits to the formation operable to effect efficient reduction of hard material in the formation while also efficiently reducing softer formations and conveying away all of the material taken from the formation.

These and other objects and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 is a view looking in from the side of a tool with the tool partly broken away and with a support block therefor in section. FIG. 1 is indicated substantially on line I—I of FIG. 2.

FIG. 2 is a view looking down on top of the tool and is indicated substantially by line II—II on FIG. 1 and with the tool mostly in elevation.

FIG. 3 is a rear view of the bit and block combination as indicated by the arrow III on FIG. 1.

FIG. 4 is a schematic view showing a bit combination mounted on a drive member.

FIG. 5 is a fragmentary view showing a different manner of keying the bit to the support block.

FIG. 6 is a fragmentary plan view looking down the end of a modified form of cutter bit.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a bit is provided which has a cylindrical shank and a flat wide working portion protruding forwardly from the shank. The working portion has a sharp leading edge formed thereon by shaping the leading edge of the working member to a chisel shape or by mounting hard wear resistant inserts therein. The bit has, as mentioned, a cylindrical shank which is receivable in a bore in a support block, and the bit is then keyed to the block to hold the bit in a proper rotated position in the block for excavating operations.

The cylindrical shank of the bit referred to is especially configured to be receivable in the bore in a block which is adapted for receiving a cylindrical bit adapted for rotating in the block. One and the same block is, thus, adapted for receiving a nonrotatable bit which is keyed to the block and another type of bit which can rotate in the block.

The flat ended bit according to the present invention can be used by itself or it can be used in combination with rotatable type bits, in which latter case a plurality of like blocks are mounted on a driving support member with certain ones of the blocks rotatably supporting bits with a single point on the front end and the others of the blocks nonrotatably supporting a flat ended bit according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, in FIGS. **1** to **3**, a support block **10** is illustrated having a bore extending therethrough with a larger diameter forward portion **12** and a smaller diameter rearward portion **14** with a forwardly facing shoulder **16** at the juncture of said portions and disposed in about the middle of the length of the bore through the block.

A cutter bit, generally indicated at **18**, is provided having a shank fitting said bore and consisting of a larger diameter forward shank portion **20** fitting in larger diameter portion **12** of the bore and a smaller diameter rearward shank portion **22** fitting in the smaller diameter portion **14** of the bore. A rearwardly facing shoulder **24** is provided on the shank at the juncture of the shank portions and engages forwardly facing shoulder **16** in the bore.

Forwardly of the block **10**, the bit has a working portion that is wider than it is high, as will be observed particularly from a comparison of FIGS. **1** and **2**. This portion is generally rectangular when viewed in plan as in FIG. **2**. The working portion tapers inwardly toward the front in the vertical direction as will be observed in FIG. **1**.

The forward portion of the bit is inclined generally downwardly from the axis of the bore in the block and at the extreme forward end has mounted therein hard wear resistant inserts **26** which may be formed, for example, from cemented tungsten carbide.

The axes of the inserts **26** incline downwardly with respect to the axis of the bore in the block, and which is also the axis of the shank of the bit, at an angle of about 15°.

It will be noted in FIG. 2 that there are three of the inserts 26 mounted in the forward end of the block with the central insert disposed in about the plane of the axis of the shank of the bit which is perpendicular to the drawing plan in FIG. 2. There could, of course, be a greater or lesser number of inserts in the bit, depending upon the width of the bit.

The axes of the outermost inserts are inclined outwardly so as to diverge in the forward direction from axis of the central insert at an included angle of about 79°.

The forward working portion of the bit has a substantially planar lower side 28 while the upper side is formed with outer longitudinally extending ribs 30, and a central longitudinally extending rib 32, the said ribs being disposed in about the longitudinal planes which contain the inserts.

Toward the shank end of the forward portion of the bit, there is a central recess 34 which interrupts rib 32. The ribs provide strength to the bit while the grooves extending longitudinally of the bit between the ribs provide spaces along which material can move which is taken by the bit and reduces the force required to move the bit through a formation.

The bit of FIGS. 1 to 3 is not adapted for rotation in the support block and, to this end, near the back end of the smaller portion 22 of the bit shank, there is a lateral bore 36 through which a pin 38 extends. Pin 38 may be a solid pin or a roll pin. The ends of the pin extend out beyond the opposite sides of the shank and are received in the diametral notches 40 formed in the back face of the block 10. The pin and notches could be offset radially to permit the bit to be mounted in the block in only a single rotated position therein.

The bit according to the present invention can be employed for reducing formations, particularly formations that do not include a great deal of hard rock and the bit can also be used in combination with other bits as will be seen in FIG. 4.

In FIG. 4, reference numeral 50 indicates a carrier which may be a disc or the like and to which is fixed blocks 52, 54 and 56, all of which may be identical and identical with block 10 of FIGS. 1 to 3. The blocks 52 and 54 are inclined in respectively opposite directions so that bits 58 and 60 mounted therein have the axes divergent toward the front.

The bits 58 and 60 are adapted for rotation in the blocks 52 and 54 and are held therein by respective retaining means 62 and 64 which prevent any substantial axial movement of the bits in the blocks but which do not inhibit rotation of the bits in the blocks. Each of the bits 58 and 60 is symmetrical about a longitudinal axis and is, thus, free to rotate when it is driven against a formation to be reduced.

Following the bits 58 and 60 is a bit 66 according to the present invention which is not only operable for carrying out a cutting action, but is also operable for bodily moving loosened material, especially material that has been loosened by bits 58 and 60. The bit 66 is, thus, particularly effective for conveying loose material in a ditching operation to a point of removal as in connection with a bucket type trenching machine.

It will be understood that the bits illustrated in FIG. 4 are viewed as a development and that, in fact, the longitudinal axes of all of the bits diverge from the forward direction of movement of the bits in a direction perpendicular to the plane of the drawing as well as the lateral divergence shown for the bits 58 and 60.

The bit of FIGS. 1 to 3 is provided with the hard wear resistant inserts 26 and is, thus, capable of carrying out cutting operations even on relatively hard formations, but in cases where the bit will not encounter hard formations, or where it is provided primarily for moving loose material, the forward end may be formed as indicated in FIG. 6 without any hard inserts mounted therein. In FIG. 6, the leading end of the working portion of the bit is provided with chisel edges 68 which will be effective for engaging and moving loose material.

FIG. 5 shows a modified arrangement for keying a bit 70 to a support block 72. In this case, lugs 74 are formed at the juncture of the forward portion of the bit with the shank and engage recesses 76 formed in the front face of the support block 72. By disposing the lugs 74 and recesses 76 off center, as illustrated in FIG. 5, it is insured that the bit will always be oriented properly in the block.

While the pin 38 extending transversely through the shank of the bit is effective for holding the bit of FIGS. 1 to 3 against rotation while also holding the bit in the support block 10, the lugs 74 of FIG. 5 are only effective for holding the bit against rotation in the respective block. Thus, in the FIG. 5 arrangement, the bit shank is provided with a keeper, preferably mounted on the protruding rear end of the shank. Such a keeper might be in the form of a snap ring or the like as shown in respect of the snap rings 62 and 64 of FIG. 4.

The lugs 74 in FIG. 5 are shown displaced laterally from the axis of the shank of the bit so that the bit can be connected to the block in only one rotated position and this is also the case in respect of pin 38 which may be off center with respect to the axis of the shank of the bit.

It is also possible to provide the element of key means on the bit so that it projects radially from the longitudinal axis of the bit in only one direction and to provide the block with a recess extending in only one radial direction from the bore of the block and in this manner, also, key the bit to the block in only one rotated position.

Modifications may be made within the scope of the appended claims.

What is claimed is:

1. In an excavating tool; a support block having a bottom surface and a forward face and a rearward face, a round bore extending through the block and intersecting both of said faces and diverging from said bottom surface in the forward direction, said block being adapted for mounting on a driver for driving said block in a direction parallel to said bottom surface, a bit having a shank portion which is round in cross section and slidably fitted in the bore in the block, said bit having a forward working portion extending forwardly from the forward face of the block and substantially coaxial with said shank portion, said working portion being generally rectangular when viewed in plan and also when viewed in cross section perpendicular to the axis of said shank with a greater dimension parallel to said bottom surface of said block and a smaller dimension, said working portion having cutting means at the free end distributed thereon in the direction of the said greater dimension, cooperating elements of key means on said bit and said block operable to locate said bit in

a rotated portion in said block and to hold said bit in said rotated position during working operations, and cooperating elements of abutment means on said bit and block to sustain working loads imposed on said bit when the bit and block are driven into a formation by the driver on which the block is mounted.

2. An excavating tool according to claim 1 in which said key means includes a linear recess formed in at least one of the said faces of said block and intersecting said bore, and means on th bit engaging said recess.

3. An excavating tool according to claim 2 in which said recess is formed in the rearward faceof said block, said means on the bit comprising a pin extending laterally in the shank of the bit and engaging said recess, said pin also holding said bit in assembled relation with said block.

4. An excavating tool according to claim 2 in which said recess is displaced radially from the axis of said bore whereby said bit can be keyed to said block only in a predetermined rotated position of said bit.

5. An excavating tool according to claim 1 in which said abutment means comprise a forwardly facing shoulder formed in said bore in the block and a rearwardly facing shoulder said shank of said bit, said shoulder engaging when the bit is seated in the bore in said block.

6. An excavating tool according to claim 5 in which said shoulders are located about midway along the said bore and shank.

7. An excavating bit comprising; a rearward shank which is round in cross section and receivable in a round bore in a support block, said bit having a working portion fixed to the forward end of said shank and extending forwardly therefrom, said working portion being generally rectangular in cross section perpendicular to the axis of said shank with a greater dimension and a smaller dimension, cutting means on the free end of said working portion distributed therealong in the direction of said greater dimension, rearward facing abutment means on said bit, and an element of key means on said bit for nonrotatably keying the bit to a support block.

8. An excavating bit according to claim 7 in which said cutting means comprises a chisel edge formed on the forward end of said working portion of the bit.

9. An excavating bit according to claim 7 in which said cutting means comprises hard wear resistant rod-like insert means mounted distributed relation in the forward end of said working portion of the bit.

10. An excavating bit according to claim 7 in which one of the wider faces of said working portion of said bit is substantially flat and the other of the wider faces is longitudinally fluted.

11. An excavating bit according to claim 7 in which said abutment means is in the form of a rearwardly facing shoulder formed on said shank in about the middle of the length thereof.

12. An excavating bit according to claim 7 in which said key means are formed on the rearward end of said working portion and protrude rearwardly therefrom on at least one side of said shank.

13. An excavating bit according to claim 7 in which said key means are formed on the rearward end of said working portion and protrude rearwardly therefrom on both sides of said shank.

14. An excavating bit according to claim 7 in which said key means are disposed in a plane offset radially from the axis of said shank.

15. A support block having a bottom surface and forward and rearward faces substantially parallel to each other and a bore extending through said block and said faces and substantially perpendicular to said faces, said bore diverging from said bottom surface toward the forward face of said block, and lateral recess means formed in one of said faces and intersecting said bore.

16. A support block according to claim 15 in which said recess means is in the form of a straight slot the axis of which is spaced radially from the axis of said bore.

17. In an excavating device; a driver member, support blocks mounted on said driver member in distributed relation an each having a forward face and a rearward face, each block having a bore extending therethrough from the forward face to the rearward face to receive from the front the shank of a bit with the bits being driven into a formation by movement of the driver member, each bore diverging from the adjacent surface region of the driver in the forward direction, said bits having working portions projecting forwardly from the respective blocks, said bits and blocks comprising groups thereof, the leading bits of each group being pointed at the forward ends and rotatable in the respective blocks, the trailing bit of each group having a spade-like forward working portion with a sharp forward cutting edge extending laterally to the forward direction of movement of said bits, means for nonrotatably connecting said trailing bits to the respective support blocks, and cooperating elements of abutment means on each bit and block.

18. An excavating device according to claim 17 in which said leading bits are laterally inclined so as to diverge from the plane of movement of the bits in the forward direction.

19. An excavating device according to claim 17 in which the said blocks of each group are substantially identical, and recess means in one of the forward and rearward faces of each said block for use in nonrotatably connecting a said trailing bit thereto whereby each block is adapted to receive either a said leading or a said trailing bit.

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