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Kniff et al.

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[54] **EXCAVATING TOOL DEVICE**

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[52] **U.S. Cl.** ..... **299/86**, 37/142 A, 175/354, 175/413, 299/92

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

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

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[57] **ABSTRACT**

An excavating tool device in which a tool which is symmetrical about a longitudinal axis is provided with a longitudinal shank rotatable in a bore in a support block while the support block is provided with a mounting rib detachably connected to a yoke which is adapted for being fixedly mounted on a drive member such as the drum of a mining machine.

11 Claims, 11 Drawing Figures

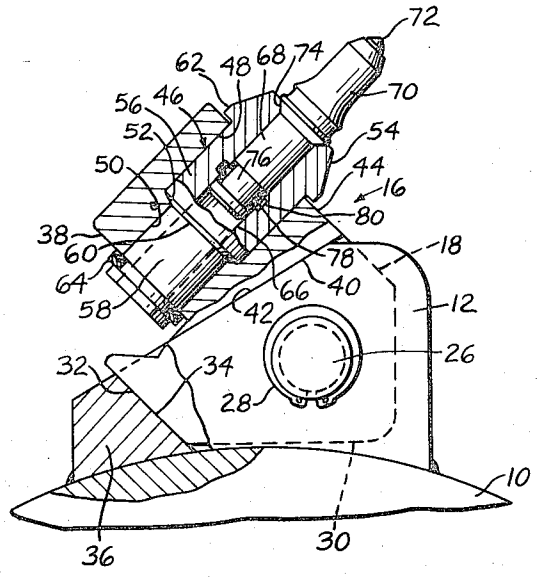


FIG-1

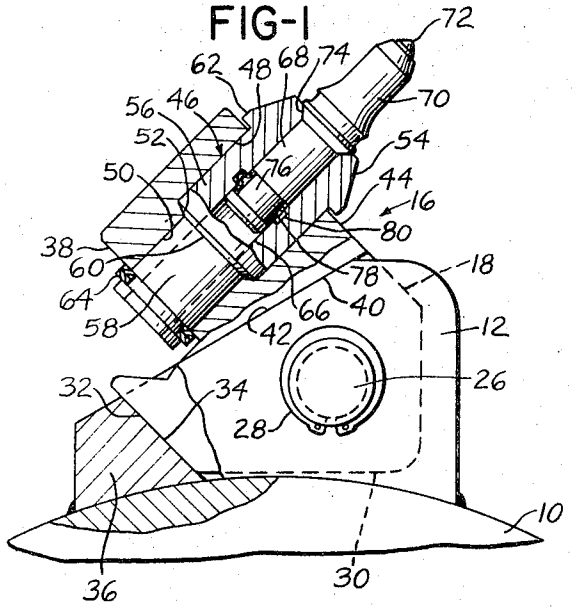


FIG-2

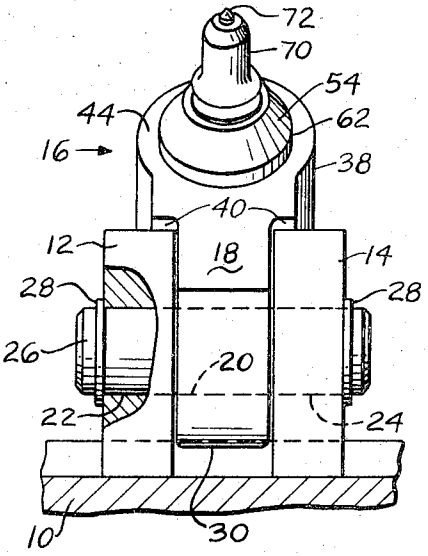


FIG-3

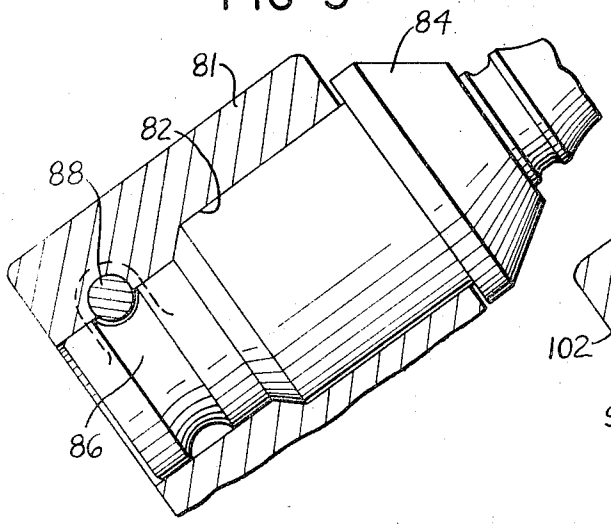


FIG-4

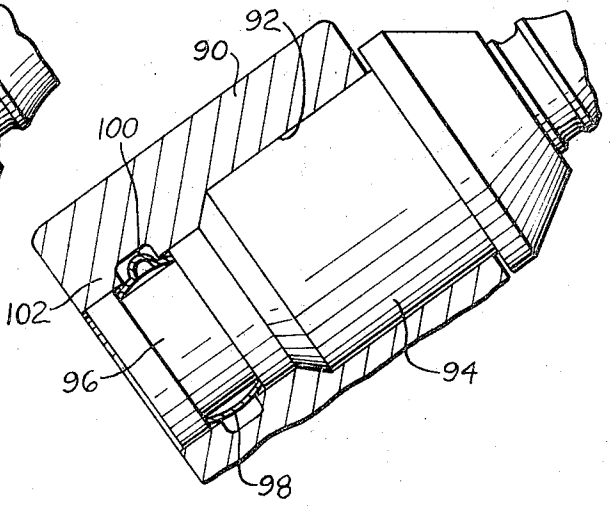


FIG-5

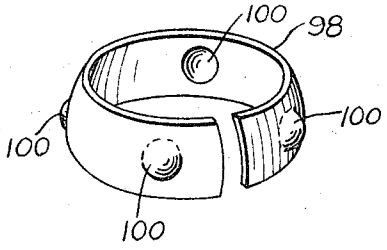


FIG-6

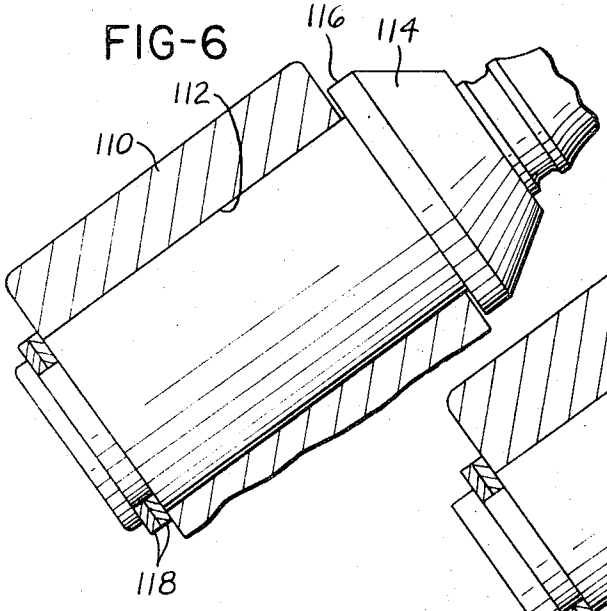


FIG-7

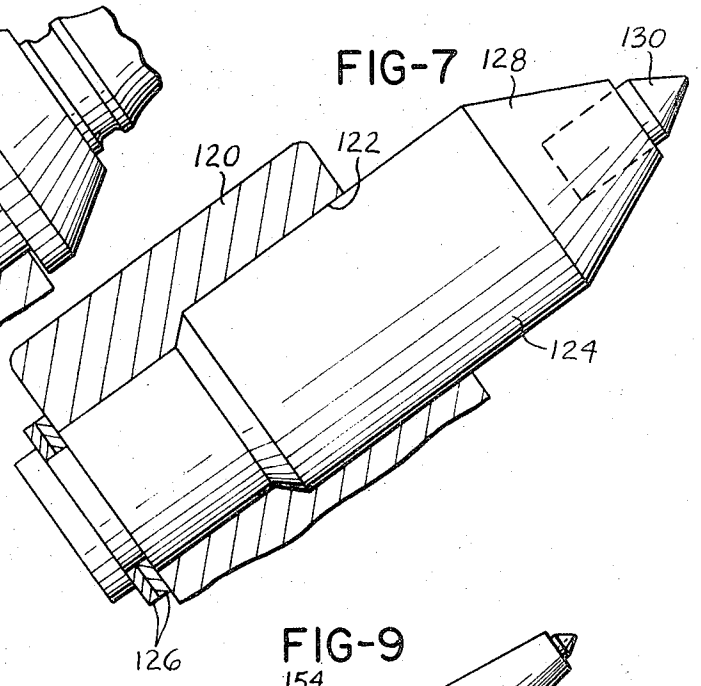


FIG-8

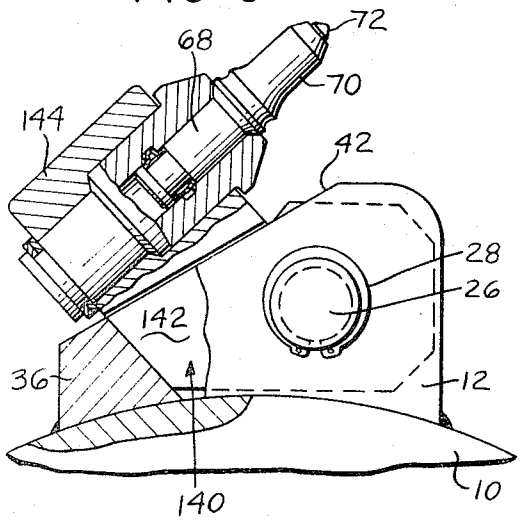


FIG-9

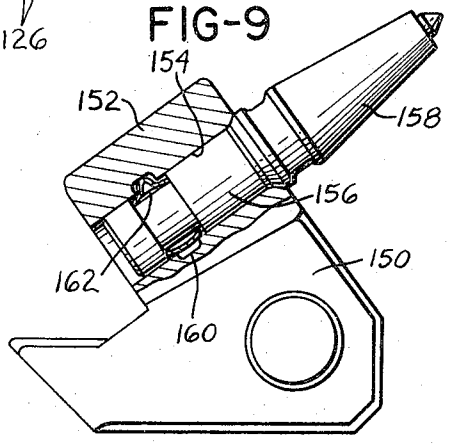


FIG-10

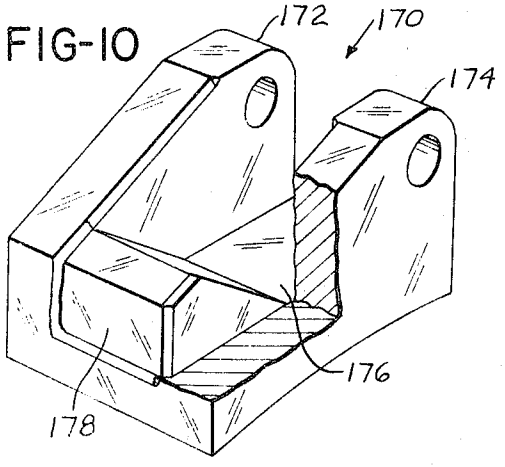
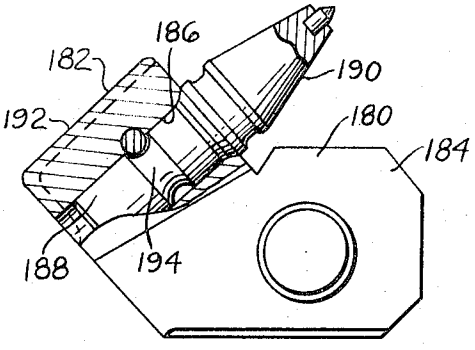


FIG-11



EXCAVATING TOOL DEVICE

The present invention relates to tool devices for mining and excavating and is particularly concerned with a tool device of the nature referred to so constructed and arranged as to be highly flexible with regard to the field of application and the adaptability thereof to various mining and excavating conditions.

Many excavating and mining tools employ drums and the like on which tools are mounted in distributed relation and which tools are driven into a formation to be reduced by movement of the drive member to drive the tools into the formation while advancing the drive member bodily towards the formation.

The present invention is particularly concerned with an improved tool device and mounting arrangement therefor for use with such mining and excavating machines.

A particular object of the present invention is the provision of a tool device and a mounting arrangement therefor having a wide range of adaptability to mining machines of various types.

Another object of the present invention is the provision of a tool device and a mounting arrangement therefor which provides a wide variation of tool placements on the member which drives the tool.

A still further object is the provision of a tool device for mining and excavating machines which has long life and which includes easily replaceable parts to permit the machine to remain in service substantially without interruption.

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 side view showing a tool device and a support arrangement therefor according to the present invention and mounted on a drum-like supporting member.

FIG. 2 is a view looking in from the right side of FIG. 1.

FIG. 3 is a fragmentary view showing a pin forming a keeper for retaining the tool device in the support block therefor.

FIG. 4 is a view like FIG. 3 but shows a different type of keeper for holding the tool in the block.

FIG. 5 is a perspective view showing the retaining device or keeper according to FIG. 4.

FIG. 6 is a fragmentary sectional view showing a modified type of tool device.

FIG. 7 is a fragmentary view showing a heavy duty tool adapted for mounting in a support block.

FIG. 8 is a view similar to FIG. 1 but shows a modified arrangement wherein the tool is supported so that the working end thereof is nearer to the surface of the supporting member or drum than is the working end of the tool in the FIG. 1 arrangement.

FIG. 9 is a sectional view showing a block like that of FIG. 8 but with a one piece tool mounted in the bore thereof.

FIG. 10 is a perspective view partly broken away showing a modified form which the support yoke for the blocks can take.

FIG. 11 is a fragmentary view of a block similar to that of FIGS. 8 and 9 but showing the tool retained in the block by means of a keeper pin.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a yoke is provided adapted for mounting on a driven member of a mining or excavating machine. The driven member may comprise a drum and the yoke is adapted for being fixed to the drum as by welding. A block is provided having a support rib adapted for detachable connection with the yoke as by a connecting pin extending through aligned apertures in the yoke and the supporting rib on the block.

The block is provided with a bore which diverges from the surface of the supporting member in the direction in which the yoke and block are driven by the supporting member and this bore is adapted for rotatably receiving a tool concentric with, and symmetrical about, the axis of the bore and projecting therefrom in the forward direction.

The tool may comprise a single element consisting of a shank portion receivable in the bore in the block and a working portion projecting forwardly from the shank portion and protruding out the front of the block, or the tool may consist of a sleeve rotatable in the bore in the block with a tool of the above mentioned nature rotatably mounted in the sleeve and protruding from the forward end.

The support block which receives the tools comprises a supporting rib adapted for detachable connection to the yoke and a portion connected to the upper side of the rib in which the aforementioned bore is formed. This last mentioned portion can upstand from the leading end of the rib or from the trailing end thereof and, since the bore can receive tools of different lengths, and either one part or two part tool devices, a plurality of different cutting radii can easily be achieved with one and the same basic supporting and drive member with yokes mounted thereon.

In practice, the yokes are distributed axially and circumferentially of the driving member, such as a drum, and in this manner complete and continuous treatment of the entire formation presented to the drum is accomplished. In general, the tools will be disposed in radial planes perpendicular to the axis of the drum, but it is also possible for at least the tool device near the ends of the drum to be tilted axially outwardly thereby to make certain that the amount of the formation reduced by the tool devices on the drum will be at least as long as the drum.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, in FIGS. 1 and 2, reference numeral 10 designates a supporting member which is in the form of the drum of a mining machine. The drum rotates in a clockwise direction as viewed in FIG. 1 and is advanced bodily toward the right, also as viewed in FIG. 1, while rotating.

Secured to the drum in circumferentially and axially distributed relation are yokes which, in the illustrated modification, take the form of a pair of legs 12 and 14 in parallel spaced relation fixedly secured to the drum as by welding.

The yoke is adapted for detachable connection with a block generally indicated at 16 and having a rib portion 18 receivable in the space between legs 12 and 14. Registering holes, 20 in rib 18, 22 in leg 12, and 24 in leg 14 receive a connector pin 26 which may be held

in place in any suitable manner as, for example, by snap rings 28 snapped in grooves formed in the pin 26 immediately outside legs 12 and 14.

Rib 18 has a bottom surface 30 closely adjacent the surface of drum 10 and at the trailing end has an upwardly and rearwardly inclined rearwardly facing abutment surface 32. Abutment surface 32 is adapted for abutting engagement with the upwardly and rearwardly inclined forwardly facing abutment surface 34 formed on abutment element 36 fixedly arranged between the trailing ends of legs 12 and 14, as by being welded to the legs or to the surface of drum 10.

Projecting upwardly from the upper side of supporting rib 18 is another portion 38 of the block which, as will best be seen in FIG. 2, is wider in the lateral direction than supporting rib 18. Portion 38 is formed with the downwardly facing shoulders 40 which are parallel to and in opposed relation to the downwardly and rearwardly inclined upper edges 42 of legs 12 and 14.

The leading face of at least portion 38 of the block, as indicated at 44, inclines rearwardly in the upward direction and portion 38 is, furthermore, formed with a bore 46 extending through face 44 and perpendicular thereto. The axis of bore 46 will be seen to diverge from the surface of drum 10 in the direction in which the yoke and block are moved when drum 10 rotates in its working direction.

Bore 46 has a larger diameter leading part 48 and a smaller diameter trailing part 50 and a forwardly facing shoulder 52 at the juncture of the said parts and which shoulder tapers outwardly toward the leading side of the block. Bore 46 rotatably receives a sleeve member 54 having a larger diameter forward portion and a smaller diameter rearward portion, indicated at 56 and 58 respectively with a rearwardly facing shoulder 60 at the juncture of said portions engaging shoulder 52 of the bore in the block.

The forward end of sleeve 54 protrudes outwardly from the leading end of bore 46 and comprises a radial flange 62 which may engage the front end of portion 38 of the block or which may be axially spaced therefrom. The sleeve 54, in the FIG. 1 modification, extends completely through portion 38 of the block and is rotatably retained in the block by a keeper in the form of snap rings 64 seated in grooves in the rearwardly protruding portion of the sleeve.

Sleeve 54 is provided with a bore 66 adapted for receiving the shank 68 of a tool which has a working portion 70 projecting forwardly from the front end of the shank portion and terminating in a hard wear resistant tip 72 which may consist, for example, of a cylindrical insert of cemented tungsten carbide with a point at the outer end.

At the juncture of the shank portion of the bit with the working portion thereof there is a tapered seat 74 engaging a correspondingly tapered mouth on the bore 66 in the sleeve.

The shank portion of tool 70 is provided with an annular groove 76 in which is seated an annular resilient keeper element 78 having at least one radial protuberant portion thereon engaging annular recess 80 formed in the bore 66 in sleeve 54.

In the described arrangement, sleeve 54 is rotatably supported in the block and tool 70 is rotatably supported in the sleeve. Working thrusts imposed on tool 70, and which will be substantially in the axial direction thereof, are transmitted to the sleeve via the tapered interengaging seat regions formed thereon and these thrusts will, in turn, be transmitted from the sleeve to the block via the interengaging shoulders 52 and 60. The thrusts exerted on the block are carried by the pin 26 and the interengaging abutment surfaces 32 and 34.

Inasmuch as the tool 70 can quickly be replaced in the sleeve, and inasmuch as the sleeve can easily be replaced in the block and, furthermore, since the block can easily be replaced in the yoke, the minimum amount of time is lost in connection with replacing the tools and the supporting parts thereof.

This is important in respect of mining machines because the tools, and the parts supporting the tools, are subjected to a high degree of abrasion and are heavily loaded, and are also somewhat unpredictably loaded because formations vary in hardness. Thus, tools can wear out quite quickly at certain times and breakage can also occur. It is, thus, quite important to be able to replace tools and parts supporting the tools quickly and easily in order to maintain the machine on which the tools are mounted in operation.

As will be further developed hereinafter, the arrangement illustrated for connecting the tools with the supporting member of the mining machine is also of considerable merit because it permits wide variation in the positioning of the working end of the tool to accommodate the assembly to different working conditions to permit the tool to be adapted to various types of machines.

The sleeve in the FIG. 1 modification is held in place in the supporting block when the snap ring is 64 mounted on the sleeve but other arrangements for holding the sleeve in the block can also be used. For example, in FIG. 3, a block 81 is illustrated having a shouldered bore 82 therein in which shouldered sleeve 84 is mounted.

For retaining sleeve 84 rotatably in block 80, the smaller diameter end of the sleeve is formed with an annular groove 86 while a transverse hole drilled in the block, and intersecting the periphery of bore 82 in the plane of groove 86, is adapted for receiving a pin 88 which loosely engages groove 86. Pin 88 forms a keeper which will prevent the sleeve from coming out of bore 82 while, at the same time, the sleeve is free to rotate in the bore.

In FIG. 4, block 90 has a shouldered bore 92 extending therethrough in which shouldered sleeve 94 is mounted. The smaller diameter portion of sleeve 94 is provided with a somewhat elongated fairly shallow annular groove 96 and disposed in groove 96 is a resilient slit ring 98 having a protuberant region 100 thereon engageable with the inwardly opening annular groove 102 formed in the smaller diameter portion of bore 92.

The resilient keeper ring 98 is shown in perspective in FIG. 5 and will be seen to comprise a strip of spring steel somewhat bowed in cross section and split and having dimple-like portions forming the aforementioned protuberant portions 100.

In FIG. 6, block 110 is provided with a straight bore 112 extending therethrough which rotatably receives a sleeve 114 having a radial flange 116 at the front end of block 110 which takes a bearing on the front end of the block. Sleeve 114 can be retained in the block in any of the aforementioned manners and is shown as having snap rings 118 mounted thereon on that portion

of the sleeve which protrudes from the back end of block 110.

All of the modifications previously referred to employ a tool in the form of a sleeve with a bit rotatably mounted in the sleeve. However, and particularly where hard formations are encountered, it is desirable to employ a heavier pick than can be mounted in a sleeve thereby to reduce the possibility of damage of breakage of the tool.

Such a pick type tool is shown in FIG. 7 wherein a block 120 is provided which has a shouldered bore 122 therein which receives a pick type bit 124 having a forward portion fitting in the larger diameter portion of bore 122 and a smaller diameter portion fitting in the smaller diameter portion of the bore. A shoulder connecting the two portions of the pick type bit bears on the shoulder in the bore in block 120. The bit 124 can be retained in assembled relation with block 120 by a keeper of any desired type and FIG. 7 shows the keeper in the form of snap rings 126 mounted on the end of the bit which protrudes from the rear end of the block.

The bit of FIG. 7 has a conical front end portion 128, the same as the tool bit 70 of the FIG. 1 modification, but, due to the larger dimensions of the body of the bit, a substantially larger pointed hard insert 130 can be mounted at the tip of the bit body. As before, the pointed insert 130 can be formed of cemented hard metal carbide material, such as tungsten carbide, the same as the pointed insert 72 of the FIG. 1 modification.

A feature of the present invention is that the dimensions of the body of the bit of FIG. 7 are the same within the range of the bore of the block as those of the sleeves previously described so that, at any time, a sleeve together with the tool bit mounted therein can be removed from a block and a heavy duty bit of the type illustrated in FIG. 7 placed in the block.

This exchange will permit the mining machine to proceed and to carry out heavy duty excavating operations and, at any time the formation ceases to be of such a nature to require a heavy duty bit, the heavy duty bit can be removed from the block and be replaced by a sleeve having a tool bit mounted therein.

FIG. 8 shows an arrangement somewhat similar to that of FIG. 1 and corresponding parts such as the drive member and the yoke bear the same reference numerals. The bit and sleeve in FIG. 8 also correspond substantially to those illustrated in FIG. 1, but the block supporting the sleeve and pick and connected to the yoke is different.

In FIG. 8, the block generally designated 140 has a web portion 142 disposed between the legs of the yoke and an upstanding portion 144 which is bored to receive the sleeve, but which is disposed near the rear end of web 142. By constructing the block in this manner, the point end of the bit is radially closer to the surface of drive member 10 than is the point end of the bit in the modification of FIG. 1.

FIG. 9 shows a support block 150 of the same general type which has been described, except in the upstanding portion 152 there is provided a bore 154 for receiving the shank portion 156 of a bit 158. The bore 154 is provided with a groove 160 and mounted on the shank of the bit is a spring clip retainer 162 which engages groove 160 when the bit is in place in the block and rotatably supports the pick in the block.

FIG. 10 shows a modified yoke 170 having the legs 172 and 174 thereof integral with a base portion 176. Disposed between the leg portions and resting on the base portion is the abutment element 178 which is advantageously welded about its entire rearwardly facing peripheral edge to the yoke.

FIG. 11 shows a block 180 similar to that block shown in FIG. 8, but wherein the upstanding portion 182, and which is positioned toward the rear of the web portion 184 of the block, is a bore 186 for receiving the shank 188 of a pick type bit 190 and with the bit being rotatably confined within the block by a pin 192 in the block loosely engaging annular groove 194 in the shank of the bit.

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

What is claimed is:

1. A tool device for use with excavating equipment comprising; yoke means having a leading end and a trailing end and having a bottom side adapted for being fixedly mounted on a driving member which is movable to drive the yoke means toward the leading end thereof, said yoke means comprising spaced support legs extending in the fore and aft direction and projecting upwardly away from said member, block means comprising an upper portion and at least one rib dependent from said upper portion and extending in the fore and aft direction and disposed in parallel adjacent and at least in part coextensive relation to said support legs and also having leading and trailing ends, connector means extending transversely through the legs on the yoke means and said rib detachably connecting said block means to said yoke means, bore means extending into said upper portion of said block means from the leading end thereof in the fore and aft direction and so inclined that the axis thereof diverges from the bottom side of said yoke means in the direction of movement imparted to said yoke means and block means by said member, tool means having shank means receivable in said bore means and having working end means concentric with said shank means and protruding outwardly from the leading end of said bore means, cooperating elements of abutment means on said tool means and block means to sustain working loads imposed on said tool means, keeper means retaining said tool means in said bore means while permitting rotation of the tool means in said bore means, the side of said rib facing away from said upper portion of said block means extending substantially parallel to the direction of movement of the block means during working operations, a rearwardly facing first abutment surface on the rear end of said rib disposed in a plane substantially perpendicular to the axis of said bore means in the block means, and a forwardly facing second abutment surface on said yoke means parallel to and engaging said first abutment surface.

2. A tool device according to claim 1 in which said upper portion of said block means is connected to the trailing end of the said rib.

3. A tool device according to claim 1 in which said upper portion of said block means is connected to the leading end of the said rib. 1

4. A tool device according to claim 1 in which the said bore means in the upper portion of said block means comprises a larger diameter portion adjacent the leading end of said block means and a smaller diameter portion adjacent the trailing end of said block means,

said bore portions being coaxial, and a forwardly facing shoulder at the juncture of said portions of said bore means, said tool means comprising shank means having a larger diameter leading portion and a smaller diameter trailing portion and a rearwardly facing shoulder at the juncture of said portions of said shank means, said shank means being rotatable in said bore means and the said shoulder on said tool means and the shoulder in said bore means being in thrust transmitting engagement when said shank means is disposed in said bore means, and keeper means carried by at least one of said block means and shank means and operatively engaging the other thereof for retaining said shank means in said bore means and preventing any substantial degree of axial movement of the shank means in the bore means while leaving said shank means free to rotate in said bore means.

5. A tool device according to claim 1 in which said shank means is in the form of a sleeve having an axial bore therein, said tool means comprising a tool having a tool shank receivable in the axial bore in said sleeve from the front end of the sleeve, said tool having a working portion concentric with the axis of said tool shank and protruding forwardly therefrom, said elements of abutment means comprising a forwardly facing abutment surface on said sleeve and a rearwardly facing abutment surface on said tool in engagement therewith and a forwardly facing abutment surface in said bore means and a rearwardly facing abutment surface on said sleeve in engagement therewith, and a keeper means connecting said tool shank to said sleeve and said sleeve to said block means permitting free rotation of the tool shank in the sleeve and the sleeve in the bore means while preventing any substantial forward movement of the tool in the sleeve or the sleeve in the bore means.

6. A tool device according to claim 5 in which said keeper means includes a resilient keeper element captive on said tool shank and said sleeve comprises internal recess means engageable by said keeper element when said tool shank is inserted into said sleeve.

7. A tool device according to claim 1 in which the upper edges of said legs incline downwardly toward the trailing end of said yoke means, said block means comprising downwardly facing shoulders parallel to and overlying the said upper edges of said legs, said yoke means having a substantially flat upwardly facing surface between said legs extending in the direction of movement of the tool device during work operations, said rib on said block means having a bottom surface parallel to and adjacent said upwardly facing surface.

8. In an excavating tool device; a support block having leading and trailing ends, a bore extending in the fore and aft direction through the block, said bore adapted for receiving a tool having a shank portion insertable into said bore from the forward end of the bore and rotatable in the bore, forwardly facing abutment means on said block concentric with said bore for engagement with rearwardly facing abutment means on the tool, the said tool including a working portion concentric with the shank portion and protruding outwardly from the forward end of the bore when the shank portion is seated in the bore, keeper means adapted for operatively interconnecting said tool and block and preventing any substantial degree of axial movement of the tool in said bore while permitting free rotation of the tool in said bore, said block having at least one fore and aft rib integral therewith and projecting therefrom substantially in a plane which contains the axis of said bore, said rib including a lateral bore for receiving a pin for connection of the block to a support member, and means forming a rearwardly facing abutment region at the trailing end of said rib substantially perpendicular to and laterally offset from the axis of said bore and adapted for engagement with a forwardly facing abutment region on a said support member, the side of said rib which faces away from said block extending in the direction of movement of said block, the axis of said bore and the said side of said rib diverging in the forward direction.

9. A tool device according to claim 8 in which said bore comprises a larger diameter forward portion and a smaller diameter rearward portion and said abutment means comprises a forwardly facing shoulder at the juncture of said bore portions.

10. A tool device according to claim 9 in which said portions of said bore are about equal in axial length and said shoulder is in about the middle of the length of said bore.

11. A yoke especially adapted for receiving a block for supporting a rotary mining tool, the block having a dependent fore and aft rib, said yoke comprising a base having a bottom surface with leading and trailing ends and adapted for mounting on a driving member for being driven thereby in the forward direction toward the leading end of said bottom surface, spaced parallel legs fixed to said base along the side edges thereof and extending in the fore and aft direction and diverging from said bottom surface in the forward direction, said legs adapted for closely receiving said rib therebetween, registering lateral bores in said legs near the forward ends for receiving a pin to connect the rib to the legs, and an abutment element on said base and upstanding therefrom near the trailing end having a forwardly facing abutment surface substantially perpendicular to the axis of the rotary tool and laterally offset therefrom, said surface adapted to abut a rearwardly facing abutment region on a rib disposed between said legs.

* * * * *