Feb. 1, 1955 M. McCLENNAN 2,701,126

AUGER HEAD

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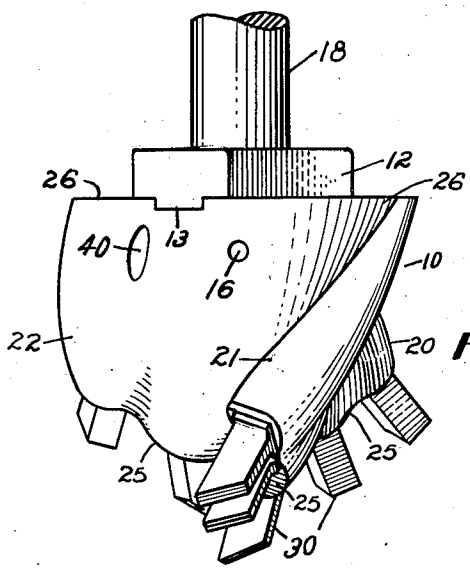


Fig. 1

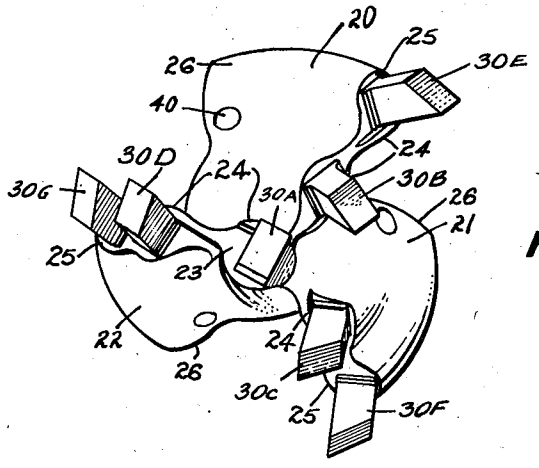


Fig. 2

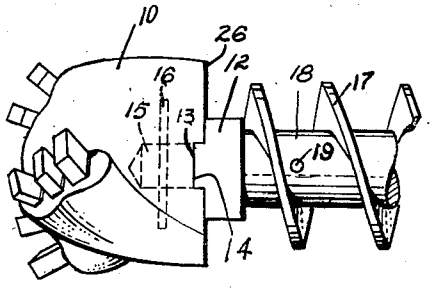


Fig. 3

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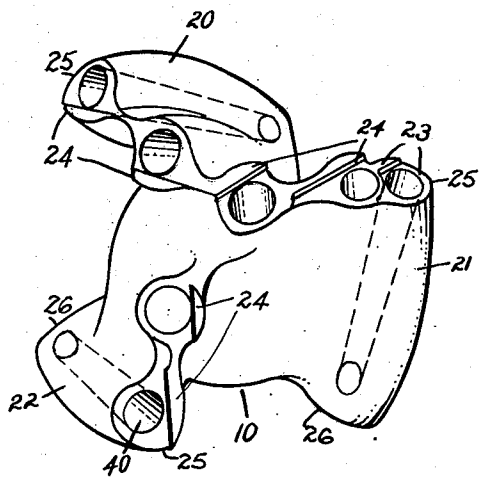


Fig. 4

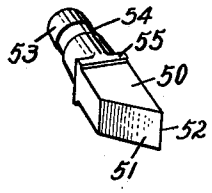


Fig. 5

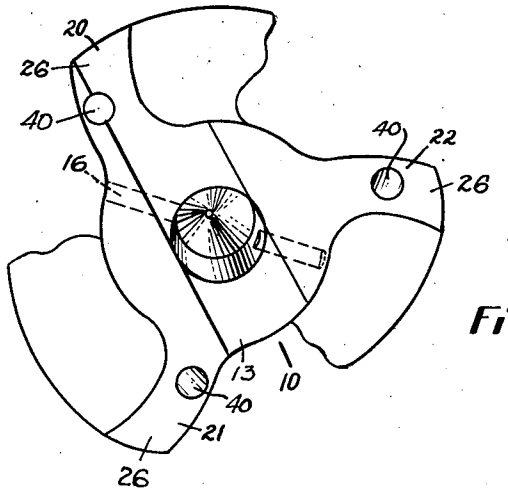


Fig. 6

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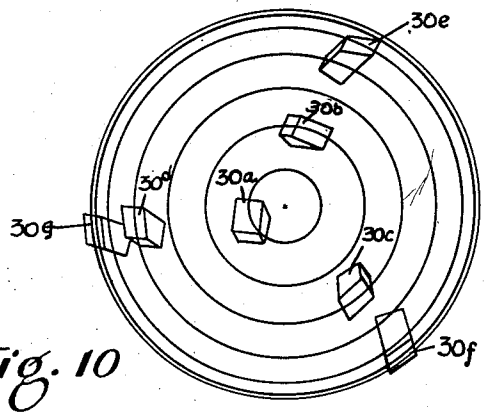


Fig. 10

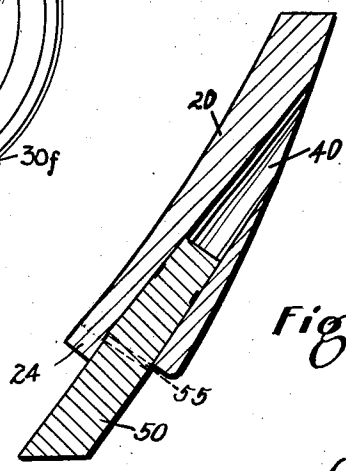


Fig. 9

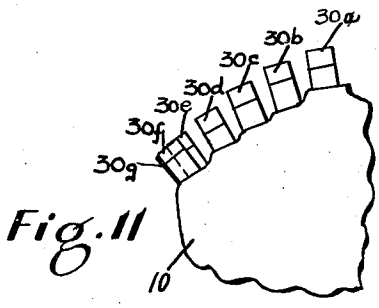


Fig. 11

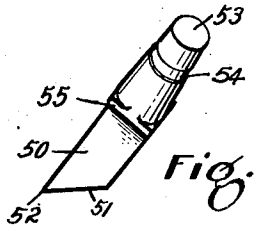


Fig. 8

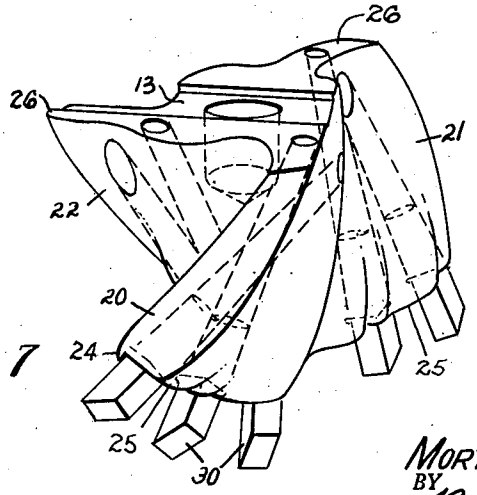


Fig. 7

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2,701,126

AUGER HEAD

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Application August 15, 1950, Serial No. 179,431

11 Claims. (Cl. 255—61)

This invention relates to drilling apparatus and more particularly to improvements in augers for drilling holes in earth rock and the like.

Drilling apparatus, including auger heads or drilling bits of the class of this invention, exist in various forms in the prior art. In most cases, however, the prior art augers and bits are subject to operating limitations which restrict their efficiency and usefulness sufficiently to fall short of the ultimate in operating characteristics.

The improved auger head of this invention more nearly approaches the desired ultimate operating characteristics by reason of a construction which enables the auger head to drill a hole of a given diameter to a greater depth than has been possible with prior art apparatus under like conditions. This results in a reduction of the number of times such an auger head must be removed from the hole for sharpening and replacement of cutting elements or bits. The resultant saving of time in the overall drilling operation increases the efficiency of the tool and enhances optimum operation.

The present invention relates to an improved body construction for an auger head and attendant improvements in the manner of removably mounting the cutting elements in position on the head as well as in the coupling of the auger head to a drill shaft.

Accordingly, it is an object of this invention to provide an auger head having an improved mounting surface for the cutters which will more effectively counteract the operating forces normally acting on the cutters.

Another object of this invention is to provide an improved manner of removably mounting the cutters in an auger head which will facilitate replacement and sharpening of the cutters associated with the auger head.

A further object of this invention is to provide a drilling tool having an improved drilling head which will require a minimum of sharpening and result in increased operating efficiency as well as improved and more efficient replacement and sharpening of cutting elements.

A still further object of this invention is to provide an improved coupling arrangement between a drill shaft and a drill bit.

Briefly, in accordance with this invention I provide an auger head having a rotatable body portion provided with a series of vanes which extend outward relative to the axis of rotation and which are provided with a plurality of individual cutters on the extended leading vane surfaces. The cutter mounting surface on the vane leading surfaces are shouldered in a manner to reinforce the cutter in a direction to counteract the main operating force thereon, and the cutters are mounted on the head within frustro-conical apertures extending from the lead mounting surface through the vane portions to provide access thereto from the trailing side of the auger head, thereby facilitating ready removal of the cutter by merely tapping the bit from the open recess end. The invention also contemplates an improved arrangement for coupling the auger head to a drill shaft.

In the drawings, Fig. 1 is a side view of an auger head embodying the present invention; Fig. 2 is a bottom or end view of the device shown in Fig. 1; Fig. 3 is a side view of the head attached to the usual drilling shaft with its axis of rotation in a horizontal plane; Fig. 4 is a view of the leading end of the auger head with the cutter elements removed; Fig. 5 is a perspective view of one of the cutters; Fig. 6 is a perspective view showing the top or trailing end portion of the head which is normally attached to a drilling shaft; Fig. 7 is a perspective view from the

side of the auger head indicating the manner in which the cutters are inserted in the extending vanes; Fig. 8 is a perspective view of one of the cutters taken from a different angle than that illustrated in Fig. 5; Fig. 9 is a section through the head and one of the recesses showing a cutter mounted therein; Fig. 10 is a diagrammatic view illustrating the spacing of the respective cutters on the auger head; and Fig. 11 is a composite diagram illustrating the positions of the various cutters with respect to the center of the axis of rotation of the auger head.

Referring now to Fig. 1, the improved auger head of this invention comprises a substantially cylindrical body **10** having provision for a removable coupling member in the form of a reduced shank **12** extending axially therefrom. The shank end of the auger head has a transverse key-way slot **13** which is adapted to receive an extending key-way guide portion **14** of the shank coupling member **12** in interlocking engagement. The removable shank **12** also has a central frustro-conical portion **15** adapted to extend axially from the key portion **14** into a tapered or frustro-conical recess located centrally in the shank end of the auger head. This central portion acts as a socket for the coupling shank and has a transverse aperture therethrough adapted to receive a pin **16** which may be inserted through corresponding apertures in the main body **10**. The resulting coupling shank is thus removably connected to the auger head and restrained against axial movement by the pin connection with the central extension and further restrained against rotation relative to the auger head by virtue of the key portion **14** on the shank **12** and the tapered socket which supports the shank extension **15** in the auger head.

The shank **12** has another axial extension at the end opposite the central portion **15** which is rectangular in cross section and which is adapted to be received by a complementary shaped socket formed in one end of a hollow axial stem in a drilling shaft generally indicated at **18**. The assembled auger head and shank coupling member is preferably secured to the drilling shaft **18** by a pin arrangement generally indicated in Fig. 3 at **19**. When coupled in position to the shaft, the upper surface of the body portion **10** of the auger head abuts the lower end of the shank **12** which, in turn, transmits both rotation and axial thrust from the shaft to the auger head.

The body **10** of the auger head is provided with a plurality of vanes which extend outwardly from the body relative to its axis of rotation. By way of exemplary disclosure three of such vanes **20**, **21** and **22** are shown in the drawings and each has a forward edge **25** and a rearward edge **26**. These vanes are substantially equidistantly spaced about the axis and each vane extends and curves outwardly and forwardly relative to the axis and direction of rotation of the body which, as illustrated in the drawings is adapted for right hand or clockwise rotation. The vanes are also swept back from the forward edge to the rearward edge so that the rearward edge is offset behind the forward edge. Thus material removed by the head would readily pass upward.

A plurality of cutters **30** are carried by the body **10** on the forward edge **25** of the vanes **20**, **21** and **22**, and may be positioned successively in a relatively straight line thereon. The forward edge **25** of each of the vanes is stepped and shouldered from the axis of rotation as best seen (**23**) in Figs. 1, 2 and 4 in order to provide a flush or flat surface for each of the cutters. The net result is that the forward edges of each of the vanes presents a generally convex face except for the stepped portion supporting each of the cutters.

Referring now to Fig. 4, where like numerals designate like parts, it will be seen that the forward vane edge is machined across each of the stepped portions to provide a flat surface **23** for each of the cutters and further to provide a shoulder **24** adjacent each of the cutters at the forward side of the cutters relative to the direction of rotation of the auger head. Such a construction provides for reinforcement on the auger head aiding the cutters in opposing the various operating forces acting on each of the cutters during drilling operations. These cutters extend substantially outwardly from the leading surfaces of the auger head and project forwardly toward the direction of rotation of the auger.

In the embodiment illustrated in Figs. 1 to 10, with particular reference to Figs. 2 and 4, two cutters **30** are mounted on each vane and one cutter is mounted centrally on the body **10** and is offset adjacent its axis of rotation. The central cutter **30***a* is positioned with one of the corners of its cutting face adjacent the axis extended of the head and is preferably shaped to permit the auger to rotate about such axis. The cutters **30** are positioned so that the innermost cutter on each of the vanes cut annular paths adjacent to that of the central cutter **30***a*. As best illustrated in Fig. 10, each of the cutters on the respective vanes is mounted on flat stepped surfaces at increasing radii from the central cutter *30a*, which has the smaller radius, to the outermost cutter **30***g* on the vane **22**. The arrangement of the cutters is preferably such that a suitable core space is provided between the paths of the adjacent inner cutting elements as diagrammatically illustrated in Figs. 10 and 11. The illustration of Fig. 11 represents the cutting area presented by all of the cutting elements when resolved into a common plane. Such an arrangement of cutting elements provides for a highly efficient operation of the auger.

As illustrated, each of the cutter elements is individually and removably mounted in the forward edges of their respective vanes on the auger head. The cutters are preferably made of high speed steel as, for example, a high speed cobalt steel. As shown in Figs. 5 and 8, each cutter has a shank **50** rectangular in section and having a beveled surface **51** at one end which forms a cutting edge **52** at the base of the cutter. The other end **53** of the cutter is frustro-conical and is adapted to seat in complementary shaped apertures **40** formed in the forward edges of the respective vanes on the auger head. The recesses **40** extend in a straight line through the respective vanes to provide ready access thereto at the end opposite the cutter.

As illustrated in cross section in Fig. 9 each of the cutters are further provided with a shouldered portion **55** at the intersection of the frustro-conical portion with the rectangular portion forming the cutter. The shoulder **55** acts as a limiting stop which determines the extent of insertion of the cutter in the corresponding vane aperture. The diameter of the aperture **40** is chosen to provide a snug locking fit for the cutter carried therein, thereby frictionally retaining the cutter within the aperture to restrict and limit the turning movement.

The described arrangement enables simple and efficient removal of the cutters from the auger head by merely inserting a tool in the opposite end of the aperture **40** and tapping the cutter out of the aperture for repair or replacement. In order to further enhance the efficient and simple removal of the cutter elements, I have provided a transverse undercut **54** a suitable distance from the frustro-conical end of the cutter which acts as a relief to prevent burring of that end from repeated blows during removal.

For convenience, the improved auger head has been described to a great extent with reference to a vertical axis and as having its cutting elements on the bottom of the head. It is to be understood that the auger head may be used with its axis in any position desired, the horizontal position being illustrated in Fig. 3, and that such references in the specification and claims are relative only.

The auger head of this invention has an improved body construction which provides a reinforced mounting for cutting elements on an auger head of the type described and provides further for easy access and ready removal and replacement of the cutters from the auger head. This invention also provides an improved coupling arrangement which results in an improved operational assembly for the auger head and drilling shaft in accordance with the initial objectives of the invention. The result is an improved drilling tool which will minimize the length of time required for a drilling operation by reducing the amount of the sharpening and by enhancing and aiding the sharpening process with a structure facilitating removal of the cutters from the auger head to further reduce the intermediate losses of time and thereby increase the operating efficiency of the drilling apparatus.

I have shown and described what I consider to be the preferred embodiments of my invention along with similar modified forms and suggestions and it will be obvious to those skilled in the art that other changes and modifications may be made without departing from the scope of my invention as described by the appended claims.

I claim:

1. In a drilling tool having a drill shaft and a drill bit mounted for rotation about the longitudinal axis of said drill shaft, said drill shaft having a hollow axial stem at one end, said drill bit having a transverse key-way slot and a central frustro-conical aperture in one end thereof, a coupling member comprising an extended shank having a transverse key-way guide a central frustro-conical axial extension carried by the key-way guide and having a transverse aperture therethrough, the other end of said coupling member having a rectangular cross section with a transverse aperture therethrough, said drill bit having a transverse aperture through the body portion adapted for alignment with the aperture in said central frustro-conical extension when seated in the central aperture of said drill bit body portion, said drill shaft also having a transverse aperture adapted to be aligned with the aperture in said rectangular end of the coupling member when seated in the hollow axial stem of said drill shaft, and a locking pin for insertion through each of said aligned apertures in the drill bit and drill shaft when coupled to said coupling member.

2. An auger head comprising, a body adapted for rotation about and movement along a central axis through the body, said body having a forward and a rearward axial end, a plurality of vanes circumferentially spaced about the axis and extending outward from the body, each vane having a forward edge and a rearward edge spaced from each other along the axis of rotation, the forward edges of each vane intersecting at the axis, each vane also having a leading face and an opposite trailing face with respect to the direction of rotation, the forward edge of each vane being stepped in a rearward direction progressing outwardly from the axis, each stepped portion partially overlapping the next succeeding stepped portion adjacent the leading face of the corresponding vane to provide a reinforcing leading shoulder for each stepped portion, each partially overlapped stepped portion having means for supporting a cutter, and a cutter extending forwardly from each partially overlapped stepped portion on the trailing side of the corresponding reinforcing shoulder.

3. The auger head of claim 2 wherein each stepped portion is spaced a different distance from the axis of rotation.

4. The auger head of claim 2 wherein the cutter supporting means on each stepped portion includes a frusto-conical aperture extending inwardly in the plane of the axial vane surface and wherein each cutter has a frusto-conical shank portion adapted to be removably secured in snug fitting relation in the corresponding aperture.

5. The auger head of claim 2 wherein the cutter supporting means on each stepped portion includes a frusto-conical aperture extending inwardly along the plane of corresponding axial vane surface, and wherein each cutter is provided at one end with a frusto-conical shank adapted to be removably mounted in snug-fitting relation within the corresponding aperture, the other end of each cutter being rectangular in cross-section and having a beveled surface at its extremity forming a cutting edge, one face of the rectangular end of the cutter adapted to seat against the rearward side of the corresponding reinforcing shoulder, and means for limiting the extent of the insertion of the cutter shank portion into the corresponding aperture.

6. An improved removable cutter element for an auger head comprising, an elongated member having a frusto-conical shank portion at one end and having a rectangular cross-section at the other end with a beveled surface forming a cutting edge at the extremity, an integral transverse shoulder intermediate at least one face of the rectangular end and the shank portion of the said member adapted to act as a stop for limiting the insertion of the shank portion into the receiving aperture of an auger head.

7. In a drilling tool having a drill shaft and a drilling bit adapted for rotation about the longitudinal axis of the shaft, said drill shaft having a hollow axial stem at one end, said drill bit having a transverse key-way slot at one end and a frusto-conical aperture extending axially from the slot into the bit, coupling means comprising a shank member having a co-operative transverse key-way guide at one end with a frusto-conical portion extending

axially therefrom, the key-way guide and axial extension of the shank member adapted to interlock with the frusto-conical aperture and key-way slot of the bit in assembled relation, the other end of said shank member adapted to seat in the hollow stem of the drill shaft, and removable means for locking each end of the shank member in the drill bit and in the drill shaft respectively.

8. In a drilling tool having a drill shaft adapted to rotatably drive an auger head about the longitudinal shaft axis, said auger head comprising a body portion having a plurality of circumferentially spaced vanes extending outwardly from the body and in spaced relation from each other about the axis, the body portion having a transverse key-way slot at the trailing end with a frusto-conical aperture extending axially from the slot into the body, said drill shaft having a hollow axial stem at one end, coupling means comprising a shank member having a transverse key-way guide with a frusto-conical projection extending axially from one end thereof and adapted to interlock with the key-way slot and aperture in the body portion of said auger head, the other end of said shank member adapted to be seated in the hollow stem of the drill shaft, and removable means for locking each end of the shank member in the auger head body and in the drill shaft respectively.

9. In a drilling tool having a drill shaft and an auger head mounted thereon for rotation about the longitudinal shaft axis, said auger head comprising a rotatable body portion having a plurality of circumferentially spaced vanes extending outwardly from the body from the axis and in spaced relation from each other about the axis, the trailing end of said auger head having a transverse key-way slot with a central tapered socket extending into the body portion, said drill shaft having a hollow axial stem at one end, a coupling shank member having at one end a transverse key-way guide with a central tapered projection extending axially therefrom and adapted to interlock with the key-way slot and socket in the trailing end of said auger head, the tapered projection of said shank member having a transverse aperture therethrough, the body portion of said auger head also having a transverse aperture adapted to align in assembled relation with the aperture through said tapered projection, the other end of said coupling shank member having a rectangular cross-section with a transverse aperture therethrough, said drill shaft also having a transverse aperture adapted to align in assembled relation with the aperture through said other end of the coupling shank member, and a pair of locking pins each adapted to be inserted through the alined apertures in the auger head and the drill shaft respectively when coupled to the interlocking portions of coupling shank member.

10. An improved removable cutter element for an auger head comprising, an elongated member having a frustro-conical shank portion at one end with a beveled cutting edge at the other end, said shank portion having an intermediately located circumferential recess forming an undercut portion transverse to the longitudinal axis of the cutter to provide multiple shank bearing surfaces.

11. The auger head comprising a body adapted for rotation about and movement along the central axis through the body, said body having a forward and a rearward axial end, a plurality of vanes circumferentially spaced about the axis and extending outwardly from the body, each vane having a forward edge and a rearward edge spaced from each other along the axis of rotation, the forward edges of each vane intersecting at the axis, each vane also having a leading face and an opposite trailing face with respect to the direction of the rotation, the plane of the faces of each vane being swept back from the forward edge to the rearward edge, whereby the rearward edge of each vane is offset behind the forward edge thereof, the plane of the faces of each vane also curving from the body toward the outward extremity thereof and into the direction of rotation, the forward edge of each vane being stepped in a rearward direction progressing outwardly from the axis, each stepped portion partially overlapping the next succeeding step portion adjacent the leading face of the corresponding vane to provide a reinforcing leading shoulder, each partially overlapped stepped portion having means for supporting a cutter, and a cutter extending forwardly from each partially overlapped stepped portion on the trailing side of the corresponding reinforcing shoulders.

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