

Nov. 12, 1940.

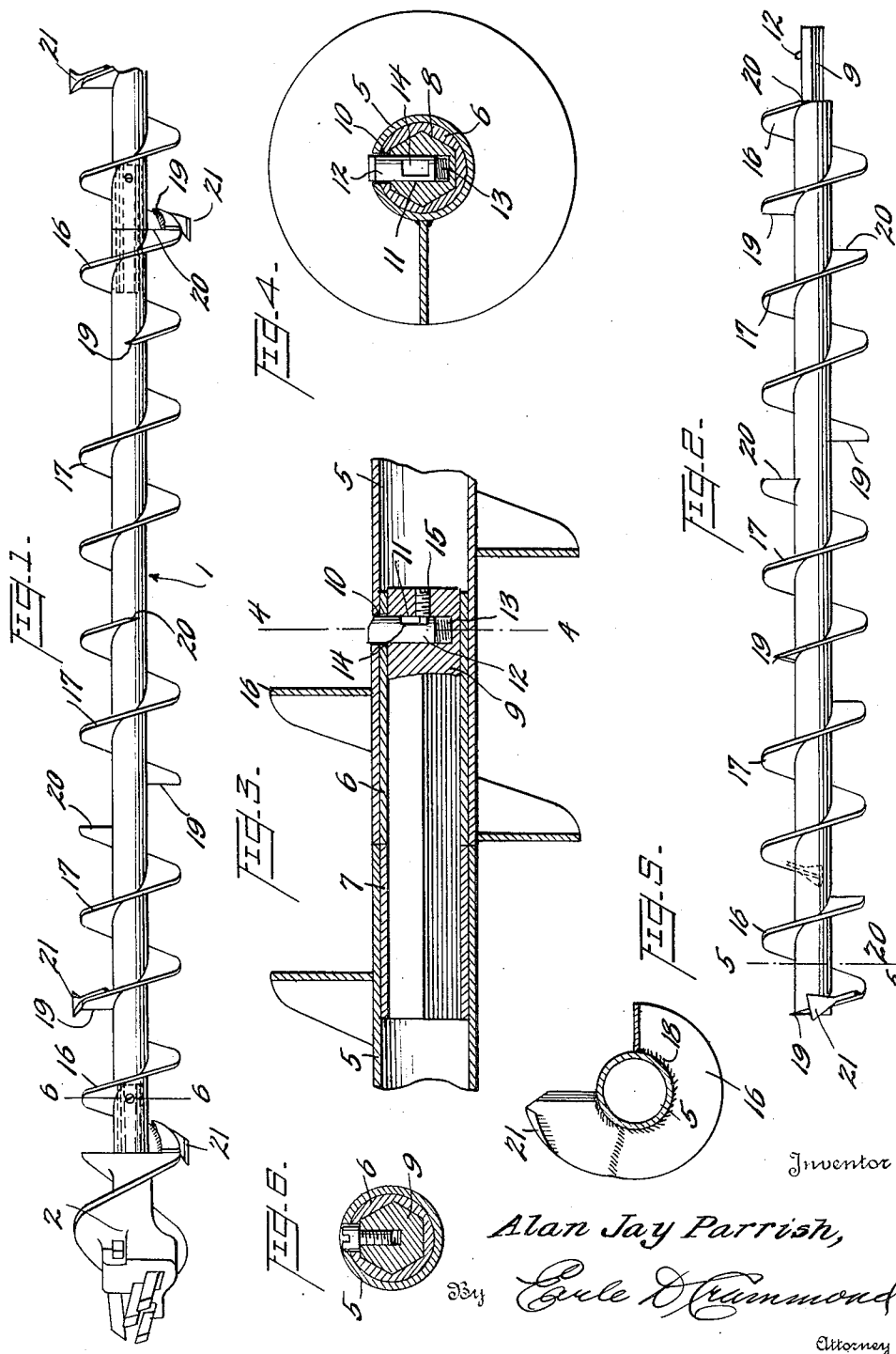
A. J. PARRISH

2,221,680

AUGER

Filed Aug. 3, 1939

2 Sheets-Sheet 1



Inventor

Alan Jay Parrish,

By *Carle & Hammond,*

Attorney

Nov. 12, 1940.

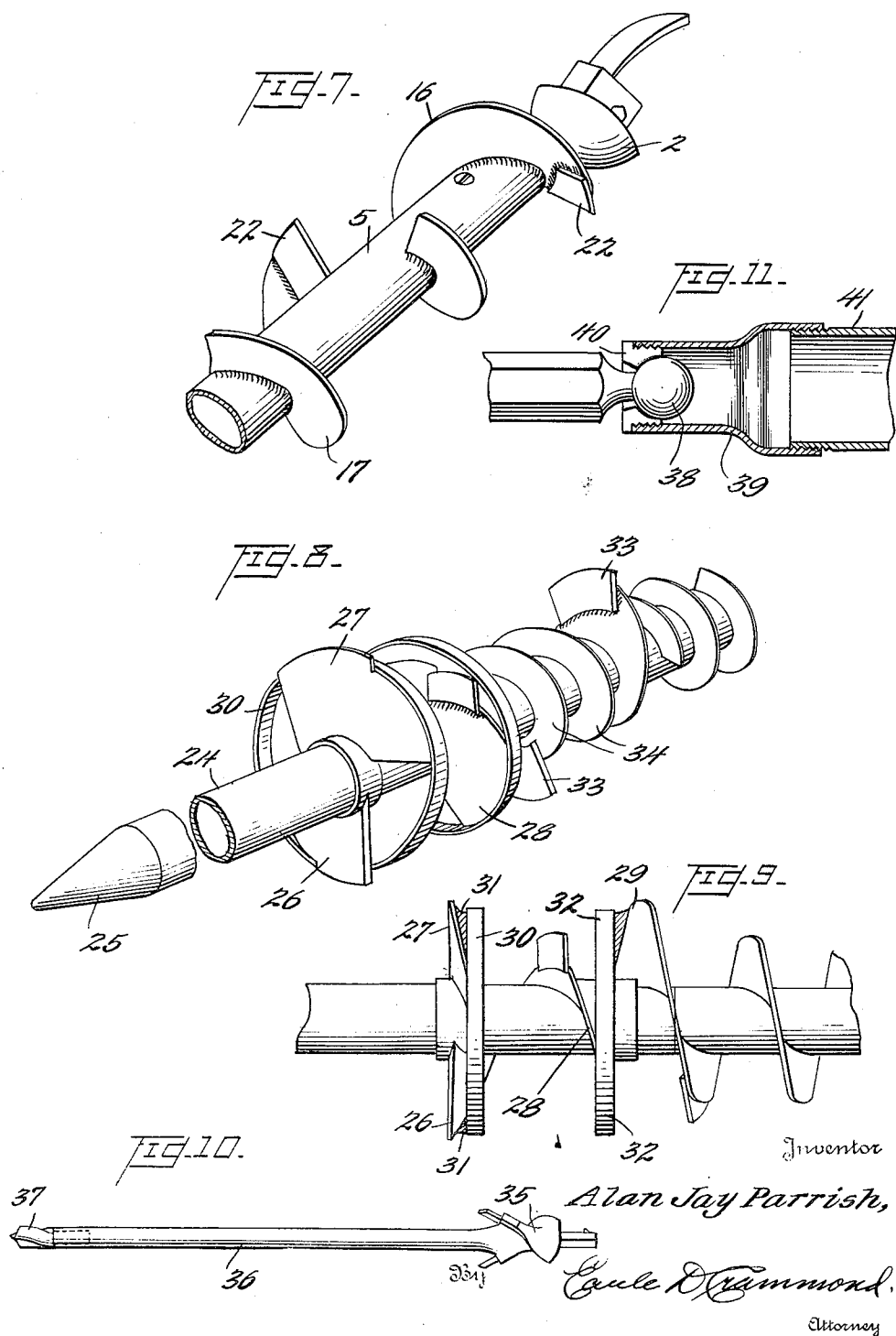
A. J. PARRISH

2,221,680

AUGER

Filed Aug. 3, 1939

2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,221,680

AUGER

Alan Jay Parrish, Paris, Ill.

Application August 3, 1939, Serial No. 288,237

6 Claims. (Cl. 255—69)

This invention relates to boring tools, and more particularly to earth boring augers which are self-clearing when operated under substantially all boring or drilling conditions.

Earth boring and drilling operations, which involved running accurate holes of any great length, have presented major difficulties due to the tendency of ordinary auger structures to plug with material from the hole which packs around the tool. Where augers are used drilling in clay, muck or the like, it has been necessarily the practice to repeatedly back off the tool to clear it of the plug of material which packs around the tool. This packing or loading of the auger flights under some ground conditions produces abnormal resistance and load conditions resulting in tool or machine breakage and also materially increases costs and delays operations. Considerable difficulty has also been experienced in making earth borings with accuracy and with clean holes under all ground conditions. Continuously progressive drilling without tool breakage and the necessity of repeatedly withdrawing augers for cleaning has not heretofore been possible under some ground conditions, particularly when holes of considerable length were found to be necessary.

The present invention aims to overcome earth boring difficulties which have been pointed out as attendant with augers in drilling operations. The invention therefore has among its objects the provision of an auger structure which will be self-clearing under substantially all ground conditions and which will provide clean cut holes of maximum diameter for an auger of given outside diameter.

A further and more specific object of the invention is to provide an auger having main and secondary cutters and interrupted cutting flights throughout its length with the auger comprising a single section or a series of duplicate quick detachable sections and a detachable leading cutter head.

Other objects include the provision of an auger having a seamless tube shaft and mild steel flights highly resistant to breakage in rocky soil conditions, and the provision of interchangeable auger guiding head structures.

Other objects of the invention will become apparent from the detailed description of the invention which follows, wherein preferred embodiments of the invention are described with reference to the accompanying drawings, wherein—

Figure 1 is a plan view of a sectionalized auger embodying the invention.

Fig. 2 is a plan view of an auger section at right angles to Fig. 1.

Fig. 3 is an enlarged longitudinal section illustrating cooperating male and female ends of auger sections.

Fig. 4 is a cross section on the line 4—4 of Fig. 3.

Fig. 5 is a cross section on the line 5—5 of Fig. 2.

Fig. 6 is a cross section on the line 6—6 of Fig. 1.

Fig. 7 is a perspective view showing an auger with modified form of cutters.

Fig. 8 is a perspective view showing a modified form of large auger construction.

Fig. 9 is a plan view of the auger of Fig. 8.

Fig. 10 is a plan view of a modified guiding head structure.

Fig. 11 is a plan view of an auger head attachment for pulling flexible pipes through a pre-bored hole.

In Fig. 1, there is shown a sectionalized auger comprising duplicate auger sections 1—1 and cutter head 2 with bit teeth 3 detachably connected with the forward or leading end of the assembly. An auger may comprise any number of interchangeable auger sections 1 successively joined together in the course of an extended drilling operation by quick detachable connections hereinafter described. The forward or leading section is associated, by detachable connections corresponding to those between auger sections, with one or the other of a plurality of interchangeable cutter heads of the type illustrated in Figs. 2 and 10, which are provided with a plurality of sets of detachable bits 3 outwardly inclined with respect to the axis of the auger and form the main cutters for the auger. The bit teeth and the secondary cutter on the following auger sections presently to be described, define the maximum diameter of the auger.

Each auger section consists of a tubular shaft 5 of high grade seamless tubing having within its end portions cylindrical heat treated and hardened inserts 6 and 7, providing respectively a female coupling member at the leading end having a hexagonal bore 8 throughout its length, and a male coupling member at the trailing end of the auger section having a reduced hexagonal shank or spline 9 for cooperation with a driving member or the female coupling member of another auger section. The coupling inserts are

preferably joined with the tubular shaft by electric welding and bear predetermined relationship to each other and flights of the auger to insure proper connection between auger sections and between the leading auger section and the cutter head. This definite relationship is insured by providing a radial bore 10 through the tubular shaft and coupling member 6 at the front end of the auger section, and, in predetermined position with respect thereto, a recess 11 in the hexagonal shank or spline 9 and a latch bolt 12 slidably mounted therein against the pressure of a spring 13. The bolt has limited movement defined by a slot 14 in its side which receives the end extension of screw bolt 15 mounted axially in the splined extension. The bolt is beveled to facilitate engagement of auger sections. Its inward travel against the spring is sufficient to permit its end to lie at least flush with the surface of the spline member, and projected travel is sufficient to allow it to pass through the walls of the shaft and insert in bore 10 of a cooperating auger section. Proper coupling of auger sections is made by merely telescoping the splined connecting members of two auger sections with the latch bolt aligned with its receiving opening in the adjacent section. Sections may be disconnected merely by pressing inwardly on the latch bolt to clear it and then pulling the sections apart.

Each auger section further comprises a series of spaced spiral flights 16 and 17 of mild steel electrically welded, as at 18, along the inner edges of the flights to the tubular shaft. Forward and trailing radially extending edges 19 and 20 of the flights are beveled to provide spaced auxiliary cutters throughout the length of the auger. The end flight sections 16 are substantially half the length of the intermediate flight sections 17 so that when auger sections are joined successively, the corresponding shorter end flights will cooperate to effect a continuous flight corresponding substantially in length to the intermediate flights. It is to be understood, however, that the particular arrangement of the spaced flights may be varied without departing from the invention.

The spaced flights have an overall diameter which is less than that defined by the bits of the cutter head except at the forward or leading end of each auger section where the leading end of the shorter flight 16 and that of the next succeeding flight 17 is reinforced by being built up and hardened to form secondary cutters 21, the outside diameter of which correspond to the largest outside diameter of the main cutters on the detachable head. Although the secondary cutters may take different form and may be provided in different ways, these are preferably built up to desired size and shape by fusing hard metals, such as Borium or Stellite or other like products, on to the forward ends of the auger flights. By this method of providing the secondary cutters, it is only necessary to weld on new metal to restore the cutters to their proper cutting radius after sufficient wear has taken place to justify the build up of the cutting surface with the hard metal.

The secondary cutters 21, as illustrated in Figs. 1 and 2, are arranged transversely of the edge of the metal strips forming the auger flights, thus presenting forwardly facing cutting edges at the rear of the cutting bits and at the forward or leading end of each auger section which shave or ream the hole cut by the bits to the maximum diameter. Figs. 7 and 8 show modified

forms of secondary cutters which function in substantially the same manner under different ground conditions to ream the hole clean to the maximum diameter of the auger. The raised secondary cutters may be omitted from the spaced flights rearwardly of the leading ones on each auger section.

When drilling operations are being conducted, the secondary cutters produce a cleanly cut hole to the full diameter of the bit, and in cooperation with the radial cutting edges of the smaller diameter spaced flights, eliminates the packing of dirt from the true auger section. When extended drilling requires a plurality of auger sections it will be noted that the hole being cut is always maintained at the maximum diameter by the successive reaming of the secondary cutters at the leading end of each successive auger section. The intermediate or smaller diameter spaced flights of the auger are out of frictional contact with the wall of the hole, thus minimizing wear and frictional loads. The auxiliary cutters on the edges of the spaced flights serve to additionally cut the borings and maintain these in discrete form as the cut material is passed rearwardly of the flights. The objectionable torque build up due to packing of dirt about the auger is overcome, thus increasing the drilling distance for earth boring machines and eliminating breakage. In removing the boring tools, when the desired depth of hole is reached, the secondary cutters keep removing all surplus dirt to the full diameter, thus relieving the tendency to pack and speeding up materially the process of removing augers.

It sometimes happens, especially when drilling in rocky soils, that augers get jammed by rocks or the like which are too large to pass the flights of the auger. This condition ordinarily results in tool breakage because the auger cannot be advanced or backed off without breaking. With the exceptionally strong shaft of seamless tubing and the mild steel flights employed in the structure described, the ordinary breakage seldom results because the auger may be backed off and away from the obstacle by simply applying a little more than the normal drilling force so that the result will be a folding or a bending over of the mild steel flights of the auger, thus allowing the auger to be backed out of the hole for replacement of the damaged sections which can be repaired merely by bending back the flights. Drilling may then be resumed without substantial loss of time.

Fig. 7 shows a modified form of auger similar to that previously described but with secondary cutters 22 which are not provided with lateral extensions transverse of the flights. The secondary cutters may comprise separate attachments which may be affixed to the flights by welding or may be formed integral with the flights and hardened, or may be simply built up in the manner heretofore described.

In Fig. 8, there is shown a modified form of large auger for effecting boring operations under some ground conditions. The structure comprises a head structure 24 having a forwardly extending guiding point 25 having a tapered point for guiding insertion and travel in a prebored hole. The detachable head comprises comparatively short flight cutters 26 and 27 which have their forward cutting edges in the same plane, and spaced cutter blades 28—29 of the same outside diameter which is the maximum outside diameter of the auger. The blades 26 and 27 are

interconnected by band 30 which is coaxial with the auger and extends from approximately the middle point of one cutter blade around to the mid-point of the opposite blade. This band is of slightly less outside diameter than that of the main cutter blades and connection is made with the rear surface of the main cutters in a supporting relationship by the triangular fillets 31 made necessary by the angular pitch of the cutter blades. The cutter blades 28 and 29 are likewise connected by the band 32 and the arrangement is such that the dimension between the bands is less than that of the maximum size rock or other boring which would pass rearwardly between the flights of the auger. The bands on the cutter head effectively prevent passage into the flights of the auger sections of rocks or other borings which are too large to be passed rearwardly by said flights. The bands press these larger rocks or borings back into the wall of the hole being bored.

The modified form of auger section cooperating with the cutter head is provided with spaced flights 34 having enlarged cutter portions 33. The enlarged cutter portions may be provided as integral portions of the flights or may be formed by hardened sections electrically welded to the leading ends of the flight sections. The enlarged secondary cutters may be provided at points along the auger, but in this modified auger form the secondary cutters are preferably of slightly less diameter than the cutters of the head portion. The interrupted auger flights and the enlarged secondary cutters function substantially as previously described to prevent packing of the auger sections and to minimize the frictional load on the smaller diameter flight sections.

In Fig. 10, there is shown a modified form of cutter head 35 having an axial tubular forwardly extending guiding member 36 provided at its forward end with a drill point 37. The drill point is preferably provided with a shank portion which enters the tubular extension and is secured in this assembly by being electrically welded. The head structure is provided with outwardly-inclined sets of bits and has a rearwardly extending hexagonal shank 9 corresponding to the shanks on auger sections and interchangeable cutter heads to provide for association of the head with the leading end of an auger section. This modified form of cutter head provides for accurate drilling in sandy soils. The forwardly extending tubular member terminating in the drill point 37 serves to accurately align and guide the auger in drilling operations such as are encountered in sandy soils and the like.

In Fig. 11, there is shown an auger attachment which is arranged for fastening to the leading end of an auger. This attachment comprises a shank corresponding to that of auger sections or other head portions, which shank portion is provided at its forward end with a ball 38. The ball end of the shank is arranged for insertion in a reduced threaded end portion of the sleeve 39 and is fastened therein by a split collar 40, providing a spherical seat portion for the ball. The sleeve is provided with an enlarged threaded end to receive a cooperating threaded end of a pipe 41. Where the drilling operation has proceeded to a desired point, the cutter head of the auger may be removed and the pipe pulling attachment may be substituted therefor to provide means for pulling a pipe back through the pre-bored hole. In this operation, a flexible pipe such as copper which cannot be pushed or otherwise laid except

by trenching, can be attached to the forward end of the sleeve member and be installed in the pre-bored hole as the auger is retrieved. In other words, as the auger is removed from the hole, the flexible pipe attached to its forward end becomes fed into the desired position of installation.

The outwardly inclined sets of bits in the cutter heads of Figs. 1 and 10 are of high grade tool steel and have their shank portions anchored in sockets in the head in any suitable manner to allow replacement of the worn bits. The preferred and illustrated manner of fastening these bits in their sockets by wedges, shaped to receive the bits for binding engagement in the sockets, is described and shown in detail in United States Patent No. 2,010,510, issued to Walter Cook, August 6, 1935.

The spring latch form of quick detachable connections serves to illustrate a preferred embodiment of the invention. However, the invention is not to be taken as limited to the use of the illustrated form of connection between auger sections and between the auger and cutter heads. Other conventional connecting means between the auger sections and between the auger and the heads may be employed without departing from the spirit of the invention.

In actual practice, it is preferred to employ a more positive connection between the cutter heads and auger sections by providing cutter head shanks with a threaded hole to receive a screw bolt passing through the radial hole in the female coupling members of the auger sections.

The operation of the auger in drilling will be clear to those skilled in the art from the above description of the invention. The bits of the cutter heads cut a hole to the maximum diameter of the auger. The boring thus produced is shaved or reamed cleanly by the secondary cutters with the loosened borings passing rearwardly to the flights of the auger. The secondary cutters are placed 180° apart to provide even cutting of the wall of the hole. The interruption of the flight into sections with radial cutting edges function, with the thrust placed upon the auger in its forward movement, to squeeze or pass between the interrupted flight sections material which tends to pack the auger, and with the rotation of the auger, this column of material which has passed through the interruptions is cut into small discrete lumps. These lumps are forced rearwardly into the main flight of the auger and are carried to the rear in the form of small lumps and form no appreciable impediment or packing of the auger. The secondary cutters not only provide a cleanly reamed hole but these cutters also provide for alignment of the auger and maintain the intermediate auger flights of smaller diameter out of frictional contact with the walls of the hole. This effectively eliminates wear on the main flights of the auger and minimizes the frictional and torsional loads on the tool.

By relieving the tendency to pack, the augers of this invention provide self-clearing structures by which continuously progressive drilling operations may be performed without repeatedly withdrawing the auger for cleaning and without tool or machine breakage. Under all drilling conditions, the auger produces a cleanly cut hole of maximum diameter. This is highly important in mine operations or general demolition work because the provision of a clean cut hole allows for better placement and more effective use of blasting charges. Where drilling is conducted in sandy soils and the like, the leading guide points in advance of the bits of the cutter head provide

a satisfactory guiding front support whereby extremely accurate borings can be made.

While the invention is described in connection with preferred embodiments, it is to be understood that the words which have been used are words of description rather than of limitation, and that changes within the purview of the appended claims may be made without departing from the spirit of the invention in all its aspects.

I claim:

1. An auger section of the type described, comprising a tubular shaft having hardened quick detachable coupling inserts in its ends, each insert providing locking means whereby a series of sections may be readily connected in locked relationship, and a plurality of spaced spiral flights of mild steel secured by welding to the tubular shaft throughout the length of the auger, said flights having their leading and trailing edges beveled to provide cutting edges, and a plurality of spaced radially enlarged cutters at the leading end of spaced spiral flights, said cutters being of hard metal welded to said flights the overall diameter of said cutters being greater than that of the spiral flights.

2. An earth boring auger comprising, a detachable cutter head having an axial forwardly extending elongated tubular guide of less diameter than said head and a plurality of sets of bits rearwardly of said guide outwardly inclined with respect to the axis of the auger, a series of spaced spiral blades with radial cutting edges defining a sectionalized spiral flight throughout the length of the auger, and a plurality of secondary cutters spaced 180° apart at leading ends of spaced flight sections along the auger adapted to ream a hole cut by the bits to the full outside diameter of the auger, said secondary cutters being of welded hard material and of greater radii than the spiral flight sections, whereby the flight sections are maintained out of contact with the cut wall of a hole being bored.

3. An auger section comprising, a shaft having at its leading end a hardened non-circular spline receiving socket and radial aperture communicating with the socket for receiving a transverse locking member and at its other end a hardened noncircular reduced spline extension having means for cooperative registration with the radial aperture in the socket end of a duplicate auger section, a series of spaced spiral blades with

radial cutting edges defining a sectionalized spiral flight throughout the length of the section, said flight sections having their inner edges welded along the shaft, and spaced radially extending reaming cutters on the leading ends of certain of the flight sections, said cutters being of greater radii than the flight sections.

4. An auger section of the type described, comprising a tubular shaft having hardened coupling inserts welded in the ends thereof, each insert having latching means whereby duplicate auger sections may be engaged and be releasably latched together, a plurality of spaced spiral blades of even outside diameter welded to said shaft and having sharpened radial cutting edges, and a plurality of raised cutter members of hard metal welded to said blades at leading ends thereof adapted to ream a hole to a greater diameter than that of the spiral blades.

5. An auger comprising a plurality of quick detachable auger sections, each of said sections having a tubular steel shaft with hardened steel coupling inserts welded in the ends thereof, said inserts having latching means whereby the auger sections may be joined and locked together by a sliding movement, and a plurality of spaced spiral blades of mild steel and of even outside diameter welded to the shaft, said blades having radially extending cutting edges and at the leading ends of the blades secondary cutters of increased diameter, said secondary cutters comprising relatively harder metal welded to said blades.

6. An auger comprising a detachable cutter head having a plurality of angularly extending detachable bits defining the outside diameter of the auger, a plurality of quick detachable auger sections associated with said cutter head, each section having a hollow steel shaft and a plurality of spaced spiral flight sections welded to said shaft and having sharpened radially extending edge portions, and enlarged secondary cutters of welded hard metal at the leading ends, said shaft having a hardened steel insert at each end, one insert providing a non-circular spline having a radially extending movable latch member, the other insert having a non-circular socket with a latch-receiving aperture therein, whereby auger sections may be joined and locked together in a sliding movement.

ALAN JAY PARRISH.