

[54] **LOCKING DEVICE FOR AUGER LATCHES**

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[58] **Field of Search**.....287/2, 119, DIG. 9; 248/408;
279/76; 198/213

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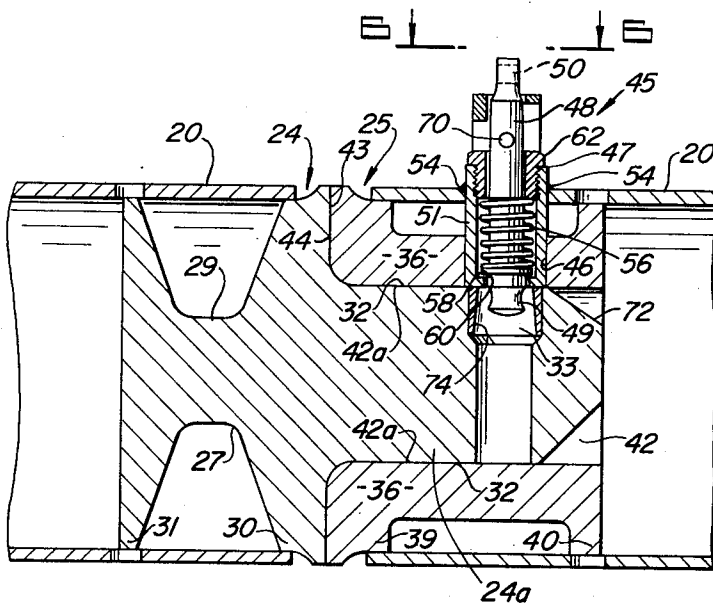
Primary Examiner—Andrew V. Kundrat

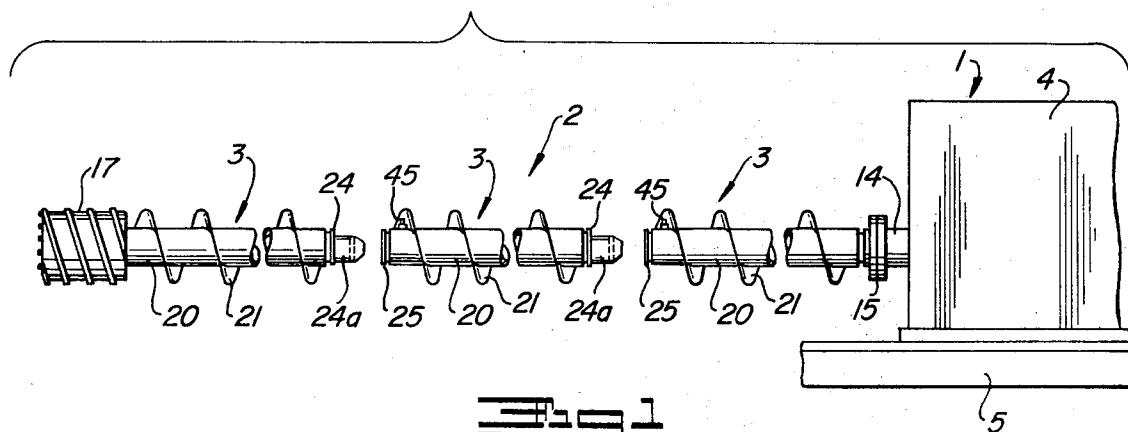
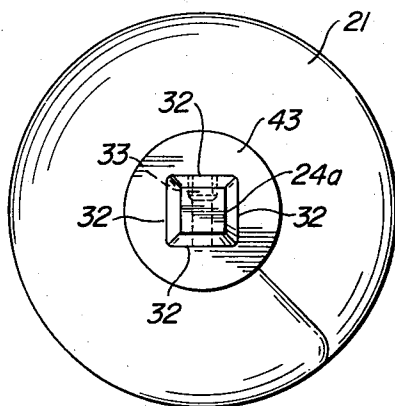
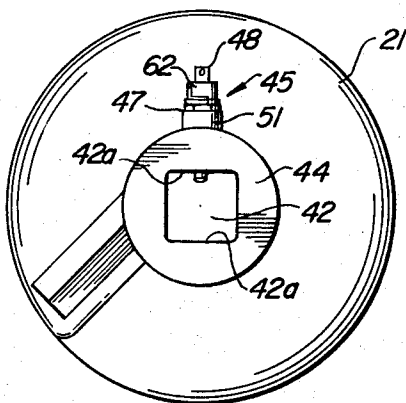
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[57] **ABSTRACT**

Apparatus for connecting the locking auger sections end to end in a string of auger sections driven by an auger mining machine. Auger sections are connected end to end by inserting a shank portion of one section into a socket portion of the adjacent section and locking them by a latch bolt. The latch bolt is carried in a housing on the socket portion of one section and extends into a hole in the shank portion of the other section. The latch bolt carries a transverse locking pin and is rotatable in the housing to position the locking pin in one of two slots in the housing. One slot is of longer length axially of the bolt to permit the latch bolt to be withdrawn from the hole in the shank portion, while the other slot prevents the withdrawal of the latch bolt. The auger sections remain locked together until the latch bolt is intentionally turned to a position where the pin is in the longer slot, and the bolt is then intentionally drawn out of the shank hole.

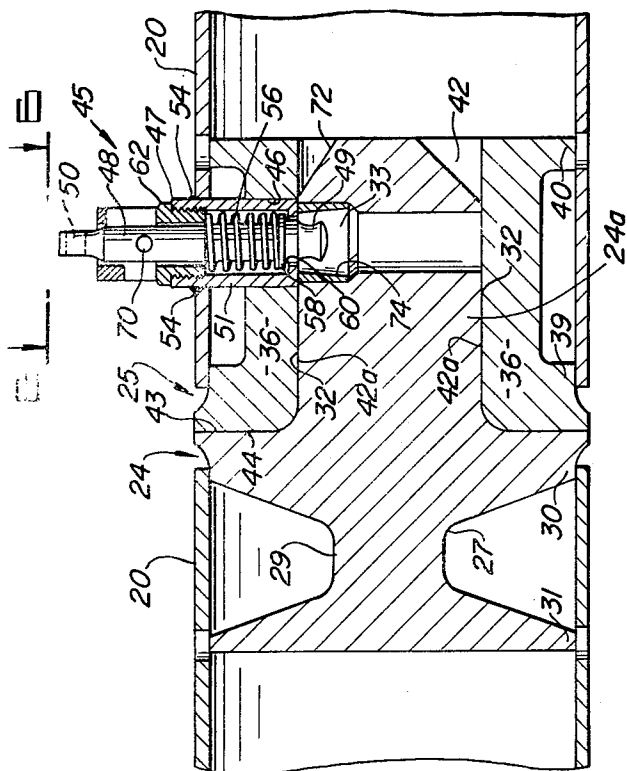
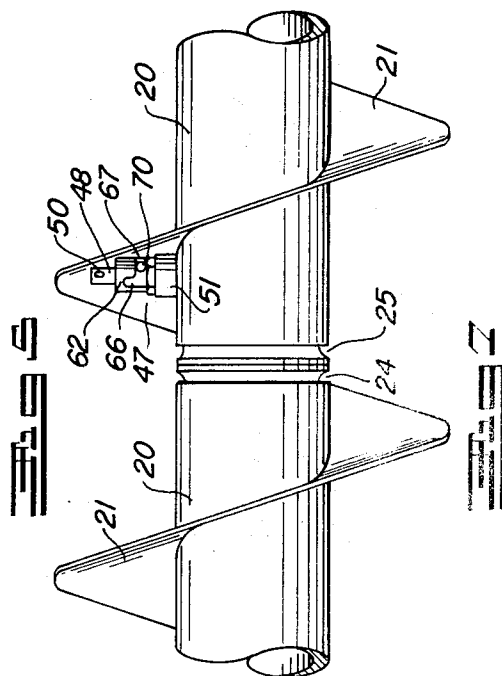
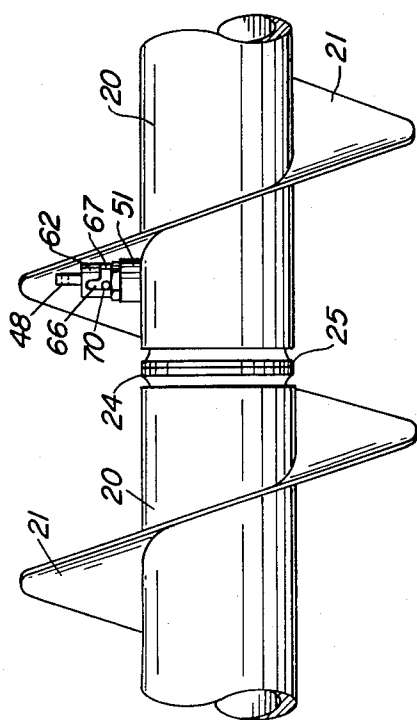
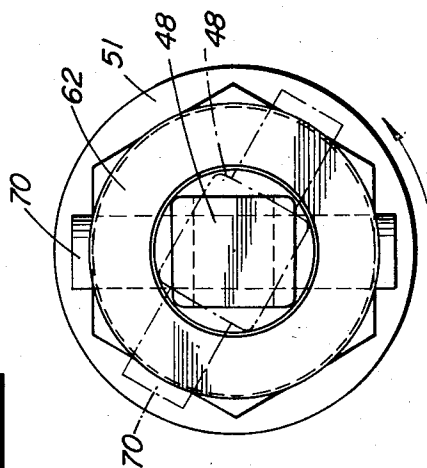
17 Claims, 7 Drawing Figures





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LOCKING DEVICE FOR AUGER LATCHES

BACKGROUND OF THE INVENTION

This invention relates to auger mining machines for mining coal and the like such as described in McCarthy U.S. Pat. No. 2,880,707, and more particularly to latching devices for retaining auger sections in such machines in end-to-end contact.

In a typical auger mining operation, the auger mining machine is positioned adjacent a wall of earth containing a seam of coal so that a string of connected auger sections rotated and pushed by the machine penetrates and follows the coal seam. A cutting head at the lead end of the auger string is thus advanced into the coal until it reaches its maximum depth permitted by the advance of a carriage on the machine that rotates and advances the auger string. The auger string including the cutting head is then disconnected from the carriage which is thereafter retracted. A section of auger is then added to the string between the rearmost auger section and the carriage, and the cutting head and auger sections are then again advanced into the coal seam to the maximum advance of the carriage while the auger string is rotated. Coal feeds back along the helical auger flighting of the auger string. When the rearmost auger section again has reached the maximum advance permitted by the machine carriage, an additional section of auger is connected between the carriage and the previous section.

The process is continued in this manner until the desired depth of hole is reached. Thereafter, the string of auger sections is withdrawn by retracting the machine carriage until the rearmost auger section clears the hole, removing such section, advancing the carriage and reconnecting it to the last section in the auger line, retracting the carriage to expose another auger section, removing it, and so on.

Conventionally, each auger section is provided with a socket or female portion that is non-circular, and preferably square in one end and a non-circular shank or male portion of the same shape and slightly smaller cross section at the other end. The shank fits into the female portion of an adjacent auger section and is retained there by a latch that extends through a wall of the socket into a hole in the shank.

Such connections have proven to be unreliable under certain conditions, since the latch bolt may work itself free and allow the auger sections to become disconnected. When this occurs, torque can no longer be transmitted to the portion of the auger string and cutting head beyond the disconnection or break in the string, and the auger sections must therefore be reconnected if it is intended to continue drilling. When it is intended to withdraw the auger string, such undesired disconnection also prevents withdrawal of the portion of the auger string beyond the disconnection, unless the sections are reconnected.

Reconnecting the auger sections thus unintentionally disconnected in an auger string is extremely difficult, time consuming and expensive, particularly on machines that employ parallel dual or triple cutting heads utilizing more than one auger string. Often all the equipment in the hole must be removed. Thus, considerable time and danger may be involved, since often a man must go into the hole to reach the portion of the auger string beyond the break.

SUMMARY OF THE INVENTION

A general object of this invention is to provide latch means for connecting auger sections end-to-end that overcomes the problems encountered with prior latch means.

A more particular object is to provide improved latch means for connecting auger sections end-to-end that includes provision for locking the latch means to prevent unintentional disconnecting.

Another object of this invention is to provide a bolt and hole latch for connecting auger sections end-to-end that includes means for locking the bolt in the hole, whereby the auger sections cannot become disconnected.

Still another object is to provide improved latch means for latching and locking auger sections end-to-end that is reliable, convenient to use and inexpensive to manufacture.

A preferred form of latch means according to this invention for latching and locking together a first auger section having a shank and a second auger section having a longitudinally extending socket receiving the shank, includes a housing mounted on the second auger section and a latch bolt in the housing having an end protruding therefrom. The housing has first and second interconnected slots one of which is generally parallel to the latch bolt. A locking pin extends transversely through the latch bolt and into one of the slots. The length of the slots axially of the bolt is such that the locking pin is free to move in one of the slots at least the length of the protruding end of the latch bolt and in the other slot substantially less than the length of the protruding end. The latch bolt is rotatable in the housing to position its locking pin in one or the other of the slots. In use the latch bolt may extend into a transverse hole in the shank and be locked therein or not according to whether the locking pin is positioned in one or the other of the slots. Preferably, the latch bolt is biased, as by a compression spring, so the end moves into the hole in the shank when aligned with the hole.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat diagrammatic side elevation of the basic parts of an auger mining machine showing adjacent auger sections ready for end-to-end connection;

FIG. 2 is an end view in elevation of the shank end or male portion of an auger section;

FIG. 3 is an end view in elevation of the socket end or female portion of an auger section showing the improved auger latch of this invention;

FIG. 4 is a side elevation of two auger sections latched but not locked together by the improved auger latch of this invention;

FIG. 5 is a longitudinal sectional view to a larger scale of the auger sections and latch of FIG. 4;

FIG. 6 is a plan view along the line 6—6 of FIG. 5 but to a larger scale showing the latch of this invention in its locked and in its unlocked position;

FIG. 7 is a side elevation similar to FIG. 4 but showing the auger sections latched and locked together.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows an auger mining machine 1 for rotating and advancing an auger string 2 made up of auger sec-

tions 3 adapted to be connected together end-to-end. Sections 3 are rotatably driven by a carriage 4 movably mounted on a base 5 of the machine for advancing and retracting movement in a straight path, in a manner and by means known in the art. The drive shaft 14 of the carriage, connected to a suitable known power source on the carriage, is connected through a known coupling 15 to the rear end of the auger string for rotating it.

The leading end of the leading auger section 3 carries a cutting head 17 of a suitable known type. The auger sections 3 are conventional except for the latch means of the invention; each section comprises a tubular shaft portion 20 around the exterior of which a helical nave or flight 21 is rigidly connected as by welding. The auger sections may be made in any suitable length which may be conveniently handled and transported and are adapted to be connected together end to end so that a hole of any desired or necessary depth may be drilled.

For coupling the auger sections to each other and to the cutting head, in order to assemble the auger string in operative condition so all sections will be rotated from the carriage 4, each auger section has a reduced male portion of shank member 24 at one end for insertion into a corresponding female portion or socket member 25 in the other end of a similar auger section. As shown in FIG. 5, each shank member 24 includes a circular cross section portion 27 that fits snugly within and is welded to the tubular shaft portion 20 of an auger section. If desired, the intermediate part of portion 27 may be reduced in diameter as at 29 to reduce weight, so that only the outer and inner ends 30 and 31 of the shank member are large enough to snugly fit within the interior of the tubular shaft portion 20.

The shank indicated at 24a is formed integrally at the outer end of portion 27 and axially aligned therewith and preferably square in cross-section as shown in FIG. 2 having flat inner walls 32 or may have any other suitable non-circular cross sectional shape. A transverse opening 33 is formed in one of the walls 32 of the shank midway of its width, to receive the end of a latch bolt as will be described more fully below.

As shown in FIG. 5 the socket member 25 includes a cylindrical portion 36 that fits snugly and is fixed within the tubular shaft portion 20 of the auger section. The intermediate part of the cylindrical portion is also reduced in diameter to save weight so only the outer and inner ends 39 and 40 contact and are welded to the interior of tubular shaft portion 20. A longitudinal opening 42 of the cross sectional shape, preferably square, of the shank 24a and slightly larger in size extends through the socket member; it has flat outer walls 42a.

The outer end of the cylindrical portion of the shank member 24 and the socket member 25 terminate in annular faces 43 and 44, respectively, preferably of about the same diameter as the exterior of the tubular shaft 20. The faces 43 and 44 are in contact when the shank and socket are mated as described below.

A latch assembly 45 extends radially through the wall of tubular shaft portion 20 and the cylindrical portion 36 of socket member 25 into socket opening 42 (FIGS. 3 and 5). An aperture 46 is formed through one wall of shaft 20 and midway of the width of a flat wall 42a in socket member 25 at the proper location to receive

latch assembly 45 and to be aligned with the opening 33 of a mating auger section the shank of which is inserted into opening 42.

The latch assembly includes a housing 47, and a latch bolt 48 extending longitudinally within the housing and radially of shaft 20 and protruding from each end of the housing. The lower end of latch bolt 48 is recessed circumferentially at 49 for a purpose described below. The upper end of latch bolt 48 is squared off and has a transverse through hole 50 for a purpose described below.

Housing 47 includes a cylindrical sleeve member 51 that fits snugly within aperture 46 and of the proper length to extend radially outwardly a short distance from the tubular shaft 20 when its inner end is aligned with the outer wall 42a of the longitudinal opening 42 in socket member 25. Sleeve member 51 is rigidly connected to shaft 20 preferably by welding as at 54.

A compression type coil spring 56 fits within sleeve member 51 and surrounds latch bolt 48. A disk 58 surrounds the lower end of latch bolt 48 and seats against an annular shoulder 60 at the lower end of sleeve member 51, to provide a seat for the inner end of spring 56. A pin retainer member 62 is threaded into the outer end of sleeve member 51 and when fully threaded slightly compresses spring 56.

Retainer member 62 includes a radially outwardly extending cylindrical portion having cut-outs therein to define radially extending slot 66 and connected transversely extending slot 67, as shown in FIGS. 4 and 7. Latch bolt 48 carries a transversely extending pin 70 that extends into either slot 66 or slot 67, according to whether latch bolt 48 is locked or not as will be described below. Slot 66 is longer than slot 67 radially of member 20, the length of the slots being such that transverse pin 70 is free to move radially outwardly in slot 66 at least the distance that the inner end of latch bolt 48 (see FIG. 3) extends into the longitudinal opening 42 of socket member 25, and in slot 67 substantially less than that distance. Latch bolt 48 is free to rotate within housing 47 within the limits defined by the extent of slots 66 and 67 circumferentially of retainer member 62.

Adjacent end opposing auger sections 3 are connected and latched end-to-end by insertion of shank 25a of one section into the longitudinal opening 42 of socket member 25 of the other section with the wall 32 of the shank containing the opening 33 facing wall 42a until annular faces 43 and 44 are in contact. As shank 24a is inserted, its tapered forward face 72 contacts the inner end of latch bolt 48 and cams it radially outwardly against the biasing force of spring 56. When shank 24a has completely entered longitudinal opening 42 the opening 33 in the shank is aligned with latch bolt 48 and the latch bolt is urged by the compressed spring 56 radially inwardly into the opening 33.

The auger sections 10 at this point are in the position shown in FIG. 4; that is, they are latched together but not locked together. A force tending to pull apart the auger sections may have a component that will act upon latch bolt 48 and tend to force it radially outwardly out of opening 33. Such a component, aided by centrifugal force produced by rotation of the auger assembly and acting to force latch bolt 48 radially outwardly, may be sufficient to unlatch the auger sections

and permit them to come apart. Such a separation occurring while the auger assembly is within a drilled hole renders the auger string useless, as described above, until the auger sections are reconnected.

The improved latch assembly of this invention, however, permits the latch bolt 48 to be locked in opening 33, so that the auger sections cannot be unintentionally disconnected.

Such locking is accomplished as shown in FIG. 6 by rotating the latch bolt 48 in the direction of the arrow until locking pin 70 passes from slot 66 (the full line position) into slot 67 (the dotted line position). Such rotation may be facilitated by use of a lever or tool inserted through hole 50 in the radially outer end of latch bolt 48 and used to rotate the latch bolt.

At this point, the auger sections are not only latched together but also are locked together as shown in FIG. 7. The radial length of slot 67 limits the radially outward movement of locking pin 70 and, therefore, also of latch bolt 48. In this position the auger sections 10 are latched and locked together and cannot become disconnected without human intervention.

It should also be noted that the inner wall of the transverse opening 33 in shank 24a is tapered as shown at 74 in FIG. 5. This taper along with the shape of the radially inner end 49 of latch bolt 48 tends to prevent a force acting to pull apart the auger sections from developing a component that acts to push latch bolt 48 radially outwardly.

When a rearmost auger section is retracted from the drilled hole in the coal seam, and it is desired to disconnect it from an adjacent forward auger section, it is merely necessary to rotate latch bolt 48 of the rearmost section to the position where locking pin 70 is positioned in radial slot 66, and then lift the latch bolt radially outwardly, preferably by a tool inserted in hole 50 in the projecting top portion of the latch bolt 48. The lower end of the latch bolt can thereafter be readily withdrawn from opening 33 of shank 24a of the adjacent auger section by drawing upwardly on the tool in hole 50, and the shank 24a may be easily withdrawn from the longitudinal opening 42 of the rearmost auger section usually by retracting carriage 4. The rearmost auger section can then be disconnected from shaft 14 of carriage 4, removed, and the carriage advanced until it connects to the next auger section. The carriage can then be retracted, and the process repeated until all sections including the cutting head have been removed from the hole and the machine.

While a preferred form of this invention has been shown and described herein it will be apparent to those skilled in the art that various modifications may be made in the form herein disclosed without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited to the form herein specifically disclosed and described but only by the progress in the art which the invention has promoted.

What is claimed is:

1. Apparatus for latching and locking together first and second auger sections, said first auger section having an axially extending shank and a generally radially extending transverse opening in said shank, said second auger section having a socket to receive said shank, said apparatus comprising a housing for mounting on said second auger section to have its longitudinal axis

extend transversely of said socket, said housing comprising a sleeve member adapted to be mounted to extend through the wall of said socket and a retainer member fixedly engaging said sleeve, a latch bolt having an axis and mounted in said housing and extending through said retainer member and said sleeve for reciprocable movement along said axis and having an end protruding from said housing and adapted to extend into said transverse opening in said shank when said auger sections are connected, first and second slots in said retainer member, said second slot extending generally axially of said latch bolt and said second slot being longer in said axial direction than said first slot, a locking pin extending transversely from said latch bolt and into one of said slots, said latch bolt being rotatable about its said axis to position said locking pin in one or the other of said slots to limit the longitudinal movement of said latch bolt in accordance with the length of the slot in which said locking pin is positioned, the length of said first and second slots axially of said latch bolt being such that said locking pin is free to move in said second slot at least the length of said protruding end of said latch bolt and in said first slot substantially less than the length of said protruding end, whereby the protruding end of said latch bolt may extend into said transverse opening and may be locked therein or not in accordance with whether said locking pin is positioned in said first or in said second slot.

2. Apparatus as claimed in claim 1 further comprising means biasing said latch bolt to cause its end to protrude from said housing.

3. Apparatus as claimed in claim 1, in which said latch bolt has an opposite end protruding from said housing, said opposite end providing means for rotating said latch bolt to move said locking pin into either of said slots.

4. Apparatus as claimed in claim 2, in which said latch bolt has an opposite end protruding from said housing, said opposite end providing means for rotating said latch bolt to move said locking pin into either of said slots, and to permit said latch bolt to be lifted so its first mentioned protruding end can be removed from said first auger section.

5. In combination, a first auger section having an axially extending shank having generally flat axially extending external surfaces defining a polygonal cross section, said shank having a generally radially extending transverse opening in one of said external surfaces, a second auger section having an axially extending socket with a socket opening defined by generally flat axially extending internal surfaces shaped to receive and fit said shank and defining a socket wall of substantial thickness, said socket having a generally radially extending aperture extending through said wall and terminating in one of said internal surfaces and aligned with said transverse opening, and means for latching and locking said sections together comprising a housing on said socket and extending into said aperture for a major portion of the thickness of said wall, a latch bolt having an axis and supported in said housing for reciprocable movement along said axis and having an end adapted to protrude into said transverse opening, first and second interconnected slots in said housing extending generally axially of said latch bolt, and a locking pin extending transversely from said latch bolt

and into one of said slots, the length of said first and second slots being such that said locking pin is free to move axially of said latch bolt in said second slot at least the length of said protruding end of said latch bolt and in said first slot substantially less than the length of said protruding end, said latch bolt being rotatable in said housing to position said locking pin in one or the other of said slots to limit the movement of said latch bolt in accordance with the length of the slot in which said locking pin is positioned, whereby said latch bolt is locked with its protruding end in said transverse opening or not in accordance with whether said locking pin is positioned in said first or in said second slot.

6. The combination as claimed in claim 5 comprising resilient means biasing said latch bolt to cause its end to protrude from said housing and extend into said transverse opening.

7. The combination as claimed in claim 6 comprising means on said latch bolt permitting it to be turned about its axis until its locking pin is aligned with said second slot and to be moved axially until its protruding end is moved out of said transverse opening.

8. In combination, a first auger section having an axially extending shank having generally flat axially extending external surfaces defining a polygonal cross section, said shank having a generally radially extending transverse opening in one of said external surfaces, a second auger section having an axially extending socket with a socket opening defined by generally flat axially extending internal surfaces shaped to receive and fit said shank, said socket having a generally radially extending aperture terminating in one of said internal surfaces and aligned with said transverse opening, and means for latching and locking said sections together comprising a housing on said socket and aligned with said aperture, a latch bolt having an axis and supported in said housing for reciprocable movement along said axis and having an end adapted to protrude into said transverse opening, first and second interconnected slots in said housing extending generally axially of said latch bolt, and a locking pin extending transversely from said latch bolt and into one of said slots, the length of said first and second slots being such that said locking pin is free to move axially of said latch bolt in said second slot at least the length of said protruding end of said latch bolt and in said first slot substantially less than the length of said protruding end, said latch bolt being rotatable in said housing to position said locking pin in one or the other of said slots to limit the movement of said latch bolt in accordance with the length of the slot in which said locking pin is positioned, whereby said latch bolt is locked with its protruding end in said transverse opening or not in accordance with whether said locking pin is positioned in said first or in said second slot, the protruding end of said latch bolt and the walls of said transverse opening being tapered to prevent a force tending to pull apart said auger sections from developing a component that acts to push said latch bolt radially outward out of said transverse opening.

9. The combination as claimed in claim 8 comprising resilient means biasing said latch bolt to cause its end to protrude from said housing and extend into said transverse opening.

10. The combination as claimed in claim 8 comprising means on said latch bolt permitting it to be turned about its axis until its locking pin is aligned with said second slot and to be moved axially until its protruding end is moved out of said transverse opening.

11. In combination, a first auger section having an axially extending shank having generally flat axially extending external surfaces defining a polygonal cross section, said shank having a generally radially extending transverse opening in one of said external surfaces, a second auger section having an axially extending socket with a socket opening defined by generally flat axially extending internal surfaces shaped to receive and fit said shank, said socket having a generally radially extending aperture terminating in one of said internal surfaces and aligned with said transverse opening, and means for latching and locking said sections together comprising a housing on said socket and aligned with said aperture, a latch bolt having an axis and supported in said housing for reciprocable movement along said axis and having an end adapted to protrude into said transverse opening, first and second interconnected slots in said housing extending generally axially of said latch bolt, and a locking pin extending transversely from said latch bolt and into one of said slots, the length of said first and second slots being such that said locking pin is free to move axially of said latch bolt in said second slot at least the length of said protruding end of said latch bolt and in said first slot substantially less than the length of said protruding end, said latch bolt being rotatable in said housing to position said locking pin in one or the other of said slots to limit the movement of said latch bolt in accordance with the length of the slot in which said locking pin is positioned, whereby said latch bolt is locked with its protruding end in said transverse opening or not in accordance with whether said locking pin is positioned in said first or in said second slot, said surface of said shank that contains said transverse opening and contacts the end of such latch bolt has its leading end tapered to cam said latch bolt axially thereof towards said radially extending aperture in said socket as said shank is advanced into said socket.

12. The combination as claimed in claim 11 comprising resilient means biasing said latch bolt to cause its end to protrude from said housing and extend into said transverse opening.

13. The combination as claimed in claim 11 comprising means on said latch bolt permitting it to be turned about its axis until its locking pin is aligned with said second slot and to be moved axially until its protruding end is moved out of said transverse opening.

14. In combination, a first auger section having an axially extending shank having generally flat axially extending external surfaces defining a polygonal cross section, said shank having a generally radially extending transverse opening in one of said external surfaces, a second auger section having an axially extending socket with a socket opening defined by generally flat axially extending internal surfaces shaped to receive and fit said shank, said socket having a generally radially extending aperture terminating in one of said internal surfaces and aligned with said transverse opening, and means for latching and locking said sections together comprising a housing on said socket and

aligned with said aperture, a latch bolt having an axis and supported in said housing for reciprocable movement along said axis and having an end adapted to protrude into said transverse opening, first and second interconnected slots in said housing extending generally axially of said latch bolt, and a locking pin extending transversely from said latch bolt and into one of said slots, the length of said first and second slots being such that said locking pin is free to move axially of said latch bolt in said second slot at least the length of said protruding end of said latch bolt and in said first slot substantially less than the length of said protruding end, said latch bolt being rotatable in said housing to position said locking pin in one or the other of said slots to limit the movement of said latch bolt in accordance with the length of the slot in which said locking pin is positioned, whereby said latch bolt is locked with its protruding end in said transverse opening or not in accordance with whether said locking pin is positioned in said first or in said second slot, said housing including a

cylindrical sleeve member received within said aperture, said sleeve member having a threaded portion and a locking pin retainer member threadedly engaging said sleeve member, said latch bolt extending through said pin retainer member and said sleeve member and having an end protruding from said sleeve member and into said transverse opening.

15. The combination as claimed in claim 14 comprising resilient means biasing said latch bolt to cause its end to protrude from said housing and extend into said transverse opening.

16. The combination as claimed in claim 14 comprising means on said latch bolt permitting it to be turned about its axis until its locking pin is aligned with said second slot and to be moved axially until its protruding end is moved out of said transverse opening.

17. The combination as claimed in claim 14 wherein said first and second slots are formed in said locking pin retainer member.

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