Jan. 11, 1944. L. E. YOUNIE 2,339,128

DIGGER TOOTH CONSTRUCTION

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Fig. 1.

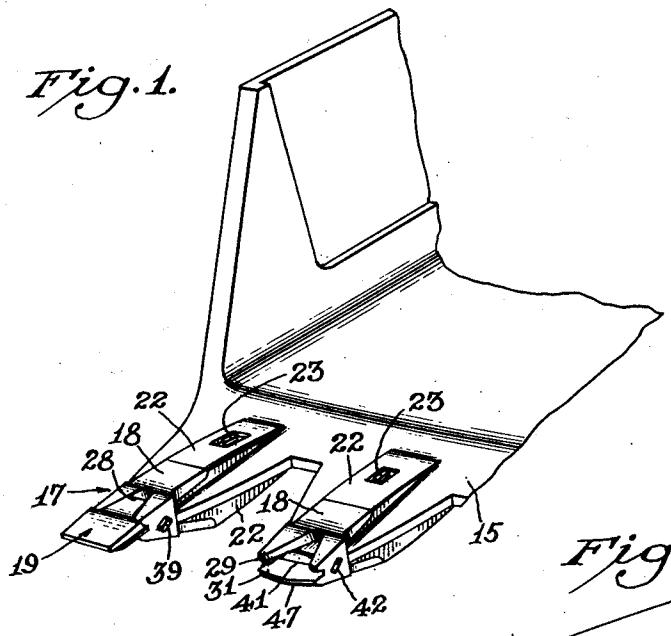


Fig. 2.

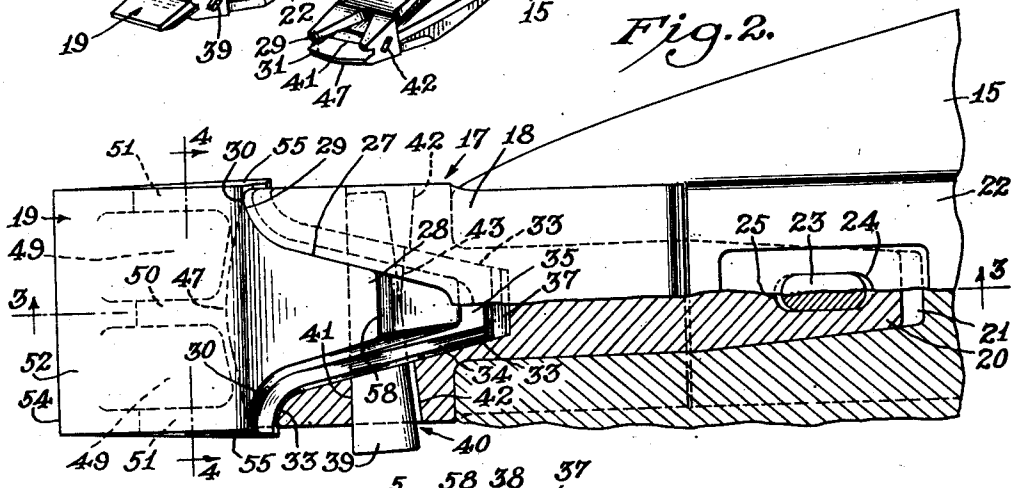
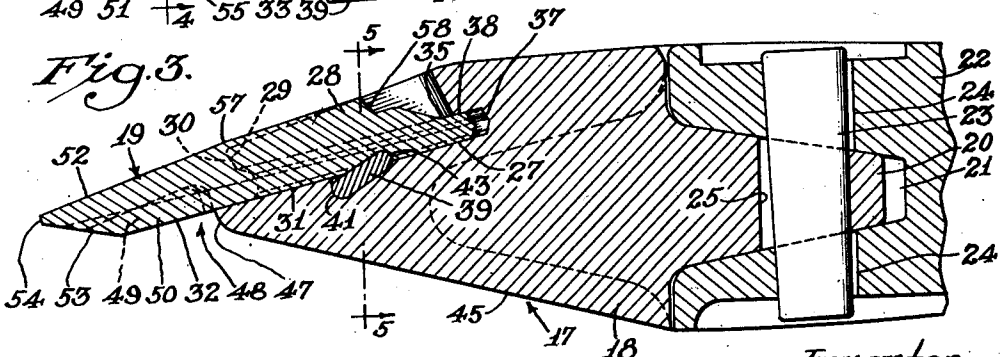


Fig. 3.



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Fig. 5.

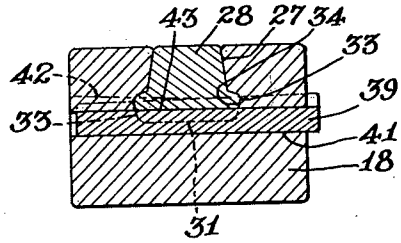


Fig. 4.

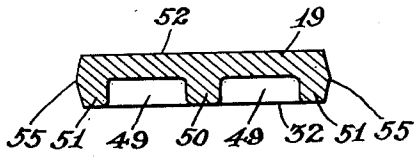


Fig. 6.

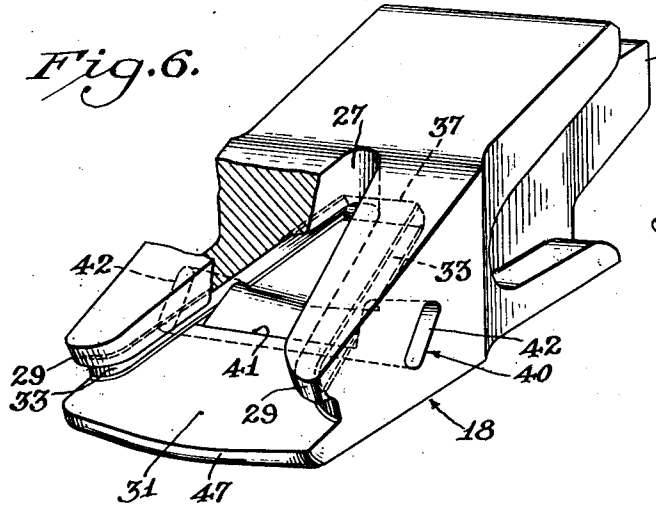


Fig. 8.

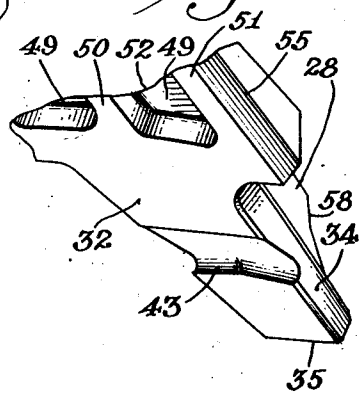


Fig. 9.

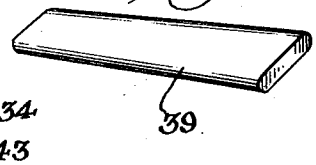
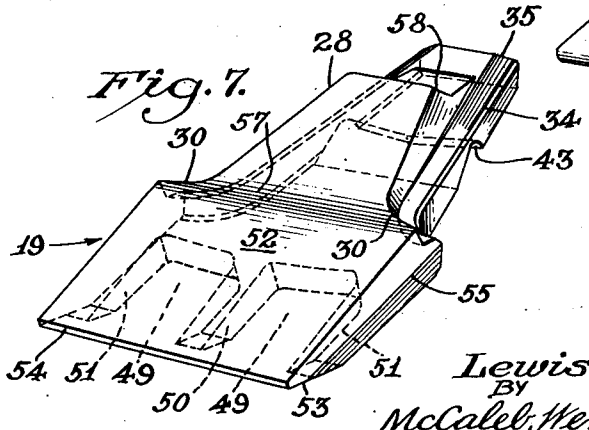


Fig. 7.



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UNITED STATES PATENT OFFICE

2,339,128

DIGGER TOOTH CONSTRUCTION

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Application March 11, 1942, Serial No. 434,171

14 Claims. (Cl. 37—142)

This invention relates to improvements in replaceable point digger teeth such as are used on the forward cutting edges of power driven digging, excavating or loading buckets, dippers, scoops, scarifiers, and the like.

One of the most serious deficiencies in prior replaceable point digger teeth has resided in the means by which the point is keyed to the supporting body or base. Except in certain instances involving relatively massive and complex structural relationships, the prior securing keys are received between surfaces that are offset from one another longitudinally of the key. Thus, one side of the key in the prior structures is engaged at longitudinally spaced points by the keyway surfaces of one of the secured members, and the opposite side of the key is engaged at one or more points on the other of the members, offset from and intermediate said surfaces. The key is therefore subjected to crosswise bending and shear stresses during use of the tool. This all too frequently causes the key to be deformed and results in damaging looseness or deflection of the point relative to the base and makes it very difficult, if not impossible, to drive out the key for replacement of the point.

According to the present invention, the base and the replaceable point of the tooth are secured together by a novel key arrangement in which the key is safe from being sheared or otherwise deformed by the opposing forces and strains to which it is subjected between the secured members, particularly when there is a strong pull tending to separate the point from the base.

Another feature of the invention is the improvement in the key arrangement whereby in securing the replaceable point and tooth base together, at least certain of the more important interengaging surfaces thereof are driven and held more closely and firmly together so that all transverse working stresses and strains are more unifommly distributed and relative looseness of the parts prevented.

The securing key is also of such character that under certain working conditions where prior keys have had to take the principal strain and shock of separating forces, the point and base are caused to absorb such forces to a substantial extent.

The invention also has among its objects to improve the construction of the point of the tooth and to facilitate removal and replacement of the point.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are two sheets:

Fig. 1 is a fragmentary perspective view of a digger scoop or bucket showing the use of teeth embodying the features of my invention;

Fig. 2 is a top plan view, partly in section, showing the details of one of the tooth assemblies and its mounting;

Fig. 3 is a longitudinal sectional view through the tooth assembly taken substantially in the plane of line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view through the point of the tooth taken in the plane of line 4—4 of Fig. 2;

Fig. 5 is a transverse sectional detail view taken substantially along the line 5—5 of Fig. 3;

Fig. 6 is a perspective view of the adapter base member of the tooth;

Fig. 7 is a top perspective view of the replaceable point of the tooth;

Fig. 8 is a fragmentary bottom perspective view of the shank portion of the replaceable point; and

Fig. 9 is a perspective view of the key.

By way of illustration, a portion of a dipper front 15 is shown in Fig. 1 carrying at its digging edge forwardly projecting, generally wedge-shaped digger teeth 17 embodying the features of my invention. Each of the teeth comprises an adapter base 18 carrying a replaceable, flattened and wedge-shaped cutting bit or digging point 19 which projects substantially beyond its forward end. The base 18 is adapted to be formed as a casting and the point 19 is preferably drop forged from a suitable highly wear resisting metal.

An integral rearwardly extending tang 20 on the base 18 fits in a well-known manner into a forwardly opening socket 21 formed within a fixed base structure 22 integral with the forward edge of the dipper front 15. The tang 20 is secured within the socket 21 by means of a tapered key 23 driven into a vertical keyway formed by alined slots 24 opening into the socket 21 and a registering slot 25 in the tang 20.

The base 18 and the replaceable point 19 are constructed for relative longitudinal sliding assembly and thorough interengagement adapted to meet all practical field requirements. Accordingly, the base 18 is formed with a forwardly taper-

ing blunt end portion substantially thicker than the point 19.

A downwardly and forwardly opening flaring socket 27 in the base is arranged to receive a complementary rearwardly extending centered shank 28 of reduced width on the point. At the mouth of the socket 27, its side walls curve sharply laterally to provide forwardly facing shoulders 29 which abut opposing rearwardly facing complementary shoulders 30 on the main body of the point 19. The bottom wall of the socket 27 provides a flat, forwardly slanting surface 31 which slidably receives a flat lower surface 32 on the point.

Within the socket 27 the shank 28 is held against vertical or lateral displacement by a tongue and groove arrangement. To this end, the socket has inwardly opening narrow undercut grooves 33 at its sides, inclusive of the shoulders 29, adjacent to and parallel with the bottom surface 31. Into these grooves fit laterally extending complementary ribs or tongues 34 on the shank 28 and the shoulders 30. The grooves 33 may be of uniform depth (Fig. 2) but are preferably of gradually diminishing width from front to rear (Fig. 3) and have at least the upper surfaces thereof slanted up (Fig. 5) so that the complementary tongues 34 are received with a snug, wedging engagement when the base and the point are fully assembled.

Additional stability and firmness in assembly is attained by forming the rear extremity of the shank 28 in alinement with the side tongues 34 as a flat tang 35 which is received within a complementary tang-socket 37 formed at the rear end of the main socket 27 by a forwardly extending, overhanging wall portion 38.

An important feature of the invention is the key structure by which the base 18 and the replaceable point 19 are held securely against accidental longitudinal separation. A preferred form of the key structure comprises a flat, tapered key 39 which is driven into a horizontally transverse keyway 40 intersecting the abutting flat socket and point bottom surface 31 and 32, respectively, in a forwardly slanting plane (Fig. 3). The keyway 40 is formed in part by a lower upwardly and rearwardly opening groove 41 extending across the socket surface 31 and alined with entrance slots 42 opening through the opposite sides of the base 18 (Figs. 2, 5 and 6). The upper part of the keyway is completed by a complementary downwardly and forwardly opening groove 43 formed across the lower surface 32 of the point (Fig. 8) and at least partially intersecting the tongues 34.

As best seen in Figs. 2 and 5, the upper rear wall of the keyway 40 which is engaged by the upper edge of the key 39 is preferably tapered inwardly from each side to the longitudinal center of the tooth complementary to the taper of the key and the lower forward wall engaged by the lower edge of the key is stright across. In this way the key may be driven in from either side of the base. In addition, the slots 42 are of a width to clear the upper edge of the key 39 after the latter has been driven home so that the entire wedging effect of the key will be directed at its upper and lower edges into the base and point grooves 43 and 41, respectively. Thus, the key 39 forces the shank 28 firmly backward and upward in the socket 27 so that the tongues 34, and particularly the upper tapered surfaces thereof, are in tight engagement within the grooves 33, and the tang 35 is driven tight against the overhanging wall 38 of the tang socket 37.

All portions of both edges of the key 39 which are involved in the keying action are directly opposite one another, the lower edge being fully seated and backed up within the lower groove 41 and the engaging portion of the upper edge being fully seated and backed up within the upper groove 43. This places the key 39 under transverse compression.

Any force tending to pull the point 19 longitudinally out of the socket 27, as, for example, by the tooth becoming wedged between rocks or other relatively non-yielding objects during use, will merely increase the compression on the key between the directly opposed walls of the keyway grooves, and to some extent tend to place the key under a longitudinal shearing strain in a diagonally transverse direction. However, the shearing strain is spread over such a great longitudinal portion of the key as to leave the key unaffected so that it will withstand any such force that can be applied up to destruction of the tooth structure.

Resistance to dislodgment of the point 19 by pulling forces is further increased by the action of the key 39 as it tends to tip up in the base groove 41 under the influence of the compression and shearing strains developed by the pulling. Thus, the upward component of force by the key is increased and the upper surfaces of the tongues 34 are pressed into even tighter frictional engagement with the opposing top surfaces of the grooves 33 as is also the tang 35 with the roof surface 38. The increased frictional engagement of the shank and socket surfaces, and the corresponding increase in resistance to the pulling force, has a snubbing effect, to the relief of the key 39.

The construction of the digging portion of the replaceable point 19 and its relationship to the base 18 is such as to improve the digging qualities of this type of tooth and also to protect the exposed faces of the base against excessive wear. For this purpose, the cutting portion of the point 19 extends substantially beyond the forward end of the base 18 and below the plane of the lower substantially flat, upwardly slanting face of the base, identified by the numeral 45. At its forward edge the lower surface 45 swings preferably radially upwardly to form the forward surface of a forwardly arcuate point-supporting lip 47 which has as its upper surface the forward extremity of the socket bottom wall 31. The lip 47 lies substantially rearwardly and above the forward end of the lower surface 32 of the point. In this manner a substantial undercut or digging relief space 48 is provided back of the point.

Further digging relief for the point 19 is attained by forming one or more downwardly opening relief cavities 49 auxiliary to the relief space 48 in the lower surface 32 of the point forwardly of the lip 47. In the present instance there are two of the relief cavities 49 separated by a narrow reinforcing rib 50 and flanked by reinforcing ribs 51 at the sides of the point (Figs. 2 and 4). Each of the cavities has its top wall substantially parallel with the top surface of the point, identified by the numeral 52. The front end of each of the relief cavities 49 opens forwardly through a chamfer surface 53 that extends rearwardly and downwardly from a cutting edge 54 formed

at the convergence of the chamfer with the top surface 52 (Figs. 3 and 7). The rear walls of the cavities 49 are substantially coincident with the edge of the lip 47.

Another valuable function of the relief cavities 49 is to render the point 19 self-sharpening. This results from the substantially uniform thinness of the overlying, rib-reinforced body of the point from the cutting edge 54 back to the lip 47. Thus, both the edge 54 and the forward chamfered ends of the ribs 50 and 51 will wear off with sufficient evenness to retain good cutting efficiency until practically all of the cutting portion of the point is worn away, and without requiring removal and grinding of the point. Even when the point has largely worn away, however, the relief space 48, augmented by the remaining portions of the cavities 49, continues to be effective. The point 19 can therefore be used continuously without attention until completely worn out.

In order to protect the top and sides as well as the bottom surface 45 of the base 18 from excessive wear, the sides and top of the point 19 are provided with buffer structures. Laterally extending longitudinal buffer ribs 55 which become progressively more prominent from front to rear serve this purpose at the side edges of the point by having their rear end portions protruding substantially outwardly beyond the plane of the side faces of the base so as to divert away therefrom or at least loosen up the material through which the tooth is driven when digging.

As shown, (Figs. 2, 4 and 7) the ribs 55 are preferably of increasingly sharper V-shaped cross section so as to cut through the dug material easily and without back pressure at the sides of the point and also to direct the material upwardly and downwardly from the faces of the ribs. The upward diversion of material by the ribs 55 assists in loading the bucket 15. The downward diversion aids in the digging by development of an upward component of force against the lower rib faces due to compression of the material as the tooth travels forward while digging.

Protection against wear for the upper surface of the base, and especially those portions of the surface at each side of the main socket 27, is afforded by an upstanding gently sloping ridge 57 extending across the top surface 52 of the point above the lip 47. The ridge 57 extends above the adjacent top surface areas of the base and thus takes the brunt of the digging pressure and the abrasive action of the dug material.

The upper portion of the shank 28 substantially fills the top opening of the socket 27, except at the rear extremity where a kickout shoulder 58 is provided. This shoulder faces upwardly and rearwardly to receive a tool for driving the shank 28 forwardly out of the socket 27 when the point is to be replaced.

It will thus be apparent that in addition to being effectively and positively secured to the base 18 by the novel, practically indestructible key structure, the replaceable point 19 is of improved digging efficiency by reason of the novel relief undercutting arrangement. Since the point is constructed to protect the base from excessive wear, the latter may safely be made from softer material. Service and maintenance costs are substantially reduced not only because the key securing the point and base is free from bending, shearing or jamming, but because the point is self-sharpening throughout its effective digging length. Moreover, every feature of the replaceable point is designed for simple and efficient formation by drop-forging in relatively simple dies.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction as set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A digger tooth construction comprising a base and a replaceable point adapted for assembly by relative longitudinal movement and interengaging against separation in all but one direction, a key for securing the base and the point against separation in said one direction, and a keyway opening in a direction transverse to said direction of separation, said keyway including opposing key-engaged surfaces respectively on said base and on said point constructed and related to receive the thrust of the key thereagainst in a plane diagonal to said direction when the key is driven home in said keyway and thus force the point and the base together in opposition to said direction and also transversely.

2. In combination, in a digger tooth comprising a base and a replaceable point having opposed relatively slidable broad surfaces, means to hold the point and base against displacement except separating movement in one direction, and a key for locking the point and base against the separating movement, said opposed surfaces having a parallel and intersecting keyway therein for receiving said key and constructed and arranged to receive the thrust of the key in a plane diagonally intersecting the surfaces.

3. A digger tooth comprising, in combination, a cutting point having a rearwardly extending portion including laterally projecting longitudinal tongue ribs, a base structure having means to receive said rearwardly extending portion and including grooves complementary to said tongue ribs, and a securing key, said rearwardly extending portion and said base structure having oppositely cooperating transverse grooves forming a keyway intersecting said tongues and said complementary grooves for receiving said key.

4. In combination in a digger tooth including a base having a forwardly opening socket therein, a relatively flat wedge-shaped replaceable point including means fitting in said socket and having a substantially thinner digging portion projecting substantially beyond the forward end of the base after the point is completely received in said socket, the forward cutting edge of the point projecting substantially below the lower surface of the base and affording digging relief space rearwardly thereof, the lower face of the digging portion of the point having reenforcing ribs extending in a front to rear direction to substantially the forward edge of the base, said ribs extending substantially below the adjacent lower face areas of the digging portion of the point and having their forward ends chamfered back from the cutting edge of the point, and means for removably securing the point and the base together.

5. In combination in a digger tooth construction, including a generally wedge-shaped base and a flattened wedge-shaped point of substan-

tial width, the base having a forwardly opening socket and the point having a shank fitting in said socket, and means for removably securing the shank in the socket, the forward portion of said point projecting substantially beyond the forward end of the base and having a chamfer starting in spaced relation to the adjacent forward edge of the base and carrying the forward end of the point to a cutting edge, the lower face of the projecting portion of the point being relatively deeply undercut through said chamfer and extending rearwardly substantially to the adjacent forward edge of the base and affording digging relief.

6. In a digger tooth point, a generally flat wedge-shaped body having broad upper and lower faces and a relatively sharp chamfer intersecting said lower face and carrying the forward end of the body to a sharp cutting edge, said lower face being undercut rearwardly from the chamfer substantially parallel to said upper face intermediate the sides of the body for digging relief and to render the point self-sharpening as the cutting edge wears back during use.

7. A digger tooth construction comprising a base and a replaceable point adapted for assembly by relative longitudinal movement and interengaging against separation in all but one direction, a key of generally flattened form for securing the base and the point against separation in said one direction, and a keyway comprising complementary grooves in the base and the point located on an axis transversely of the base and point assembly and providing keyway surfaces opposing one another diagonally relative to the direction of relative separation movement of the point and base and adapted to receive the key thereagainst edgewise and tilted generally diagonally relative to said direction of separating movement to thus force the point and the base together in opposition to said direction and also transversely.

8. A digger tooth comprising a base and a replaceable point having means including opposed interengaging surfaces arranged to hold the point on the base against all but a separating movement, and an elongated key of generally flattened form for locking the point against separation from the base, said key being interengaged with the base and the point on an axis transverse to the direction of separating movement of the point from the base and with its major transverse plane disposed at a tilted angle opposing said direction of separating movement, so that when the point is subjected to a separating pull the key tends to tip toward the perpendicular, and thus effect a closer driving together of at least certain of the interengaging surfaces of the point and base.

9. A digger tooth comprising, in combination, a base having a forwardly opening socket, a separable point interengageable with the base and having a rearwardly extending generally complementary tang fitting into said socket, said base and said point having spaced opposed keyway surfaces facing one another in a diagonal plane tilted upwardly and rearwardly relative to the axis of the tang, and a key arranged to be driven into place in slidable interengagement with said surfaces to be placed under compression by such surfaces and to drive the point rearwardly to hold the tang in its socket and also drive the upper surface of the tang against the opposing upper wall of the tang socket.

10. A digger tooth comprising a base including a forwardly opening socket having a lower surface straight in a front to rear direction, a digging tooth having a reduced shank portion adapted to interengage within said socket and including a bottom surface slidably interengageable with said socket surface, said socket surface having an upwardly and generally rearwardly opening transverse groove therein, said bottom surface of the point having a downwardly and generally forwardly opening groove therein opposing the first-mentioned groove, and a key slidably interengaging within said grooves to hold the point and the base against separation.

11. A digger tooth construction comprising a base member and a replaceable point member, said replaceable point member having a supporting shank and a body provided with a digging edge, said shank tapering backwardly from said body, said base having a socket complementary to said shank, a key member which is tapered from its driving point to its entering end, said base and said shank being formed with grooves providing a key-way for receiving said key member, said key and key-way being disposed at an angle traversing the line of juncture between said shank and said base, whereby a separating force exerted on said shank and base tends to cause the key to exert a transverse force on the shank which causes the shank to bind more firmly in its socket.

12. A digger tooth construction comprising a base member and a replaceable point member, said replaceable point member having a supporting shank and a body provided with a digging edge, said shank tapering backwardly from said body, said base having a socket complementary to said shank, a key member which is tapered from its driving point to its entering end, said base and said shank being formed with grooves providing a key-way for receiving said key member, said key and key-way being disposed at an angle traversing the line of juncture between said shank and said base, whereby a separating force exerted on said shank and base tends to cause the key to exert a transverse force on the shank which causes the shank to bind more firmly in its socket, the wall of the groove in said base forming said key-way and directly opposing separation of the shank from its socket, extending at substantially right angles to the axis of the juncture and the opposite wall of the groove forming said key-way in said shank, being inclined with respect to the opposing groove to correspond substantially to the taper of said key.

13. A digger tooth construction comprising a base member and a replaceable point member, said replaceable point member having a supporting shank and a body provided with a digging edge, said shank tapering backwardly from said body, said base having a socket complementary to said shank, a key member which is tapered from its driving point to its entering end, said base and said shank being formed with grooves providing a key-way for receiving said key member, said key and key-way being disposed at an angle traversing the line of juncture between said shank and said base, whereby a separating force exerted on said shank and base tends to cause the key to exert a transverse force on the shank which causes the shank to bind more firmly in its socket, the wall of the groove in said base forming said key-way and directly opposing separation of the shank from its socket, extending at substantially right angles to the axis of the juncture and the opposite wall of the

groove forming said key-way in said shank, being inclined with respect to the opposing groove to correspond substantially to the taper of said key, to a point substantially midway between the walls of the shank from each side of said shank, whereby the key may be driven in from either side of the base and shank.

14. A digger tooth construction comprising a base member and a replaceable point member, said replaceable point member having a supporting shank and a body provided with a digging edge, said shank tapering backwardly from said body, said base having a socket complementary to said shank, a key member which is tapered from its driving point to its entering end, said base and said shank being formed with grooves providing a key-way for receiving said key member, said key and key-way being disposed at an angle traversing the line of juncture between said shank and said base, whereby a separating force exerted on said shank and base tends to cause the key to exert a transverse force on the shank which causes the shank to bind more firmly in its socket, the said key member being formed with substantially parallel plane sides and with curved edges, the said key-way having its grooves complementarily curved.

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