

March 12, 1946.

J. C. LANG

2,396,276

EXPANSIBLE PRONG DEVICE

Filed June 11, 1943

2 Sheets-Sheet 1

Fig. 1.

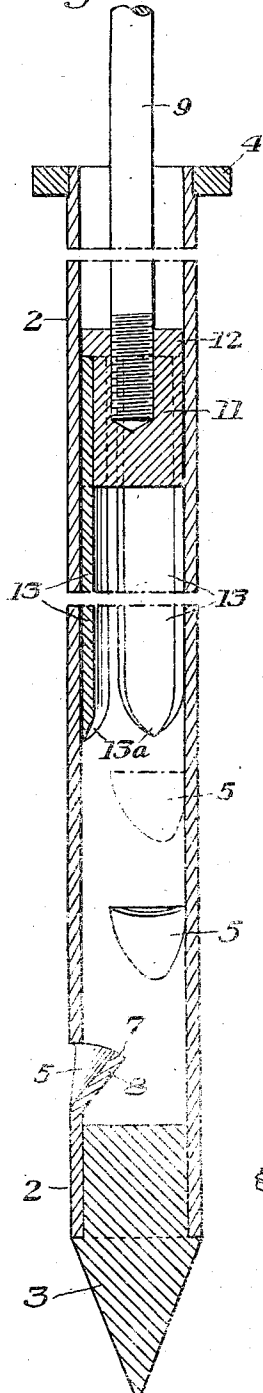


Fig. 2.

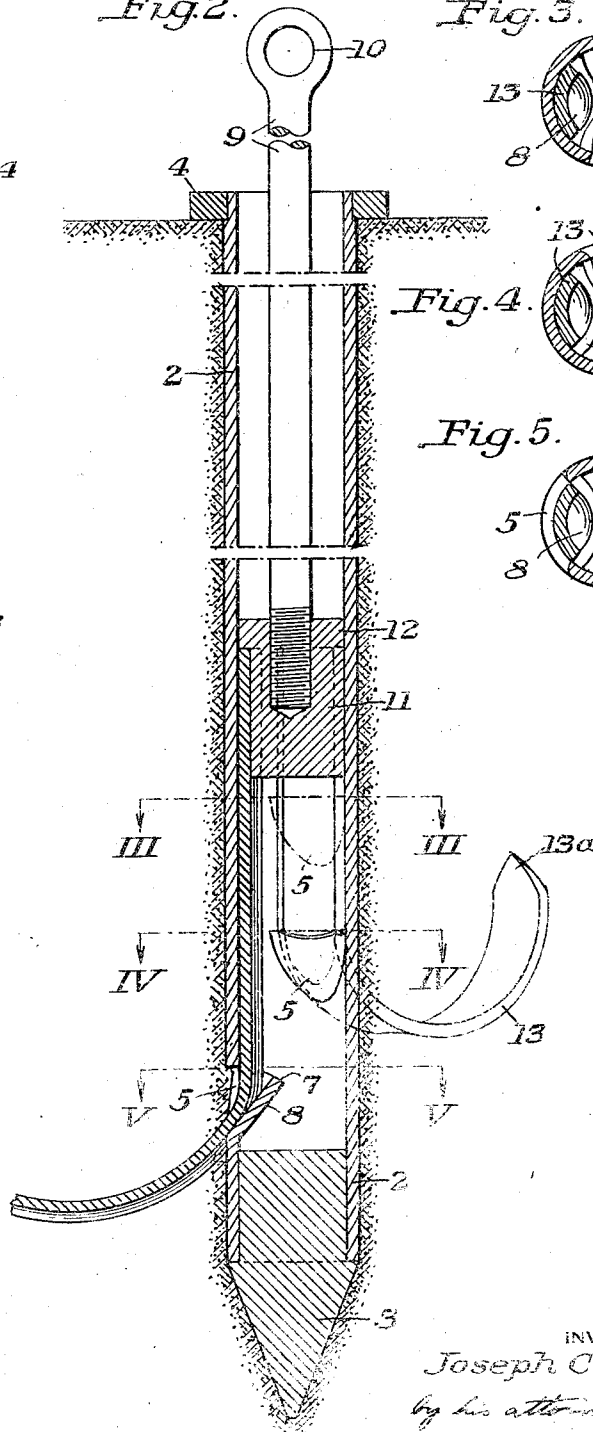


Fig. 3.

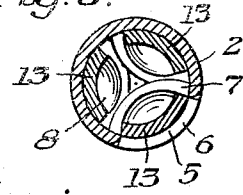


Fig. 4.

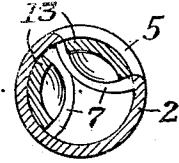
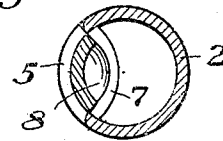


Fig. 5.



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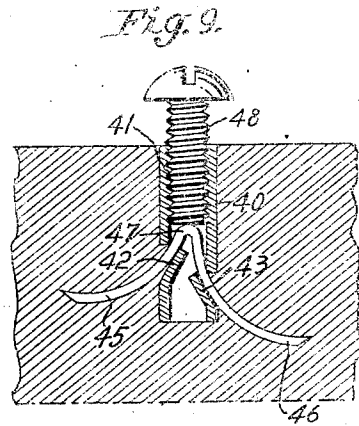
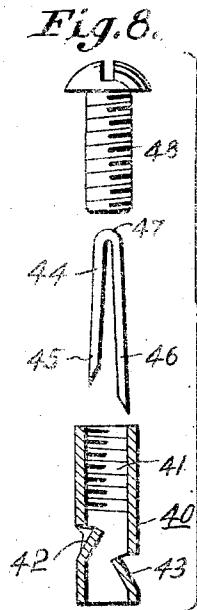
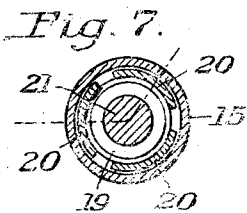
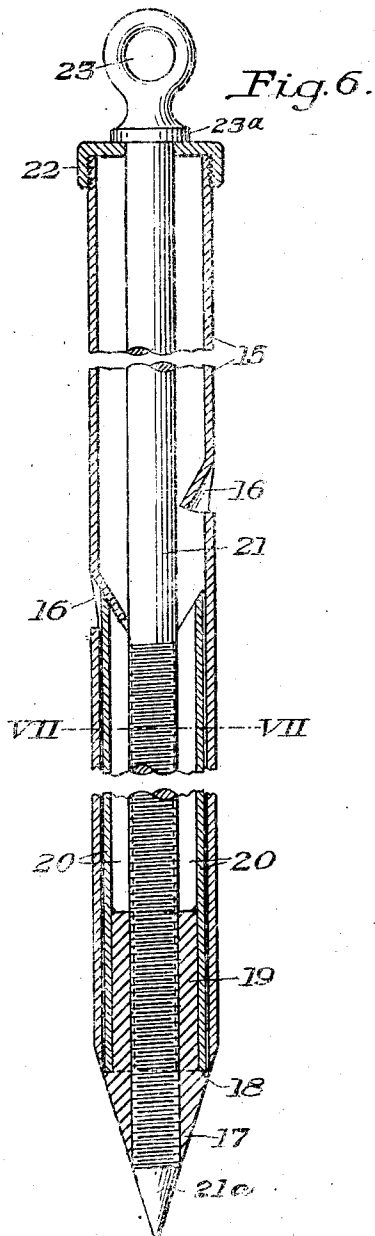
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EXPANSIBLE PRONG DEVICE

Filed June 11, 1943

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,396,276

EXPANSIBLE PRONG DEVICE

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Application June 11, 1943, Serial No. 490,547

5 Claims. (Cl. 85—26)

This invention pertains to devices of the character having prongs or tines which are normally received within an exterior shell or casing, but which, by effecting relative movement between the tines and the shell or casing, the tines or prongs can be forced outwardly. Devices embodying my invention may be constructed in various different shapes and sizes to accomplish a variety of results.

It has heretofore been proposed to construct expansible prong devices of the general character to which the present invention pertains with a casing or sleeve. Within this casing or sleeve there has been provided a body member which is movable longitudinally in the casing sleeve, and which carries prongs that are either pivotally attached to the movable body or are of a character which may be bent in operating the device. Cam surfaces are provided whereby when such relative movement takes place the prongs are caused to move outwardly through the openings in the body. In such devices as heretofore constructed, a plurality of prongs, usually two or more, engage anvil elements which are located in the same transverse plane so that all of the prongs are thrust outwardly at the same time. One disadvantage of such an arrangement is that it requires considerable force, particularly in large objects such as ground anchors, to simultaneously effect the penetration of both or all of the prongs. Another difficulty with such devices is that where all of the openings for the prongs are in the same transverse plane in the casing, the prongs have to be of relatively small section so that the casing will not be too greatly weakened in the plane where the holes are provided for the points of the prong to emerge. For example, if there were three prongs, each approximately 120° in extent, within a cylindrical casing, the open area for the three prongs to come through the casing would be 360°, or in other words, the casing would be cut in half, which of course would be an impossible condition. Therefore, the number and dimension of the prongs had to be determined and limited by how much of the casing could be satisfactorily cut away to provide openings for the prongs to pass through the casing and still have sufficient strength in the casing. Finally, in fastenings to be driven into wood or other material, the prongs emerging readily in several directions in the same plane often tended to split the wood in the plane of the emergence of the prongs.

An important advantage of the present invention is the provision in a device of this kind of

holes in the sleeve and casing through which the prongs pass, these holes being circumferentially and longitudinally spaced. For example, in an implement having three prongs, the three holes through the casing may be separated longitudinally and may be disposed around the casing at angles of 120°. Due to the fact that all of the holes are not in the same transverse plane, the casing is not materially weakened. Each of the prongs in that instance may then be nearly 120° in angular width. Since the holes are spaced longitudinally, the prongs will, if they are of the same length, emerge through the holes at different times so that there is less resistance at any one time to the operation of the device than where all of the prongs have to be bent at the same time. Moreover, because of the longitudinal separation of the holes through which the prongs emerge, the prongs, in a fastener used in wood or other material, emerge in transverse planes which are separated one from another so that there is less tendency for such a fastener to split the wood or composition material into which the fastener is driven.

Another advantage of my invention is the provision of a simple means for deflecting the prongs to enable the shell or casing of the device to be made either from sheet metal or from standard machineless tubing, depending upon the character of the fastener, without the customary machining operations.

My invention may be more fully understood by reference to the accompanying drawings, in which:

Figure 1 is a longitudinal section through a ground anchor constructed in accordance with my invention;

Figure 2 is a view similar to Figure 1, showing the same anchor with the prongs expanded;

Figures 3, 4 and 5 are transverse sections in the plane of lines III—III, IV—IV and V—V of Figure 2, respectively;

Figure 6 is a longitudinal sectional view of another form of ground anchor in which the setting of the prongs is accomplished by moving the inner body upwardly relatively to the outer casing or sleeve instead of pushing it down, as in the modification shown in Figures 1 to 5, exclusive;

Figure 7 is a transverse sectional view in the plane of line VII—VII of Figure 6;

Figure 8 is an exploded view showing my invention embodied in an anchor fastener for use in wood, ply wood, or composition bodies, where, for example, it is desired to mount a threaded element in such body; and

Figure 9 is a view of the fastener shown in Figure 11, showing the fastener of Figure 11 driven and assembled.

Referring first to Figures 1 to 5 inclusive, 2 designates a cylindrical shell or casing which may be formed, for example, of seamless tubing. Welded to its lower end is a driving point 3. Welded to the upper end is a driving collar 4. Spaced at regular intervals from the driving point and at equal intervals around the circumference of the tube are a plurality, preferably three, prong deflectors 5. These prong deflectors are formed by cutting a transverse curve through the wall of the tube through an arc of approximately 120° and then forcing in the wall of the tube below the curve to form an opening base, which opens downwardly and laterally, the metal inwardly from the opening having a free edge 7. The part which slopes from the edge 7 to the original wall of the tube is designated 8 and constitutes the actual point deflecting element. The contour of these deflectors, in the particular form of device illustrated, is best shown in the transverse section, Figure 3.

In use as a ground anchor the casing 2 is driven, point first, into the ground a suitable distance, usually six or eight feet, depending upon the character of the soil and the amount of pull which the anchor is expected to resist. After the casing has been driven, the other part of the anchor may be inserted in the casing. This other part of the anchor comprises a rod 9 having an eye 10 at the outer end thereof. The inner end of the rod is threaded into a cylindrical body or mandrel 11, which mandrel has a shoulder 12 at its upper end, the diameter of which is substantially equal to the inside diameter of the tube 2. Welded to the mandrel 11, with their upper ends abutting against the shoulder 12, are three prong elements 13, these prong elements projecting a substantial distance beyond the end of the mandrel 11. The prong elements are curved in transverse section to conform to the internal surface of the casing or pipe 2. They extend through an arc of nearly, but not quite 120° each, so that each is separated from the other. In the construction shown, the three prongs are of the same length and they terminate in pointed portions 13a.

When this prong assembly, just described, is thrust down into the casing which has previously been driven, one of the prongs 13 engages the surface 8 of one of the deflectors 5. This arrests the downward movement of the interior assembly. Then the eye 10 may be hit with a sledge or otherwise struck with heavy blows. This will force the first prong 13 out through the uppermost opening 6, while the other two prongs will continue to travel straight down the interior of the casing. The prong which first strikes the uppermost deflector will penetrate the surrounding soil initially at an acute angle downwardly, but as the driving continues with the prong being progressively bent, it will tend to curve upwardly, as shown. The angle of the deflectors may be varied to vary the resulting prong curvature. When several inches of the first prong penetrate the earth the second prong will engage the second deflector and it, too, will start to penetrate the earth, but at a plane below the first prong. Finally, the last prong will engage the lowermost deflector and be forced out into the earth in the same manner as the two preceding prongs. Since the prongs are all initially of the same length and since the deflectors are

separated longitudinally, it is apparent that the last prong to be deflected will not project laterally so far into the earth as the first prong, and that the middle prong will penetrate a distance intermediate the uppermost and lowermost prongs. Such prong, however, projects in a different direction, and the transverse curvature of the prongs, convexed upwardly, makes them very rigid. When the anchor has been set, the prongs are in shear where they pass through the casing, and the anchor, even in filled soil, develops a tremendous holding power.

When the end of the mandrel 11 has almost reached the top of the first deflector it will be impossible to drive the inner member farther and the operation of setting the anchor will be complete.

The anchor when thus set will resist enormous tension without pulling out of the earth. The prongs being convex in section offer a maximum resistance to upward movement through the earth, and the convexity imparts rigidity to the prong. In this case the prong is preferably of steel which does not have much spring to it, and the prongs are permanently distorted when the anchor is set.

Because of the fact that the prongs enter the earth at different elevations, the holding power of the anchor is increased. Because of the fact that one prong starts to bend and is well into the earth before the next engages its deflecting element, the device is not so hard to drive as if all of the prongs had to all initially bend at the same time. Even though each of the deflectors extends through an angle of about 120° the long separation of the deflectors does not result in the casing or tube being substantially weakened, as would be the case if all of the deflectors were in the same plane. Because the deflectors themselves can be a full 120° or more in extent, the three prongs can each nearly be 120° in width. Thus, the prongs have a very substantial projected surface when they are set in the ground to resist outward pull, whereas if they were narrow prongs they could more easily pull upwardly through the earth. Also, because of the relatively heavy section of metal in the prongs, the prongs will resist very heavy pull before they are bent downwardly to let the anchor pull out of the ground.

In the modification shown in Figures 6 and 7 the structure is essentially the same as the one shown in Figures 1 to 5, the device also being a ground anchor, but in this modification the prongs are expanded by moving the inner assembly upwardly inside the casing or tube rather than downwardly. In this view the casing is designated 15. It is provided with deflecting elements 16 which are formed similarly to the ones shown in Figure 1, but they are reversed in direction with respect to the form shown in Figure 1. The driving end 17 is of a diameter such that it can pass through the interior of the tube 15, and it has a shoulder at 18 above which there is an upwardly extending mandrel portion 19. The prong elements 20 are welded to this mandrel portion 19 and abut against the shoulder 18. These prongs are similar to those previously described, but extend upwardly instead of downwardly. A central rod 21 having a pointed terminal 21a is telescopically screwed into and through the mandrel 19 and end member 17, this being the driving point of the anchor. This central rod passes upwardly through the tube 15 and passes through a cap 22

at the upper end of the tube. There is an eye 23 at the outer end of this rod, and at the bottom of the eye is a thrust collar 23a.

In use, the assembly shown in Figures 6 and 7 is driven at a unit with the prongs entirely within the tube. After the casing has been driven as far as is necessary, a bar is put through the eye 23 to turn it, and the body 15 and mandrel 19 screw upwardly on the threaded end of the rod, similarly to a nut moving upwardly on a bolt. This forces one of the prongs out through the first deflecting element 16. Subsequently, the second prong is forced out through the second deflector, and finally the third prong is forced through the third deflector.

This structure has the advantages of the structure previously described in that the prongs are staggered vertically as well as disposed angularly about the periphery of the tube, so that the prongs initially bend at different times, and the openings are not all in the same transverse plane. A powerful force can be exerted through the screwing of the rod into the mandrel to expand the prongs, and the angle at which the prongs enter the earth is favorable to developing a great holding or anchoring power.

In the modification shown in Figures 8 and 9, there is shown another type of fastener for use in wood, ply wood, or composition material, as for example plaster or gypsum board, or even cinder blocks. This fastener may be made in various sizes, adapting it either to the assembly of ply wood airplane parts or structures, or to anchorage for relatively heavy machinery in lieu of lag screws.

As shown in Figure 8, the fastener comprises a fastener or sleeve 40, which is preferably formed of sheet metal rolled up into cylindrical form. Part way down the interior it is threaded, as indicated at 41. Below the threaded section of the sleeve there are inwardly formed deflectors 42 and 43. In this instance there are illustrated two deflectors and they are separated center to center 180° around the sleeve, and they are at different distances from the lower end of the sleeve so that they are both longitudinally and angularly spaced as are the deflectors in the ground anchor construction previously described. These deflecting elements as shown in Figure 8 are formed the same way as the deflector elements in the ground anchor specifically described in Figures 1 to 5, being, however, of greater angular extent because of their being only two of the deflectors instead of three as in Figures 1 to 5.

For cooperation with the sleeve or casing element there is a bifurcated body or prong member 44, having two legs 45 and 46, connected by a loop or head portion 47. It is of a size such that it has a relatively close working fit inside the sleeve, and in this instance the two legs are shown as being of different lengths, the leg 46 being longer than the leg 45. Hence, the tips of the free ends of both legs or prongs simultaneously engage their respective deflectors 42 and 43. Where desirable, however, the legs may be of the same length, and it will be understood that in the modifications previously described, the legs of the prongs may be of dissimilar length so as to simultaneously engage the several deflectors.

In using the fastener shown in Figures 8 and 9, a hole is drilled into the wood or other material into which the fastener is to be set, the hole being of a size such that the sleeve has a driving fit in it. When the sleeve has been driven into the hole the prong element 44 is driven with a nail-

punch or other appropriate tool, forcing the prongs out through the openings adjacent the deflectors 42 and 43 to approximately the position shown in Figure 12. This firmly anchors the sleeve in the body into which it is driven and also holds the sleeve against rotation. A screw or bolt 48 may then be screwed into the interiorly threaded sleeve, and the relation of the threads may be such that the entering of the bolt will tend to slightly expand the sleeve, thus tending to frictionally hold the bolt against loosening or turning under vibration. The bolt 48 may, for example, be used in securing a piece of hardware to a wooden member or for connecting wooden parts in airplane or other wooden or ply wood construction, or for securing hardware or the like to composition wall boards, and in larger instances, for bolting machinery to a wooden structure. These are only some of the uses to which such a fastener is applicable.

In this modification also the prongs enter the material at different angles and different elevations, thus tending to prevent splitting or separation of the plys of ply wood.

While I have illustrated and described a number of specific embodiments of my invention, it will be understood that this is by way of illustration and that various changes and modifications may be made within the contemplation of my invention and under the scope of the following claims, and that various other uses may be made for the device, and that further modifications may be made in the specific adaptations which have been here illustrated.

I claim as my invention:

1. In an expansible-prong device of the type comprising a casing member having a plurality of openings therein which are separated longitudinally and peripherally, a member slidable in the casing having a plurality of prongs thereon angularly separated to correspond in number and position to the openings in the casing and wherein the casing has inclined surfaces adjacent the openings for deflecting the prongs through the openings when relative movement is effected in one direction between the casing and the slidable member, characterized by the openings and the inclined surfaces being provided by a portion of the wall of the casing separated from the original wall of the casing only along its innermost edge and bowed inwardly from the original contour of the casing, the vertical edges of the inclined portions being attached to and being an integral part of the casing wall.

2. In an expansible-prong device of the type comprising a casing member having a plurality of openings therein which are separated longitudinally and peripherally, a member slidable in the casing with a plurality of prongs therein angularly separated to correspond in number and position to the openings in the casing and wherein the casing has inclined surfaces adjacent the openings for deflecting the prongs through the openings when relative movement is effected in one direction between the casing and the slidable member, wherein the prongs define a substantially cylindrical body of a diameter equal to the interior diameter of the casing with slits formed by spaces between the prongs which are of an arcuate width substantially less than half the width of the prongs, the prongs being substantially wider than they are thick, whereby to present a large projected area to the earth above and below when the anchor is set, said inclined surfaces being arranged to impart a continuous

curve to the prongs when the prongs are forced through the opening.

3. In an expansible-prong ground anchor of the type comprising a casing member having a plurality of openings therein which are separated longitudinally and peripherally, a member slidable in the casing have a plurality of prongs therein angularly separated to correspond in number and position to the openings in the casing and wherein the casing has inclined surfaces adjacent the openings for deflecting the prongs through the openings when relative movement is effected in one direction between the casing and the slidable member, wherein the prongs constitute a substantially cylindrical body fitted within the casing and having an exterior diameter substantially equal to the interior diameter of the casing, the prongs being separated by intervening slits, each prong having a width which spans at least 100° of arc.

4. A ground anchor comprising a casing open at its lower end, a driving point slidably fitted in the lower end of the casing, a plurality of prongs extending upwardly from the driving point and

being attached thereto, openings in the casing separated longitudinally and peripherally, a deflecting element adjacent each opening, the construction being such that when the driving point is moved upwardly in the casing the prongs are engaged by the deflecting means and deflected through the openings, and a screw for effecting upward movement of the driving point.

5. A ground anchor comprising a casing open at its lower end, a driving point slidably fitted in the lower end of the casing, a plurality of prongs extending upwardly from the driving point and being attached thereto, openings in the casing separated longitudinally and peripherally, a deflecting element adjacent each opening, the construction being such that when the driving point is moved upwardly in the casing the prongs are engaged by the deflecting means and deflected through the openings, and a screw for effecting upward movement of the driving point, the screw being threaded through the driving point and having a pointed end forming the tip of the driving point.

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