Sept. 22, 1959 K. R. RUNDE 2,905,288

EXPANDIBLE EARTH ANCHOR

Filed Dec. 22, 1954 2 Sheets-Sheet 1

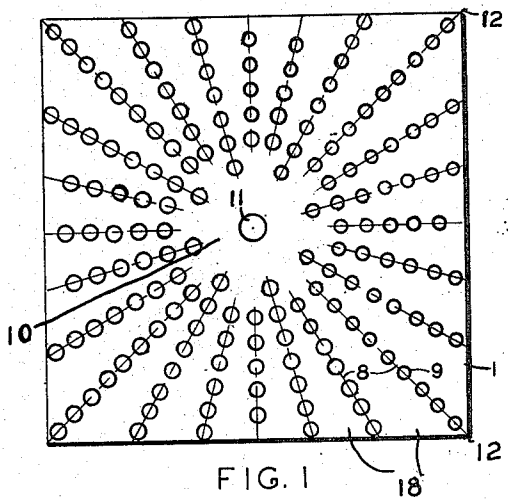


FIG. 1

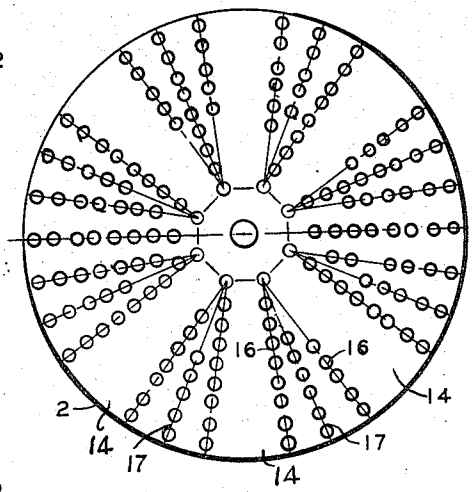


FIG. 4

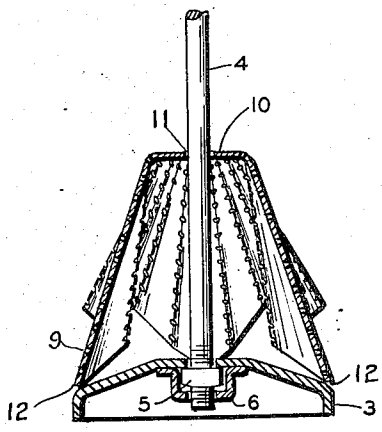


FIG. 2

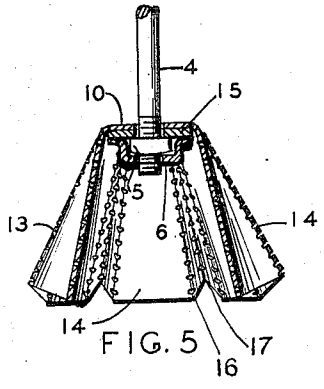


FIG. 5

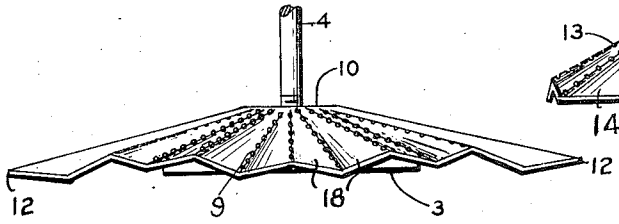


FIG. 3

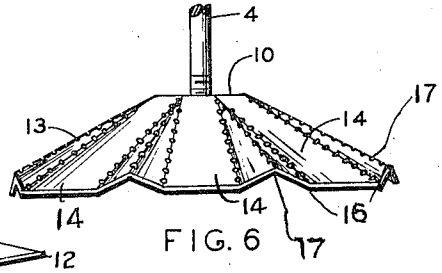


FIG. 6

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EXPANDIBLE EARTH ANCHOR

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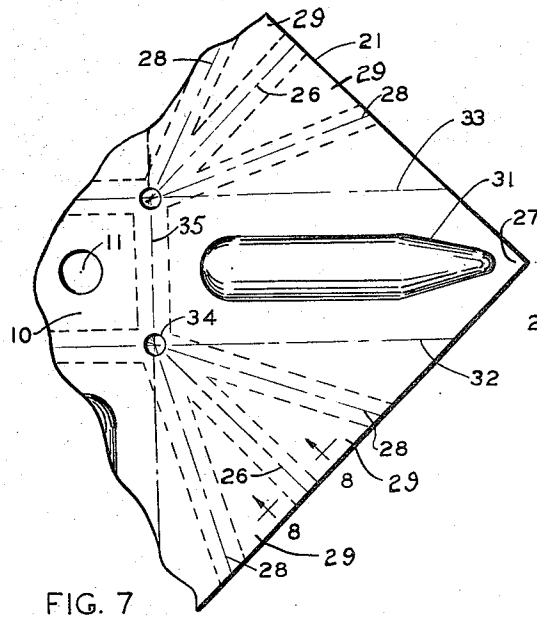


FIG. 7

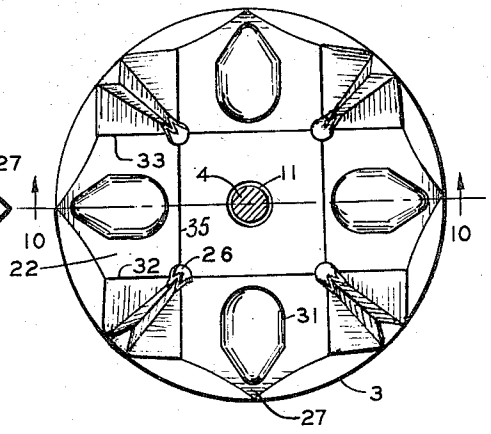


FIG. 9

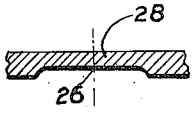


FIG. 8

FIG. 10

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EXPANDIBLE EARTH ANCHOR

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8 Claims. (Cl. 189—92)

The invention here presented is broadly in the field of expanding earth anchors and one of the objects of the same is to so improve the shape of such anchors so as to improve their efficiency and to facilitate their manufacture and installation.

An added object of this invention is to provide a simplified earth anchor which is fabricated into a finished anchor in a relatively simple stamping operation from one piece of sheet metal.

Another object of this invention is to provide an earth anchor of superior strength resulting from the shape of the anchor after its expansion.

A fourth object of this invention is to provide an earth anchor that may be used without a base or spreader plate.

Other objects and details of the invention will be apparent from the following description, when read in connection with the accompanying drawings; wherein

Fig. 1 is a plan view of a sheet metal blank from which an anchor is formed;

Fig. 2 is a vertical cross-sectional view of an anchor assembly ready for expansion;

Fig. 3 is a side elevation of the device shown in Fig. 2 after the expansion thereof;

Fig. 4 is a plan view of a circular sheet metal blank from which a modified form of the anchor may be formed;

Fig. 5 is a vertical cross-sectional view of an unexpanded anchor assembly using said circular blank;

Fig. 6 is a side elevation of the device shown in Fig. 5 after its expansion;

Fig. 7 is a plan view of a metal blank for forming another form of anchor;

Fig. 8 is a cross-sectional view of a detail of the latter;

Fig. 9 is a top view of the anchor formed from the blank shown in Fig. 7; and

Fig. 10 is a vertical cross-section of the embodiment shown in Figs. 7–10 showing the anchor before and after it has been expanded.

The earth anchors in commercial use at the present time generally have a plurality of blades, some of which may be joined together and others of which are independent and completely separated.

In my invention, an earth anchor is constructed of a single sheet of metal of medium thickness and whose shape may be polygonal as for instance, rectangular, square, or even circular. Figs. 1–3 and Figs. 7–10 show a square-shaped metal blank, while Figs. 4–6 show a circular blank. In any case, the earth anchor blank has a central aperture **11** therethrough to receive the usual guy rod **4**.

In the form shown in Figs. 1–3 the blank **1** may be divided into peripherally adjoining sections, each section adjoining its adjacent section along a line **8** radiating outwardly from a central platform portion **10** to the outer edge of blank, these sections being indicated as made through the blank material at **8**. Apertures are spaced

apart and extended from adjacent said platform portion to near the peripheral edge of the blank to weaken the blank along said lines and to act as fold lines for the blank as shown at **9**, thus leaving platform **10** unapertured except for the guy rod aperture. This platform portion provides an area to be engaged by and to receive blows from a tamping tool, as will be mentioned later.

Radiating folds are formed, in alternately opposite directions, on said bend lines, so that the blank forms a shell, sheath, skirt or similarly hollow tubular member that is open across its bottom, said bottom end being wider thereacross than the width of the shell across the top or platform end.

The resulting series of spaced apart reentrant or reverse folds or accordion-like pleats or fluting, forms a finished shape that is tapered and of wider transverse cross section toward the bottom of the shell. The resultant folded shell is longest along the four corners indicated at **12**.

In the process of folding the outer periphery of the anchor blank, it is obvious that the latter is initially contracted so that it is of a size that will permit ready insertion of the anchor shell into a hole of the diametral size used in commercial practice, or when used with an anchor base plate, to cooperate with the latter as shown in Fig. 2.

Although a cooperating base member is shown, it is possible to use the shell alone, and in the latter event the guy rod is connected directly to the anchor shell member. If a base plate member **3** is used for expansion, a nut retainer **6** is attached to the underside of the base plate, about the central aperture **11**. If a base plate is not used, this retaining member is attached to the underside of the shell itself.

In operation, and assuming that a base plate is used, the expansible anchor is placed on said base plate, whereupon the four corners **12, 12** of the anchor member will engage the upper base of the latter, and a standard guy rod having an eye at the upper end and screw threads on the lower end is placed through the expansible member and base plate, and is secured by a nut **5** and the nut retainer, as previously set forth. This assembly is lowered into a hole of proper depth dug in the ground and of sufficiently larger size than the anchor assembly to comfortably receive the latter. A standard tamping tool (not shown) is used to deliver blows to the platform portion of the expansible member. These blows drive the anchor member downwardly and cause the folded portion of the earth anchor to be forced downwardly against the inclined uppermost surface of the base and thus be directed outwardly and cause the shell to spread laterally and be projected downwardly and outwardly into the ground as shown in Fig. 3. The expansible member instead of being flat, has a series of corrugations or generally V-shaped arches to reinforce and strengthen said member and make it resist pressure of the earth, including the earth that has been tamped back into the hole, when load or pull is put upon the anchor.

If a circular blank **2** is used as illustrated in Fig. 4, the circular fold lines **16** and **17** correspond to the fold lines **8, 8** previously described. The series of spaced radiating folds or pleats are generally inverted V-shaped corrugations **13** that extend longitudinally from the platform portion **10** and terminate at the lower periphery of the blank. However, portions of the expander between adjacent, generally V-shaped portions, are flattened as shown at **14** in Figs. 5 and 6.

In operation, the circular expansible anchor member too, can be used with or without a base plate, and if used without a base plate, an extra heavy washer **15** is used to distribute the stress of the anchor over a larger area. This washer is approximately the size of the plat-

form portion and is fastened therebelow to the underside of the anchor member along with the nut retainer. A standard guy rod and nut are used and this assembly is installed in a hole in the same manner as previously described.

Assuming that the shell is used without a base plate, the blows of the tamping tool cause the earth to be forced into the inside of the hollow tubular member, and thus the earth itself acts as a non-compressible but plastic media in about the same manner as the base plate just described and will engage the underside of the anchor and expand the same.

After the anchor has been expanded into a flattened cone or shell or hollow tubular member as indicated in Fig. 6 and the earth has been replaced in the hole and tamped, the anchor is ready to withstand the pull on the guy rod and will not collapse when the pull on the guy rod forces the anchor upwardly against the ground pressing uniformly against the top surface of the anchor, and which pull against the tamped earth tends to fold the anchor back into its original shape.

However, between each flat sector there is an arched sector on which pressure is exerted by the earth, resulting in lateral pressure on the edges of said flat sectors. In addition to the forces on the arches, contracting of said expanded anchor is resisted by the tamped earth inside the hollow anchor member and which earth must be forced out in order for the anchor to collapse and return to its original position.

Another method of accomplishing more flexibility in the bending area as illustrated by the modified form of anchor shown in Figs. 7–10 inclusive, and in this case the hot metal blank may be pressed in a heavy press so that the thickness of the metal at **28** is reduced along a narrow band extending to either side of the fold lines **26** as well as along the boundary edge **35** of the platform portion as shown, and reduced thickness in the bend area being indicated in Fig. 8. This weakening along bend lines or of perforations therealong may be used interchangeably by either or both the two anchor members previously described.

Such a square-shaped anchor blank may be formed into an anchor by dividing the blank into peripherally adjoining sections **29—29**, each section adjoining its adjacent section along said weakened radiating fold line.

The four corner sections **22** may be strengthened by ribs **31**, said sections being flattened in relation to the adjoining sections and have lower portions which are flared upwardly and outwardly or slightly concaved resulting in a spoon-shaped construction Figs. 9 and 10 with tips **27**.

The adjacent areas between said corner sections **22**, **22** are folded in alternately opposite directions along bend lines **26**, **26** and result in the blank being formed in a series of spaced generally V-shaped reentrant reverse folds as previously described, though the bend lines **32** and **33** adjoining the corner sections are bent to the proper angle during the forming operation and remain in said initially bent shape even after expansion. The corner portions of the expander between the V-shaped folded portions to either side thereof are generally flattened, and the platform portion assumes a square shape with a central aperture therethrough to receive a guy rod. Corner relief holes **34** for the flow of the sheet metal during the forming of the sheet are placed where the adjacent bent portions are to meet.

In operation, when the square platform portion anchor is placed on a base plate, as shown in Fig. 10, the four tips of the corner sections will engage the upper face of the base and a standard guy rod is placed through said base and shell and fastened in place by a nut and nut retainer, as previously described.

Similarly this assembly is placed in a hole of proper depth and size and the tamping tool (not shown) is used to deliver blows to the platform portion of the anchor member.

As these blows drive the anchor member downwardly, it will be noted that lateral expansion is accomplished more rapidly and with fewer blows than has heretofore been effected with the other forms of anchor previously described. The corner portions tangentially engage the bounding edge of the top face of the base plate and the latter acts as a cam to force these corner portions and the accompanying folded portions to be moved laterally outwardly while moving downwardly, and causes them to dig into the earth as the shell is spread.

While there are disclosed above but a limited number of embodiments of the anchor member, it is possible to produce still more embodiments without departing from the concept herein disclosed and it is desired therefore that only such limitations be imposed on the appended claims as are stated therein, or may be required by the prior art.

I claim:

1. In an earth anchor adapted to be forced into the earth by a tamper, a one-piece laterally expandible tubular member having a platform section at its top, said section having a central aperture adapted to receive a guy rod therein, and having an uninterrupted periphery and tapered in transverse cross-section toward said platform section and consisting of a plurality of peripherally spaced flat sections interconnected by substantially co-extensive longitudinally reverse and reentrant folded radiating sections said folds being widest at the peripheral edge, whereby when the anchor is forced into the earth, said flat sections are expanded radially outwardly while the bottom periphery of the anchor remains annular.

2. A device as set forth in claim 1, and further characterized in that said flat sections are flared outwardly adjacent their bottom edges, and that the lines of fold of said folded sections are weakened to facilitate bending therealong.

3. In an earth anchor adapted to be driven into earth by a tamper, a one-piece laterally expandible tubular member having a platform section at its top, said section having a central aperture adapted to receive a guy rod therein, said member open across its bottom and being larger across said bottom than across its top, said member having an uninterrupted bottom peripheral edge and consisting of a plurality of peripherally spaced approximately flat non-folded earth cutting sections interconnected by substantially co-extensive reentrantly folded sections which, upon expansion in the earth, form arches, said anchor member having an annular peripheral edge.

4. In an expandible earth anchor adapted to be positioned at the bottom of a hole, a hollow tapered tubular shell having a platform portion at its top, said portion having a central aperture adapted to receive a guy rod therein, said shell whose largest opening is across its bottom the bottom peripheral edge of said shell being uninterrupted, and the material of the enclosing side wall of the shell shaped to provided substantially co-extensive accordion pleats extending lengthwise from said platform section toward its bottom, whereby said pleats will be spread open to form a series of arches and the size of the opening across said bottom will be enlarged while its periphery remains constant when pressure is applied to the top of said shell so positioned in the hole.

5. An earth anchor comprising a one-piece laterally expansible sheet metal member having a substantially horizontal tamping surface across its top and inclined downwardly and outwardly toward its lowermost peripheral edge and having a central aperture through its top to receive a guy rod, said member having relatively weakened portions to form longitudinally extending reverse and reentrant fold lines that extend outwardly from a point that is adjacent the center, said member being provided with a plurality of accordion folds along said weakened portions and extending substantially for substan-

tially the length of said member to said periphery to form a hollow tubular expansible anchor member said folds, upon expansion, form continuing arches around the constant peripheral edge of said anchor member.

6. An earth anchor comprising a base member having a central aperture adapted to receive a guy rod therethrough fastening means underside said base member comprising a square shaped metal blank having one set of opposed corners folded inwardly to retain said fastening and another set of its opposed corners folded back upon themselves to prevent said fastening from rotating around said guy rod, a laterally expansible one-piece sheet metal anchor member movably mounted therefrom and comprising a platform portion in its top, said portion, having a central aperture therethrough in alignment with said first mentioned aperture to receive said guy rod, and portions extending downwardly from said platform toward a lowermost annularly continuous peripheral edge, said expansible member being provided with a plurality of accordion folds radiating substantially from said platform portion to adjacent said lowermost peripheral edge to form an approximately tubular expansible anchor member, said uninterrupted lowermost peripheral edge of said member being engageable with the upper face of said base member, and means securing said guy rod to said base member.

7. An earth anchor comprising a one-piece sheet metal initially square expansible anchor member extended downwardly toward its lowermost peripheral edge and having a central aperture therethrough to receive a guy rod, said lower peripheral edge being continuous, said member having relatively weakened portions radiating outwardly from adjacent the center toward said periphery, and said member having a plurality of reverse and reentrant folds extending longitudinally along said weakened portions and extending substantially to said periphery to form an approximately tubular expansible anchor member having four points extending downwardly, beyond said folds, whereupon expansion, said points dig into the earth and said folds form arches between them, entirely around the constant lower peripheral edge of said anchor member.

8. An earth anchor comprising a one-piece sheet metal initially circular expansible anchor member flared outwardly toward its lowermost peripheral edge having a platform section in its uppermost portion, and having a central aperture therethrough to receive a guy rod, said lower peripheral edge being continuous, said member having relatively weakened portions extending radially outwardly from points spaced from said platform section to said periphery, said member being provided with a plurality of reverse and reentrant folds extending from said weakened portions to said peripheral edge to form an approximately tubular expansible anchor member said folds, upon expansion form spaced bearing arches around the constant peripheral edge of said anchor member.

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