March 18, 1969 J. E. SCHOLL 3,432,977

APPLICATION OF SHAPED CHARGE TO EARTH ANCHOR

Filed March 8, 1967 Sheet 1 of 4

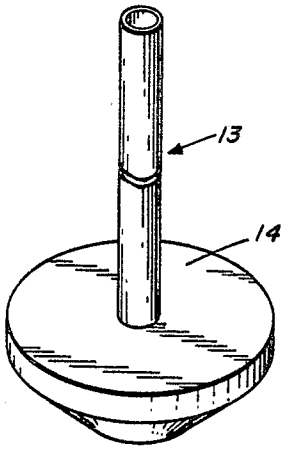


FIG. 1

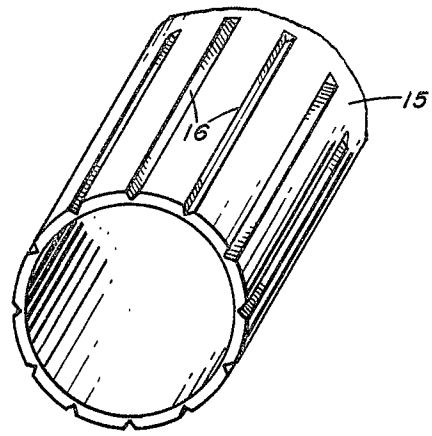


FIG. 2

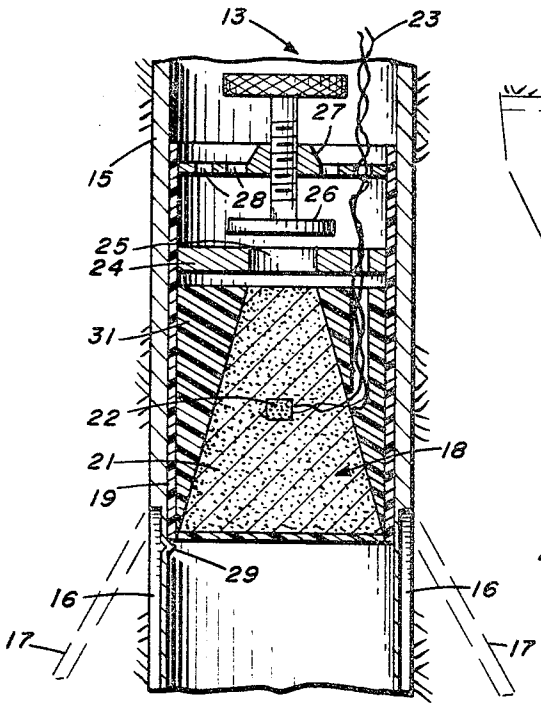


FIG. 3

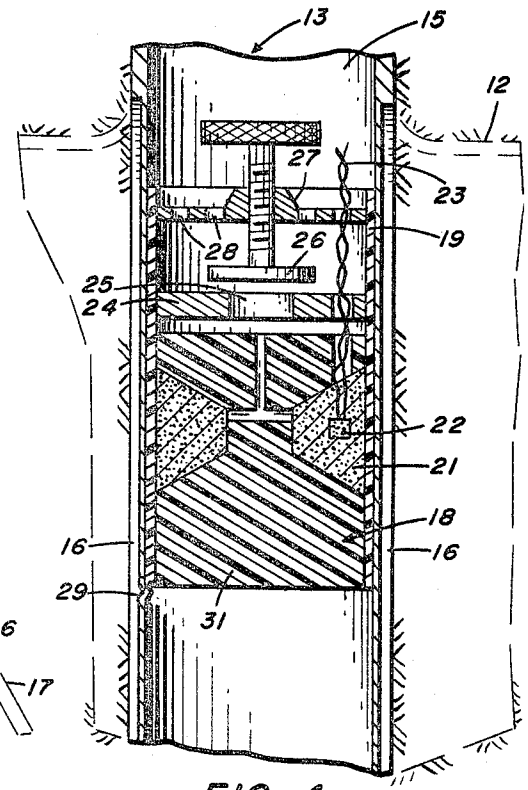


FIG. 4

INVENTOR
JAMES E. SCHOLL

BY

ATTORNEY

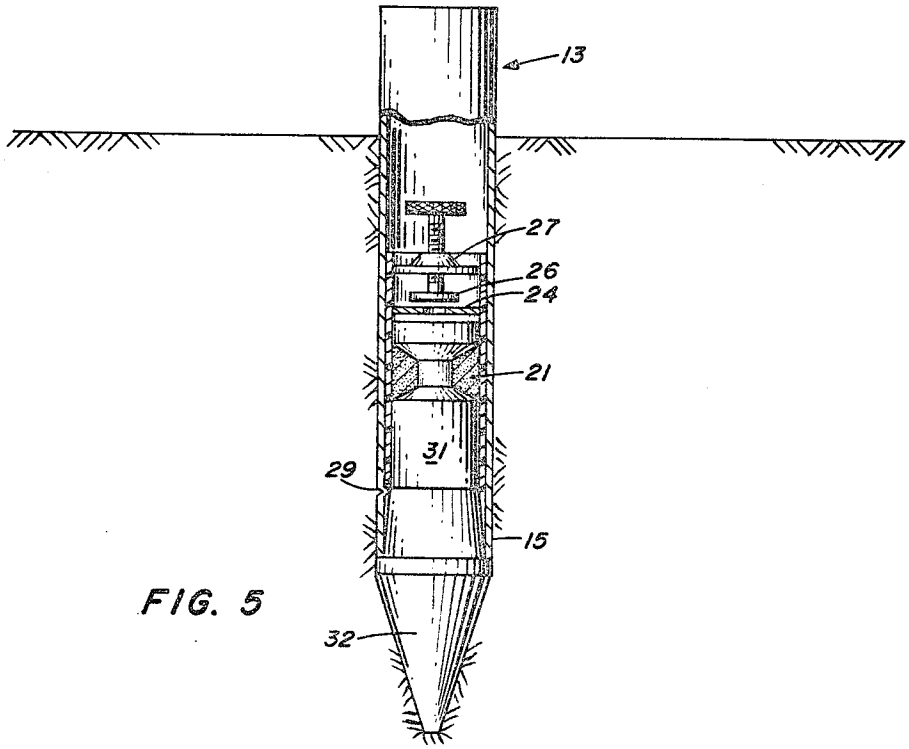


FIG. 5

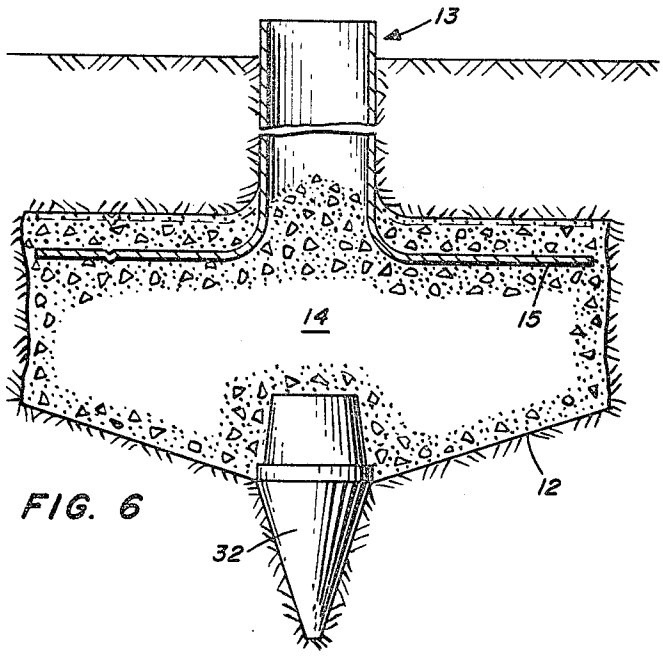


FIG. 6

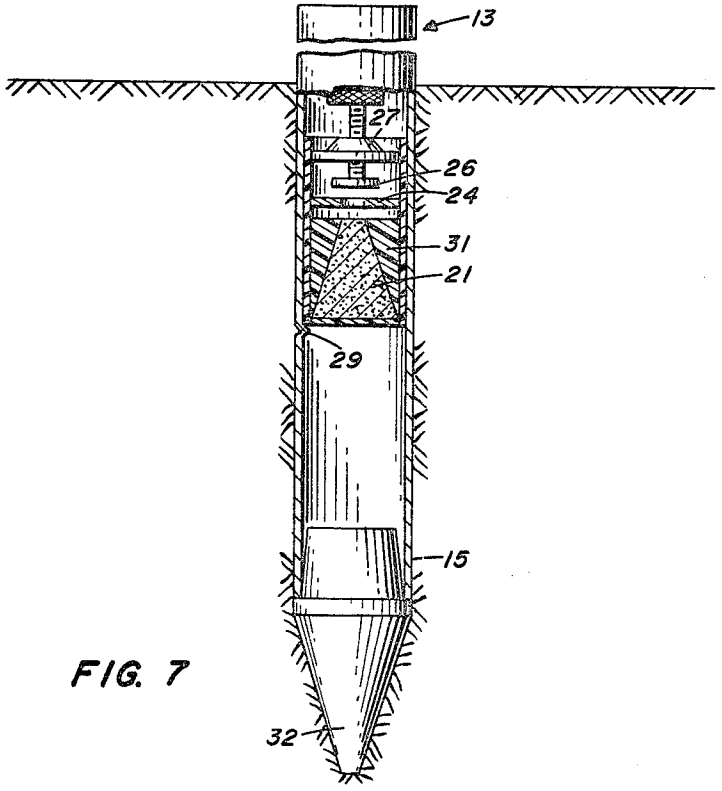


FIG. 7

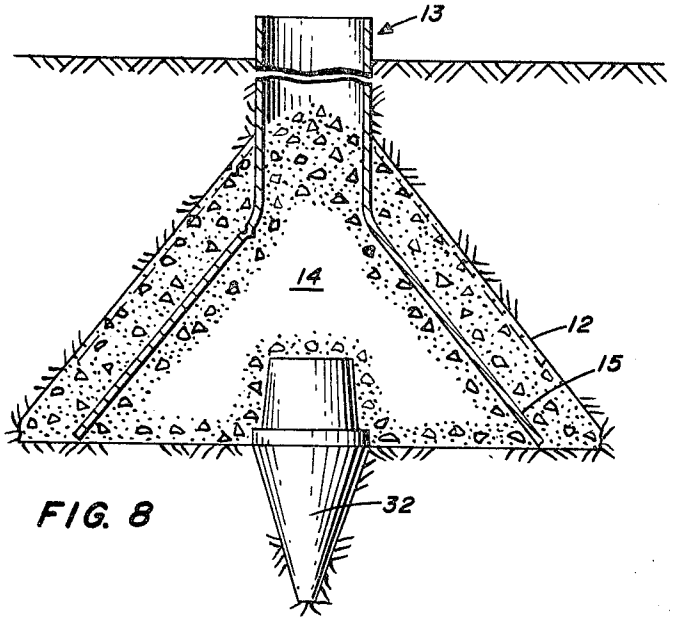


FIG. 8

March 18, 1969 J. E. SCHOLL 3,432,977

APPLICATION OF SHAPED CHARGE TO EARTH ANCHOR

Filed March 8, 1967 Sheet 4 of 4

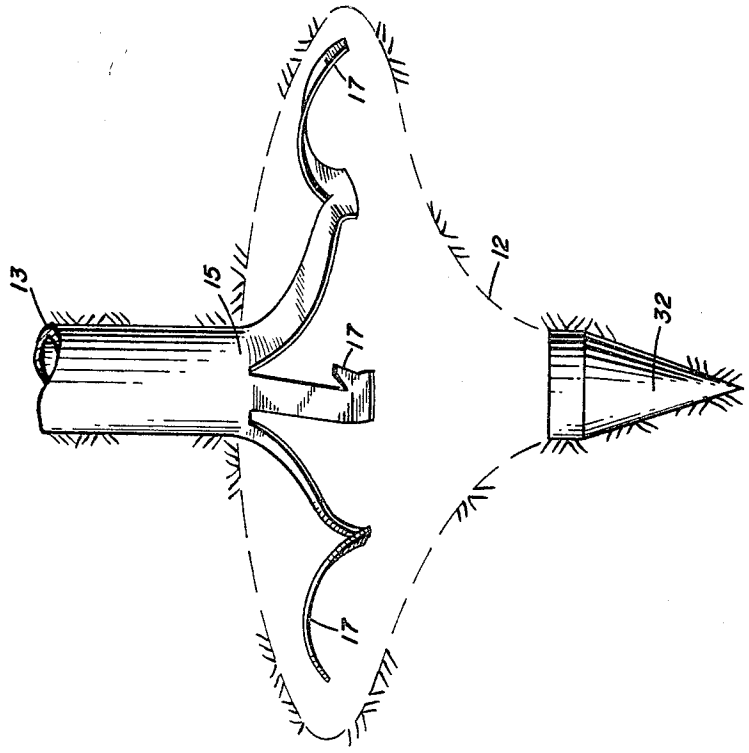


FIG. 11

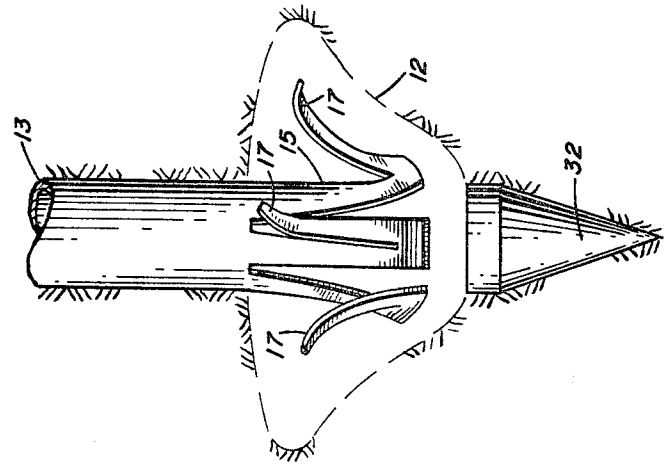


FIG. 10

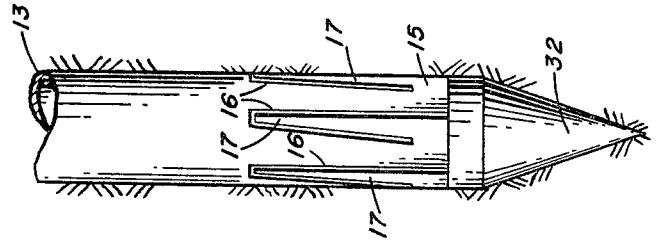


FIG. 9

United States Patent Office 3,432,977
Patented Mar. 18, 1969

3,432,977

APPLICATION OF SHAPED CHARGE TO EARTH ANCHOR

James E. Scholl, Fairfax, Va., assignor to the United States of America as represented by the Secretary of the Navy

Filed Mar. 8, 1967, Ser. No. 621,713
U.S. Cl. 52—98 3 Claims
Int. Cl. E04h 12/22

ABSTRACT OF THE DISCLOSURE

An earth anchor formed by exploding a shaped charge about an anchoring post to form a camouflet and filling the camouflet with cement to prevent failure of the anchor.

Background of the invention

Field of the invention.—This invention relates to a land anchor and more particularly to the method of forming a camouflet about the buried end of the anchor post to insure against failure of the anchor in all types of soil.

Description of the prior art

The need for short air fields, using arrestors, makes it necessary to have anchors to which the equipment used on the field may be securely fastened. These anchors must withstand a force of at least 20,000 pounds and must be set up with a minimum of labor and material. In the past it has been the practice to use tubular posts which are driven into the ground and by exploding a charge of explosive adjacent the lower end of the post, to form a camouflet which is filled with cement, to thus anchor the post. Such anchors have proven satisfactory for the most part. However, there are factors which control the efficiency of the anchor which may be improved without adding to the labor or the equipment needed to complete the anchoring project. The strength of the tubular post may be kept within limits with regard both the minimum weight of the post and its properties to provide the necessary strength. The strength of the quick set cement in both shear and compression may be varied to provide the best results. The adhesiveness of the cement to the tubular post may also be controlled. The size and shape of the camouflet is a factor both in the ultimate strength of the anchor and the quantity of cement needed to fill the camouflet. Another factor entering the picture is the weight and shearing characteristics of the soil above the anchor, as well as the disturbance of the soil during the explosion of the charge in the lower end of the tube. These factors enter into the result of obtaining a satisfactory anchor which will provide the necessary strength, and all of the factors may be controlled. Heretofore anchors such as these were fixed in the ground by driving a post into the ground and forming a camouflet about its lower end and filling the camouflet with cement. This was done without regard to the type of soil or the size and shape of the camouflet. Sometimes these anchors did not hold with disasterous results. The use of cement to fill larger and larger camouflets resulted in a transportation problem. The need was for an anchor which would have the necessary strength with a minimum of weight.

Summary of the invention

The formation of a land anchor which will have a maximum of strength relative to its weight will depend on the size, shape and location of the camouflet with regard to the end of the post and the type of soil in which the post is imbedded. This invention provides for the firing of an explosive charge adjacent the lower end of the post and so shapes the charge that the explosion provides a camouflet shaped to receive cement which will give the post its maximum holding power. The charge is designed to split the lower end of the post and spread these split portions to be firmly engaged with the cement filling the camouflet.

Objects

The object of the present invention is to provide both a method and apparatus for varying or controlling the size of the camouflet and the disturbance of the earth above the camouflet.

It is another object of the present invention to provide a method and apparatus for anchoring tubular posts to which equipment may be attached, so that the post is anchored with the least expenditure of labor and materials and able to withstand a predetermined force.

It is a further object of the present invention to provide means for controlling the size and relative position of the camouflet to provide a substantially shallow cylindrical form of concrete securely attached to the bottom of the tubular post.

It is still a further object of the present invention to provide a tubular post which is scored adjacent the bottom end, and to explode a shaped charge within the tube to separate the tube along the lines of the score and to spread the ends of the tube in accordance with a definite pattern within the confines of the camouflet.

It is a still further object of the present invention to provide an explosive charge which is so shaped to cause the force of the explosion to be directed in a planned manner to form a camouflet which is of a desired shape and to so control this explosion that the shape will be commensurate with the type of soil in which the anchor is driven, that is where the soil is of the loose or sandy type the charge is so regulated that the camouflet is spread over a larger area to provide a concrete cylinder of a large diameter, and where the soil is clay and tightly packed, the charge is so regulated that the camouflet is proportionally formed to provide the desired strength in the anchor.

A still further object of the invention is to form a camouflet for a tubular anchor so that the greatest strength may be obtained with the least amount of concrete.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

Brief description of drawings

FIG. 1 is a perspective view of the land anchor;

FIG. 2 is a perspective view of that end of the tubular post designed to be split upon ignition of the charge and showing the score lines;

FIG. 3 is a longitudinal cross-sectional view through the tubular post at one location of the charge;

FIG. 4 is a similar cross section showing another location of the charge;

FIG. 5 is a cross section showing the post in the ground with the charge in place;

FIG. 6 is a cross-sectional view showing the extent of the camouflet and the position of the spread portions of the post embedded in the concrete, with the initial

position of the spread portions shown in dotted lines.

FIG. 7 is a view similar to that of FIG. 5 with the charge located in a different position;

FIG. 8 is a view similar to that of FIG. 6 and showing the results of change in location of the charge;

FIG. 9 shows the lower end of the tubular post and a modified scored position;

FIG. 10 shows the result of the charge on the post of FIG. 9 and the spread of the scored portions with a moderate charge;

FIG. 11 shows the result of a larger charge on the post of FIG. 9, enlarging the camouflet and spreading the scored portions.

Description of preferred embodiments

Referring to the drawings, the anchor is shown in FIG. 1 above the ground. A tubular post **13** of a length of from four to twelve feet has a substantial cylindrical bottom **14** of concrete. This bottom is usually of uneven formation due to the formation of the camouflet **12**.

FIG. 2 illustrates the lower end **15** of the tube before it is driven into the ground, showing the score lines **16** substantially parallel to the longitudinal axis of the tube. With the tube driven into the ground and the explosive charge ignited the tube will split along the score lines the separated ends will bend up into the recesses of the camouflet formed by the explosion. These score lines may be of any configuration depending on the ground in which the camouflet is formed. As shown in FIGS. 9–11 the score lines **16** form the ends **17** of the tube so that they will extend further into the camouflet. This is done in ground where the camouflet is formed relatively shallow. The determination of the type of ground and the desired shaped ends of the tube to best sustain the anchor may be made as the result of previously formed camouflets and the type of shaped charge used.

The shaped charge **18** which is responsible for the direction the explosive force takes, is lowered into the tube after the tube is driven to the desired depth in the ground. It consists of an outer cylindrical housing **19** formed of paper, plastic or other suitable substance and houses an explosive **21**. The explosive **21** is provided with a fuse **22** attached to wires **23** extending up through the tube to a detonator (not shown). Also housed with the cylindrical housing **19** is a valve seat **24** formed with an opening **25** and located just above the explosive. A valve **26** threaded into a circular partition **27** carried by the housing **19** controls the size of the opening **25**. It is adjusted before the housing carrying the explosive is lowered into the tube and assists in directing the force of the explosive in the desired direction, by permitting more or less gas to escape upwards through the tube. The circular partition **27** is provided with holes **28** in sufficient number to prevent obstruction of the gas escape but to offer enough resistance so that the entire housing is blown out of the tube. At the upper section of the lower end of the tube, dimples **29** are formed in the inner wall to serve as stops for the cylindrical housing **19**. These dimples determine the position at which the explosive is set off, which is either at the top of the score lines as shown in FIG. 3 or substantially midway of the score lines as shown in FIG. 4. The explosive is packed in accordance with the results desired by the force of the explosion and shaping plates **31** determine the direction of the force. These plates may be located below and at the sides of the explosive as shown in FIG. 3 by the cone shaped structure with the bottom plate directing the force of the charge downward and outward. Those of FIG. 4 are positioned to direct the main charge outward with limited force directed downward. The difference in the results are shown in FIG. 5–8, FIGS. 5 and 6 showing the camouflet formed and the positioning of the ends of the tube when the charge is shaped as shown in FIG. 4. FIGS. 7 and 8 showing the results when the charge is shaped as shown in FIG. 3. The results desired are determined by the type of soil in which the anchors are to be positioned. It is the shaping of the charge that determines the effectiveness of the anchor.

Referring particularly to FIGS. 5 and 6, the full tube **13** is shown with the conical shaped ground piercing plug **32** which is carried in the lower end of the tube and which serves to form an easier entrance into the ground and prevents the tube from filling with soil while being driven into the ground. The portion (the lower end) immediately above the plug **32** is scored in a manner desired and as shown in FIGS. 5 and 6, with score lines substantially parallel to the longitudinal axis of the tube. The inside surface of the lower end is dimpled so that the cylindrical housing **19** containing the explosive is stopped midway of the score lines. The explosive is shaped to direct the force of the explosion laterally of the tube with the result of forming a shallow camouflet with the severed ends of the tube extending substantially at right angles to the tube. After the explosion, which blows the remnants of the housing **19** and the valve parts out through the tube, the tube is driven slightly further into the ground moving the extended ends from the position in contact with the upper wall of the camouflet to slightly below this upper wall. Concrete is poured into the camouflet, through the tube, filling the camouflet and surrounding the ends of the tube to form the cylindrical concrete base **14** as shown in FIG. 1.

In a like manner a differently shaped charge placed at a different position will form the camouflet as shown in FIGS. 7 and 8 and so extend the ends of the tube. The same procedure will form a concrete base of slightly different shape but more desirable for the ground in which the tube is sunk.

To form a very shallow camouflet with the ends of the tube extending further in a substantially right angled direction, the tube is scored as shown in FIG. 9 and the charge set off to extend the ends as shown in FIG. 11. Likewise where the ground is stony and the camouflet formed is small, similar to that shown in FIG. 10, the ends are accordingly extended to provide the ultimate holding in the concrete.

The shaped charge really determines the effectiveness of the anchor. The predetermined camouflet (predetermined by reason of the soil) governs the strength of the anchor and anchors formed by a controlled explosion are constantly proving their efficiency.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A land anchor comprising:

a tubular post, scored adjacent one end, said post being driven into the ground with the scored portion downmost;

a prepared fixed explosive charge carried within said tubular post, said charge comprising a cylindrical housing, powder contained within the housing, shaping plates carried in contact with the powder to direct the explosive force in a predetermined direction with relation to the post, and valve means carried above the powder and forming one end of the housing;

means carried within the post for initiating the explosive charge;

whereby the exploding of the charge splits the post along the scored lines to form split ends, the explosive force further forming a camouflet of a shape dependent on the direction of the explosive force, which direction is controlled by the shaping plates and the valve means, the split ends of the post extending outward into the camouflet; and

a cement filler introduced through the tubular post to fill the camouflet.

2. A land anchor according to claim **1** wherein the

valve means is adjustable to vary the escape of the explosive geses upward through the tobular post.

3. A land anchor according to claim 1 wherein the scoring of the tubular post is in a manner to provide split ends which exceed, in length, the longitudinal dimension, taken along the post, of the second portion.

References Cited

UNITED STATES PATENTS

3,115,226	12/1963	Thompson	52—156 X
3,222,842	12/1965	Luedloff et al.	52—155 X
3,228,153	1/1966	Luedloff	52—156
3,233,415	2/1966	Thomas	52—155
3,305,985	2/1967	Dean	52—155
3,324,666	6/1967	Lee	52—155 X
3,343,313	9/1967	Luedloff et al.	52—155 X

FRANK L. ABBOTT, *Primary Examiner.*

P. C. FAW, JR., *Assistant Examiner.*

U.S. Cl. X.R.

52—155