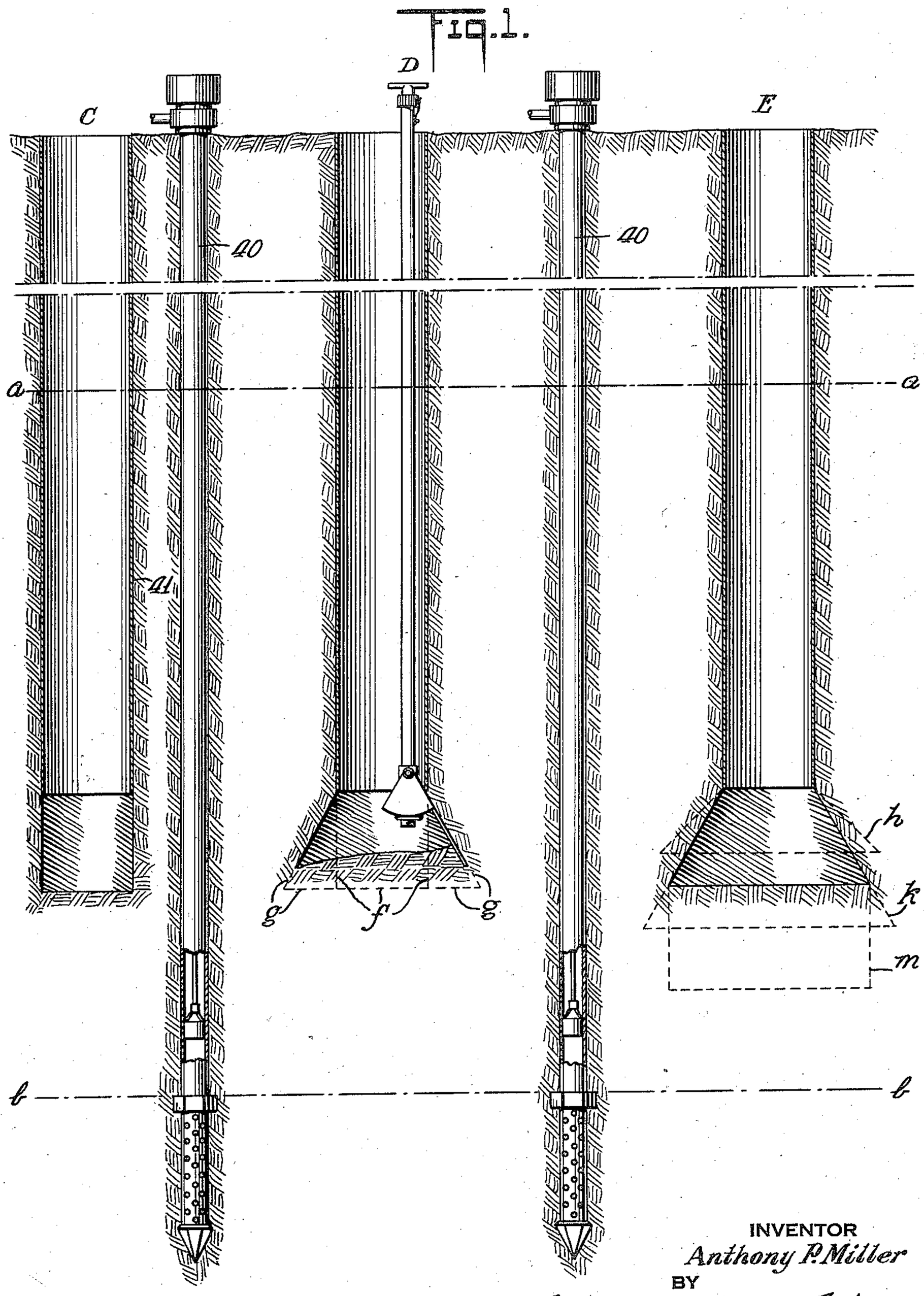
Aug. 20, 1935. A. P. MILLER 2,011,938

EXCAVATING TOOL

Filed July 18, 1932 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Anthony P. Miller
BY
Dean, Fairbank, Hirsch & Foster
ATTORNEYS

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Filed July 18, 1932 2 Sheets-Sheet 2

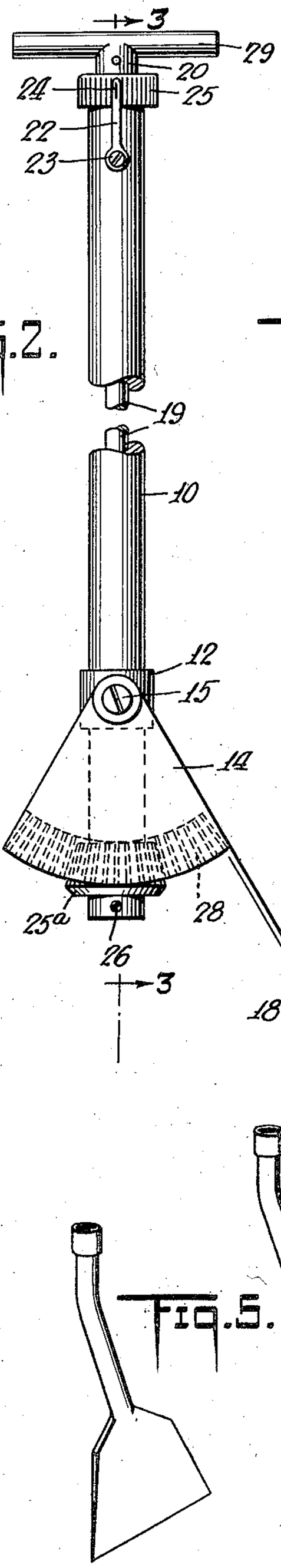

FIG. 2.

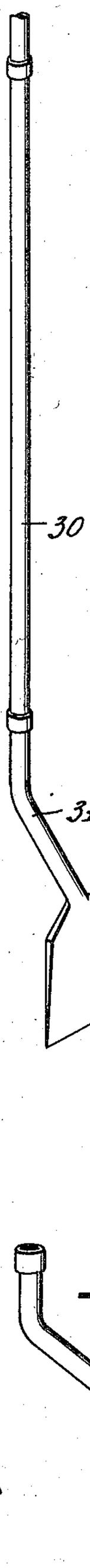

FIG. 4.

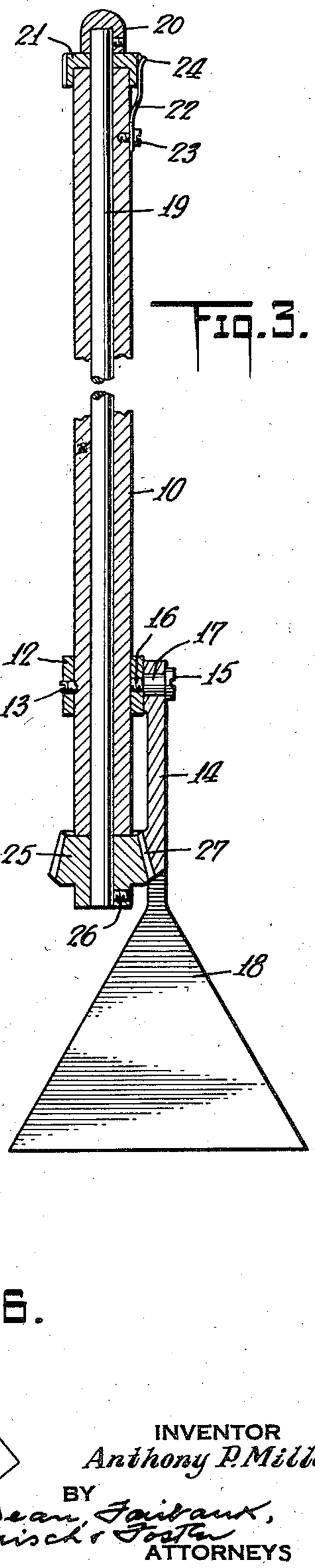

FIG. 3.

FIG. 7.

FIG. 5.

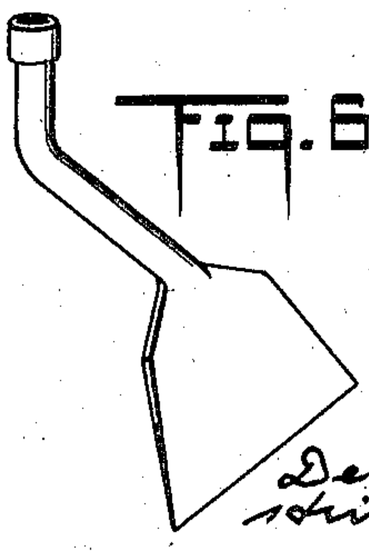

FIG. 6.

INVENTOR
Anthony P. Miller
BY
Dean, Fairbank, Mitsch & Foster
ATTORNEYS

Patented Aug. 20, 1935 2,011,938

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EXCAVATING TOOL

Anthony Paul Miller, Pleasantville, N. J.

Application July 18, 1932, Serial No. 623,031

6 Claims. (Cl. 255—76)

My present invention, considered from one aspect, is concerned with the provision of a tool for laterally undercutting the earth walls of relatively deep excavations of restricted cross section, and is especally intended and peculiarly adapted for forming an enlargement at the lower end of a straight shaft, such, for instance, as the enlargement which is required when pedestal piling are to be installed.

While the tool is capable of use in forming various undercut excavations adapted to serve as molds for spread footings, its operation may be best understood by considering it as applied to the formation of pedestal piling, it being understood that this term throughout the specification is intended to cover all analogous structures.

Heretofore the angle of undercutting of many piling shafts have of necessity varied in direct proportion to the depth and diameter of the shaft to be undercut. I refer especially to the use of automatic or semi-automatic excavating machinery which either permits no variation in the angle of undercut or necessitates varying the angle of undercut whenever the depth of the shaft itself varies. Precast piling of the pedestal type is not practicable due to the difficulty of sinking it.

For reasons set forth above it has heretofore been extremely difficult for an architect or engineer to be sure that pedestal of a piling cast in situ will be of the length and depth and contour which his specifications prescribe.

An object of the present invention therefore is to provide a cutting tool which will permit wide variation in piling depth and diameter, in pedestal depth and diameter, and in the angles of the conical walls of the pedestal. Variations in this latter angle are particularly important since the angle should be designed with due respect to the type of soil in which the piling is to be installed, and should bear a definite relation to the angle at which the load from a superimposed building is transmitted by the spread footing through the soil.

The invention further contemplates the use of a simply constructed, durable, rugged, portable tool which may be adjusted or set so that its operation even by an unskilled workman automatically results in the formation of a pedestal mold of the desired size.

Such a tool may either have an adjustable chopping or spading head, or may be equipped with a series of interchangeable heads set at different angles. By the simple expedient of varying the angle of this cutting head with respect to the handle upon which it is carried, straight downward reciprocation of the tool by a workman will cause undercutting at the desired angle. By adjusting the tool to determine the effective length of the offset cutting blade, pedestal molds of different diameters but with their conical sides sloping at the same angle may be formed.

This application is a continuation in part of my co-pending application Serial No. 408,205 filed November 19, 1929.

The invention may be more fully understood from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a somewhat diagrammatic view illustrating sucessive steps in the formation of a pedestal piling and illustrating the use of the tool of the present invention;

Fig. 2 is a broken side elevation view of a tool embodying the invention;

Fig. 3 is a longitudinal sectional view on line 3—3 of Fig. 2;

Fig. 4 is a perspective view of a tool having a removable rather than an adjustable head;

Figs. 5 and 6 are perspective view of heads having cutting portions set at different angles and which may be substituted for the head illustrated in Fig. 4; and

Fig. 7 is a view of a head having the same angle but of greater effective length than the tool shown in Fig. 5.

Figs. 2 and 3 illustrate a tool including an elongated hollow handle 10 which may be of ordinary pipe stock and formed by coupling together any suitable number of pipe sections. Adjacent its lower end the hollow handle 11 is encircled by a collar 12 fixedly secured to the handle as by a set screw 13. A sector plate 14 is pivoted to swing in a plane parallel to the plane of the longitudinal axis of the handle, this sector plate being pivoted upon a headed stud member 15 having a reduced threaded end 16 screwing into the collar and an unthreaded central portion 17 passing through an aperture in the apex of the sector plate and affording the pivotal bearing for the plate. A generally triangular shaped sharp edged spade member 18 is preferably integral with the sector plate, the spade lying in a plane at right angles to the plane of the plate and having its reduced end integrally joined to a corner of the plate.

With the sector plate locked in any position of adjustment, it will be observed that the spade extends laterally and downwardly of the handle at an angle dependent upon the setting of the sector plate, and is well adapted for undercutting the lower end of a vertical shaft in the soil by simply

imparting a vertical reciprocating motion to the handle.

The means for varying the angle of adjustment of the spade with respect to the handle includes a setting shaft 19 extending through the hollow handle member and provided at its upper end with a knob 20 resting on a thrust bearing 21 in the form of a cap flanged to encircle the upper end of the pipe 10. A flat spring 22 having one end screwed to the handle adjacent the upper end of the latter, as by a set screw 23, includes a free end 24 yieldingly engaging peripheral teeth or notches 25 on the flange of the cap 21 and normally tending to lock the setting shaft (with respect to which the cap is fixed) against rotation.

At the lower projecting end of the setting shaft a beveled gear 25—*a* is affixed as by set screw 26, this beveled gear meshing with the beveled teeth 27 of an arcuate rack 28 integral with the sector plate adjacent the lower curved edge of the latter. Integral with the knob 20 is a cross-bar 29 constituting a handle for manually operating the chopping tool.

It will be evident that by withdrawing the spring 22 and rotating the handle 29, the setting shaft will act through the medium of the gear 25—A and rack 28 to change the angle of the spade with respect to the longitudinal axis of the handle 10. Thus the spade may be set at any desired angle with respect to the handle or shank 10 in accordance with the angle of cut desired.

In Figs. 4, 5, and 6 I have illustrated an alternative type of tool of simplified construction and designed to accomplish similar results. Here the handle member is in the nature of a number of pipe lengths 30 coupled together. Additional pipe lengths may be added in accordance with the depth of the hole in which the tool is to work. Screwing onto the lower end of the lowermost pipe section is the shank portion 31 of a spade tool. This shank extends angularly to the handle 30 and is integral with the sharp edged spade member 32 also disposed at an angle to the plane of the handle. Shank 31 may either have the angular formation illustrated or may be of gooseneck design if desired, the object to be accomplished being to offset the spade 32 at such an angle to the handle 30 that the spade will cut laterally into the walls of an excavation as a vertical chopping or reciprocating motion is imparted to the handle.

In this case no adjustment of the removable spade head is possible, and instead I provide a number of detachable heads. Some of these heads, such as those of Figs. 5 and 6, are designed to set the spade at different cutting angles to the handle; others, such as that of Fig. 7, are designed to afford spades of varying lengths set at similar angles to the handle (compare Figs. 5 and 7). With a complete set of such heads it is possible not only to vary the angle of undercutting but to vary the maximum diameter of the undercut area in accordance with the particular mold shape required.

Fig. 1 is a diagrammatic view showing a typical development of a piling mold in the formation of which my tool is used. This view is typical of the use of the method in beach sand where the undercut should not be at an angle of more than 30 degrees to the vertical if caving of the sand is to be prevented.

The view illustrates a set of well points 40 which have been sunk at the region where the pilings are to be installed, these well points serving in customary fashion to dewater the sand so that excavation may be performed. In this view the normal water level of the sand is indicated at *a—a*, and the artificially lowered water level produced by sucking the water from the sand by the well pumps is shown at *b—b*.

The first step in the method is to sink a straight vertical shaft in the sand, of diameter corresponding to the proposed diameter of the pillar portion of the pile, and then to line this shaft with a metallic can or liner member 41. The condition of the excavation after this operation has been performed is illustrated at C. The can is of a length corresponding to exactly the length of pillar required and prevents scaling or shaling of the sand walls of the mold during subsequent operation of the spading tool and removal of the sand from the region below the shell.

The next step illustrated at D is to continue the excavation with a posthole digger to a depth below the shell equal to the proposed total height of the pedestal. Thereupon the spade tool is brought into play, the head having been first set at the desired 30 degree angle, and the pedestal portion of the mold is chopped out. The condition illustrated at D represents the condition where the vertical bore has first been extended to dotted lines *f—f—f* and the chopping operation is still in progress, dotted lines *g—g—g* showing the outline of the undercut when completed.

In using the spade tool the workman thrusts it downwardly with the cutting edge of the spade riding on the can. As soon as the spade passes beyond the can it slips off sidewise into the sand, cutting or chopping the same out.

It will be seen that the angle of the cut of this tool is independent of the length of the bore and that the handle of the tool need not be tilted, it merely being necessary that the diameter of the bore be sufficient to accommodate the spade.

At E I have illustrated the condition of the completed mold after the chopping operation has been completed and the mold bottom tamped by pouring in a little water, which quickly drains down to the level at *b—b*. As the sand is chopped out by the spade it falls toward the center of the excavation where it may be conveniently removed with a posthole digger.

As to the advantage of varying the angle of cut it may be noted that different types of soil have different caving angles, and a tool which will maintain the proper angle in beach sand may be entirely unsuitable for working in clay where a greater angle of undercutting is possible without danger of collapse of the mold walls.

The advantage of having removable heads of suitable angles but of different lengths will be obvious when it is borne in mind that it may in some instances be desirable to vary the depth of the pedestal chamber, i. e., to increase its maximum diameter without varying the angle at which the undercutting is done.

The tool also permits the formation of pedestal molds in which cylindrical pedestals of greater diameter than the pillar portions are connected to the pillar portions by conical necks.

In that section of diagrammatical Fig. 1 marked E I have illustrated in dotted lines at *h* the manner in which undercutting in clay, for instance, may be performed at a greater angle. I have illustrated at *k* in dotted lines the manner in which a deeper pedestal mold may be cut at the same angle by the use of a longer spade,

and I have illustrated in dotted lines at *m* the appearance of a cylindrical pedestal of greater diameter than the shaft and connected to the shaft by a sloping shoulder portion.

These are merely typical of some of the numerous pedestal designs made possible by the use of my improved spade tool, and are intended to illustrate the fact that by using this tool a foundation contractor may form pedestal molds in accordance with any practical design desired by the architect. The angle of cut may be very definitely predetermined by setting of the tool. Proper depth may be assured by simply placing a mark on the tool handle at a point which will indicate the maximum depth of cut to be made. Thus unskilled workmen can produce an earth mold into which concrete is to be poured, exactly in accordance with architects' specifications.

Furthermore, the use of my improved method and tool permits the accurate formation of the type of mold best suited to the soil conditions and loading conditions of each particular job.

It will thus be seen that there is herein described a device in which the several features of this invention are embodied, and which in its action attain the various objects of the invention and is well suited to meet the requirements of practical use.

As many changes could be made in the above device, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:—

1. As a new article of manufacture an excavating tool of the class described, including a long hollow shank, a handle at the upper end of the shank, a chopping blade angularly offset with respect to the lower end of the shank, means for adjusting the angle of the blade with respect to the shank, comprising a gear at the lower end of the shank operatively connected to the handle and a sector plate fixed to the blade and having a rack portion meshing with said gear.

2. As a new article of manufacture, an excavating tool of the class described, including a long hollow shank, a handle at the upper end of the shank, a chopping blade angularly offset with respect to the lower end of the shank, means for adjusting the angle of the blade with respect to the shank, comprising a gear at the lower end of the shank operatively connected to the handle and a sector plate fixed to the blade and having a rack portion meshing with said gear, and a shaft extending through the hollow shank connecting the gear and the handle.

3. As a new article of manufacture an excavating tool of the class described, including a long hollow shank, a handle at the upper end of the shank, a chopping blade angularly offset with respect to the lower end of the shank, means for adjusting the angle of the blade with respect to the shank, comprising a gear at the lower end of the shank operatively connected to the handle and a sector plate fixed to the blade and having a rack portion meshing with said gear, a shaft extending through the hollow shank connecting the gear and the handle, and means normally blocking rotation of the handle and the shaft to which it is connected.

4. As a new article of manufacture an excavating tool of the class described, including a long hollow shank, a handle at the upper end of the shank, a chopping blade angularly offset with respect to the lower end of the shank, means for adjusting the angle of the blade with respect to the shank, comprising a gear at the lower end of the shank operatively connected to the handle and a sector plate fixed to the blade and having a rack portion meshing with said gear, a shaft extending through the hollow shank connecting the gear and the handle, means normally blocking rotation of the handle and the shaft to which it is connected, said means comprising a toothed cap rotatably mounted on the upper end of the shank and a spring finger engaging with said teeth to block rotation.

5. A chopping tool for undercutting the walls of small diameter vertical shafts formed in the earth and adapted to be manually reciprocated by a workman standing at the mouth of the shaft, said tool including an elongated shank member, a handle at the upper end of the shank and a flat, sharp-edged, chopping head of greatest width at its sharpened edge, means for rigidly connecting the shank and handle together for movement as a unit with the head inclined outwardly and downwardly at a definite angle to the longitudinal axis of the shank with the cutting edge of the head most remote from the axis of the shank and the entire head bodily offset from such axis the handle being of substantially uniform cross section throughout its length, and the sharp edge of the chopping head being of a length exceeding by several times the maximum cross sectional dimension of the handle.

6. A chopping tool for undercutting the walls of small diameter vertical shafts formed in the earth and adapted to be manually reciprocated by a workman standing at the mouth of the shaft, said tool including an elongated shank member, a handle at the upper end of the shank and a flat, sharp-edged, chopping head of greatest width at its sharpened edge, means for rigidly connecting the shank and handle together for movement as a unit with the head disposed at a definite angle to the longitudinal axis of the shank and bodily offset from such axis and means for adjusting the angle of the head with respect to the shank and locking said head in a selected position of adjustment during operation of the tool.

ANTHONY PAUL MILLER.