June 25, 1963 E. I. ROBINSKY ET AL 3,095,051

EARTH BORING AUGER AND SAMPLER

Filed Nov. 24, 1961

Fig. 1.

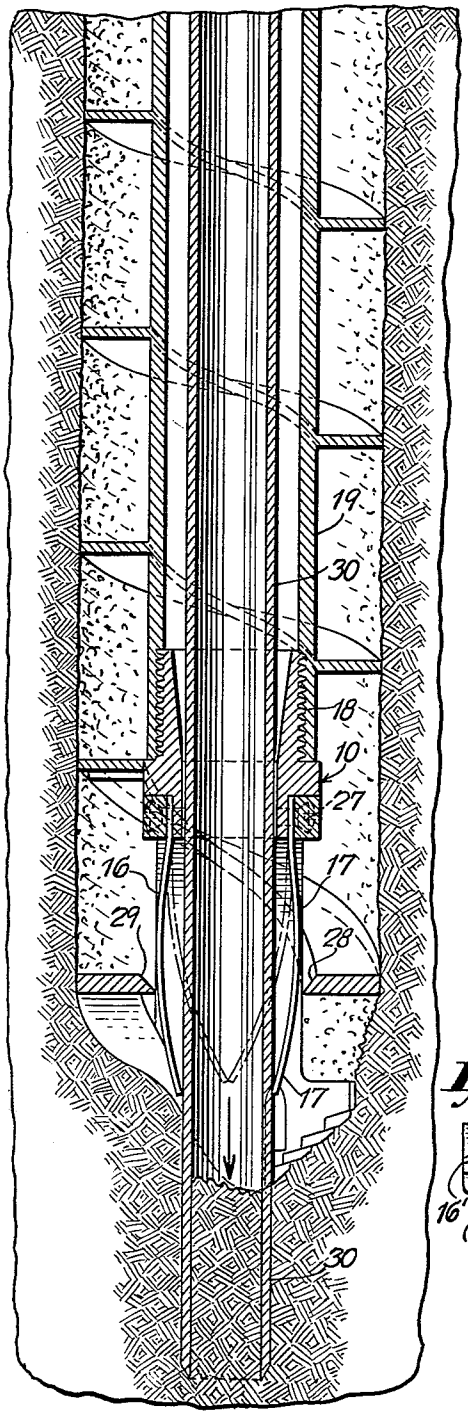


Fig. 2.

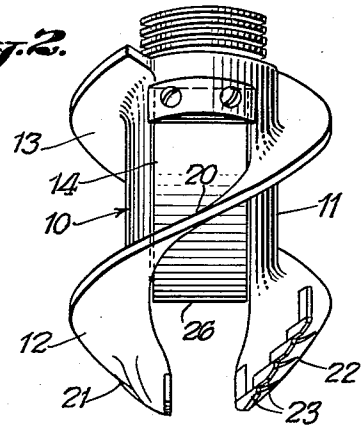


Fig. 3.

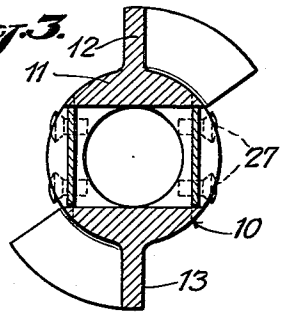


Fig. 4.

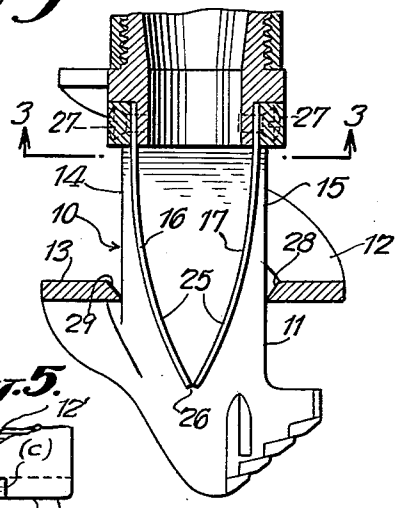
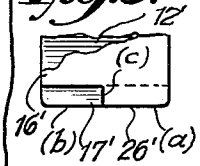


Fig. 5.



United States Patent Office 3,095,051 Patented June 25, 1963

3,095,051

EARTH BORING AUGER AND SAMPLER

Eli Ivan Robinsky, Don Mills, Ontario, Canada, and Henry A. Nelson Holland, Ridgewood, N.J., assignors to Raymond Concrete Pile Company Limited, Unionville, Toronto, Ontario, Canada, a corporation of Canada

Filed Nov. 24, 1961, Ser. No. 157,297
9 Claims. (Cl. 175—270)

This invention relates to augers and the like of the type adapted for earth boring, and more particularly to hollow stem augers for that purpose equipped with means at or adjacent the cutting head thereof for taking samples of the earth from time to time as the boring proceeds.

This application comprises a continuation-in-part of application Serial No. 101,286, filed April 6, 1961, now abandoned, and entitled "Cutter Head for Hollow Stem Auger."

So-called continuous flight augers for earth boring have been extensively used in forms having a hollow center adapted for inserting sampling tools for the obtaining of soil samples from adjacent or below the boring head without the necessity of removing the auger as a whole each time that it is desired to take and remove a sample of the earth as encountered during the earth boring process. With such augers, the hollow stem may be surrounded by one or two helically shaped fin-like formations or "flights" which force the dislodged earth upwardly as the boring proceeds. With such types of augers the drilling may be performed, if desired, without the use of wash water and thus sampling of the earth may be achieved without difficulty in cases where the earth may constitute soft or loose soils, since the auger acts in effect as a casing as the drilling proceeds.

When such types of augers are used, particularly for exploring or examining the conditions in the soil at succeeding levels, it is common practice to take samples of the earth as the drilling proceeds at levels about five feet or less apart. Possibly the most common practice for accomplishing this purpose with such augers has been to provide a closure means at or near the cutter head for normally closing the lower end of the hollow stem, such closure means being operated by using a succession or "string" of rods lowered through the hollow stem of the auger and which must be withdrawn through the hollow center prior to each sampling operation so that then a sampling tube may be lowerd in place through the hollow auger stem and subsequently withdrawn to remove the sample. But such an operation involves an excessive loss of time and expense inasmuch as the "string" of rods must be pulled up through the length of the auger and replaced at least twice for each of the numerous sampling operations usually desired. Furthermore, the samples, as obtained with such methods and means, oftentimes become so disturbed that they may not be as truly representative as desirable of the actual condition of the soil as it existed beneath the lower end of the cutting head.

The present invention provides a highly dependable, relatively simple and easily operable means for overcoming the above-noted difficulties.

In accordance with this invention, a hollow cutting head is provided for a hollow stem auger, preferably a continuous flight auger, and within such cutting head a downwardly directed cusp-like formation is mounted, same being formed of a pair of members of resilient sheet material such that when a sampling tube is lowered through the hollow stem auger and down into this cusp-like formation, the two resilient members which form same will separate at the vertex of the cusp and allow the sampling tool to be advanced and to penetrate into the earth below the cutter head. As the sampling tube is withdrawn, these

resilient members will come together again at the vertex of the cusp, thus closing the space within the cutting head and leaving the latter in conditon for resuming drilling operations. With this arrangement, samples of the earth may be quickly taken at successive levels with substantially a minimum loss of drilling time.

While the above-mentioned cusp-like formation preferably comprises two resilient sheet metal members, the lower end edges of which, because of their springiness, are normally urged together, it will be understood that a larger number of members may be used, so long as they normally act to close off the central hollow space in the cutting head and yet may be flexed to open position to allow the sampling tube to be lowered and raised therethrough. Also, if desired, while each of these "leaves" or members of the resilient formation may be conveniently formed as one thickness of sheet metal, same may be strengthened if desired by using pluralities of overlapping sheets of metal. In the preferred form, each of the resilient members forming the cusp-like closure, is shaped with a curvature so that the surfaces thereof extend downwardly and gradually somewhat inwardly to the line at the apex of the cusp where the two members come together in closed posiiton. However, other curvatures may, if desired, be preferable under some circumstances for example curvatures such as similar to those of the petals of a flower or bud as same approach their closed positions.

In accordance with a preferred embodiment of the invention, the cutter head is formed with a generally cylindrical hollow central body portion surrounded by helical flight formations, preferably a pair of helical flights formed integrally with the body portion and with their lower end edges forming cutting edges or having cutting teeth, if desired. Such cutting edges or arrangements of cutting teeth preferably are so shaped that when the cutter head is revolved, the surface of revolution created thereby is substantially conical (except for the central passage space) such conical shape facilitating the self-centering properties of the auger during the drilling.

Also, according to a preferred embodiment of the invention, the hollow body portion of the cutting head is preferably formed with its side walls apertured, the apertures being of a shape and size such as to receive the resilient members which make up the cusp formation when same are pushed aside to open position during the taking of a sample. Thus also the portions of the earth which rest outside such cusp-forming members will be pushed aside outwardly through such apertures, leaving the undisturbed earth within the hollow lower central portion of the cutter head exposed to receive the sampling device.

Various further and more specific objects, features and advantages of the invention will appear from the description given below, taken in connection with the accompanying drawings, illustrating by way of example preferred forms of the invention.

In the drawings:

FIG. 1 is a vertical sectional view of a cutter head embodying the invention shown as attached to a continuous flight type of hollow stem auger and further showing in dotted lines the above-mentioned cusp-like closure formation in closed condition, same also being shown by full lines in open condition and with a sampling spoon or tool protruding down therethrough;

FIG. 2 is a side elevational view of the cutter head of FIG. 1 shown separate from the other parts;

FIG. 3 is a horizontal sectional view taken substantially along line 3—3 of FIG. 4;

FIG. 4 is a vertical sectional view of a cutter head taken at right angles to position thereof shown in FIG. 2; and

FIG. 5 is a view broken away showing the tip portions

of an alternative type of members which may be used for the cusp-like formation.

Referring now to the drawings in further detail, the cutter head is shown at 10 and same may, as shown, largely be formed of one integral piece of suitable hard, tough wear-resistant steel. This structure includes essentially a generally cylindrical body portion 11 with integral flight formations thereon, preferably a pair of helically formed flights as indicated at 12 and 13. The body portion is formed on opposite sides with apertures or cut out portions of a suitable size and shape to receive the cusp-forming closure members hereinafter described. In the example shown, these apertures as at 14 and 15 are of a generally rectangular shape and of a size sufficient to receive with some slight clearance respectively the "leaves" or resilient cusp-forming members 16 and 17.

The upper end of the body portion of the cutter head may, as shown, be provided with a threaded connection means as at 18 for engagement with a lower threaded end of a continuous hollow stem auger structure of known type such as indicated at 19.

The flights as at 12, 13 on the cutter head should be made of adequate thickness and strength, particularly at regions such as at 20 (FIG. 2) where they cross the areas of the apertures 14, 15, so that they will be able readily to resist breakage at these areas, and as best shown in FIG. 2, the lower ends of the flights are preferably so shaped as to give the lower end of the tool a substantially concial appearance when viewed from the side, and this shape will contribute to the self-centering properties of the auger in operation, as well as avoiding disturbance of the earth at the center where samples are to be taken. The lower end edges of the flights as at 21, 22 may either comprise cutting edges or in some cases, depending upon the soil conditions, same may comprise holding means for cutting teeth as at 23 formed of carballoy or other suitable material for the purpose.

As best shown in FIG. 4, the members 16, 17 which constitute the cusp-like closure formation, may comprise two resilient sheet steel members or may be formed of other suitable resilient material, same being bent preferably slightly downwardly and inwardly as at 25 and so that they will normally firmly press together along a line as at 26 at the apex of the cusp. The upper ends of these members may be removably secured in suitable socket formations on the body of the cutter head, as by screw means indicated at 27. Thus, if either of these members become worn or damaged in use, it may be quickly and readily replaced. The apex of the cusp formation as at 26 may preferably be located at a few inches above the lower tips of the flights or cutting edges thereof, as best shown in FIG. 4. As also shown in FIGS. 1 and 4, the inner edges of the flights are preferably bevelled as indicated at 28, 29, at least at regions adjacent the apertures 14, 15 so that when the members 16 and 17 are forced outwardly, any rocks or similar masses which may be lodged adjacent such bevelled edges, will be readily thrust aside outwardly and thus not prevent the outward opening movement of the cusp parts. The side edges of the members 16, 17 are preferably so positioned as more or less to scrape past the edges of the apertures 14, 15 when the cusp opens so as to assure that the masses of earth and any other material located outside the members 16, 17 will all be pushed aside, rather than being allowed to fall into the hollow interior of the cutting head where same might become mixed with the desired sample during the sampling operation.

In the use of the apparatus, the hollow stemmed flight auger equipment is rotated in the usual way and when drilling has proceeded to the depth where a sample is to be taken, then a suitable sampling device may be lowered through the hollow assembly until it rests against the members 16 and 17. Or if preferred, the sampling device may be allowed to remain inside the auger and resting on the members 16, 17, while the auger is being rotated for drilling. As the sample is about to be taken, it may be desirable with some soils to lift the auger a few inches to permit the members 16 and 17 to open more readily as the sampler device is lowered. The sampling device may, of course, be supported within the auger on a succession or string of suitable members and when slight pressure is applied thereto, the sampler will force the spring members 16 and 17 apart, whereupon the sampler may be pushed into the undisturbed soil below the tips of the auger. Then, upon withdrawing the sampler, same may be pulled upwardly an doutward of the auger to discharge the sample and meanwhile the cusp formation formed by the members 16, 17 will automatically close as the sampler passes same and the equipment is ready for the resumption of drilling. If desired, the auger may be operated for continuing the drilling during the time when the sampler is initially being lowered ready for use, as well as during the time after the sample has been taken and the sampler is being withdrawn up through the auger for discharge of the sample. Thus, especially in cases where the drilled hole becomes very deep, a relatively large amount of time may be saved, since the auger may be kept in continuous operation, except for the brief intervals when the samples are actually being taken, and no time need necessarily be lost either while the sampler supporting means is being introduced in sampling position, or withdrawn after the sample has been taken.

FIG. 5 shows a somewhat modified form of members as at 16' and 17' for constituting the cusp formation, the lower ends thereof, as here shown, being notched. That is to say, the lower end edge *a* of member 16' extends half way across the width of the member, whereas the lower end edge *b* of the member 17' extends half way across its width but in a position so as to overlap portion *a* at the center line *c*. With this tip construction, any upward forces thereagainst will in general tend to insure more secure closure of the cusp formation rather than causing spreading apart and opening thereof.

As shown, the sampling device may comprise simply a tubular member as at 30, having its lower peripheral edge sharpened, if desired, as indicated, or various special forms of samplers may be used such as those disclosed in U.S. Patent to Gordon F. A. Fletcher and Henry F. Le Mieux, No. 2,993,367, granted July 25, 1961.

Although certain particular embodiments of the invention are herein disclosed for purposes of explanation, further modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains. Reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A cutting head for attachment to a hollow stem earth boring auger, such cutting head being formed with an axial cavity for communicating with the hollow interior of the auger, means for normally closing said axial cavity to exclude earth during operation of the cutting head, said means comprising a plurality of members of resilient sheet material providing a downwardly directed cusp-like formation, said members being adapted to separate at the vertex of the cusp and allowing a sampling tool to be advanced through said axial cavity into the earth below the cutter head, such resilient members being adapted to come together again to close off said axial cavity upon upward withdrawal of the sampling tool.

2. A cutting head for attachment to a hollow stem earth boring auger, such cutting head being formed with a generally cylindrical body portion having an axial cavity for communicating with the hollow interior of the auger, means for normally closing said axial cavity to exclude earth during operation of the cutting head, said means comprising a plurality of members of resilient sheet material providing a downwardly directed cusp-like forma-

tion, said members being adapted to separate at the vertex of the cusp and allowing a sampling tool to be advanced through said axial cavity into the earth below the cutter head, such resilient members being adapted to come together again to close off said axial cavity upon upward withdrawal of the sampling tool, said body portion being formed with apertures through the walls thereof to receive said members when separated and through which apertures earth is discharged by said members from said axial cavity upon such separation.

3. A cutting head for attachment to a hollow stem earth boring auger, such cutting head being formed with a central body portion having an axial cavity for communicating with the hollow interior of the auger, helical flight means formed on the exterior of said body portion and terminating in cutting means at the lower end portion of the cutting head, means positioned closely above said lower end portion for normally closing said axial cavity to exclude earth during operation of the cutting head, said last-named means comprising at least a pair of members of resilient sheet material providing a downwardly directed cusp-like formation, said members being adapted to separate at the vertex of the cusp and allowing a sampling tool to be advanced through said axial cavity into the earth below the cutter head, such resilient members being adapted to come together again, at such vertex to close off said axial cavity upon upward withdrawal of the sampling tool.

4. A cutting head for attachment to a hollow stem earth boring auger, such cutting head being formed with an axial cavity for communicating with the hollow interior of the auger, means for normally closing said axial cavity to exclude earth during operation of the cutting head, said means comprising a pair of members mounted at their upper ends at the opposite side walls of said axial cavity and directed downwardly and inwardly into resilient contact with each other at their lower ends, said members being adapted to separate at their lower ends for allowing a sampling tool to be advanced through said axial cavity into the earth below the cutter head, and such members being adapted to come together again to close off said axial cavity upon upward withdrawal of the sampling tool.

5. A cutting head in accordance with the foregoing claim 4 and in which said members are detachably and replaceably secured at their said upper ends to the exterior walls of the body portion of the cutting head, such body portion being formed with apertures into which said members are received when separated.

6. A cutting head in accordance with the foregoing claim 4 and having helical flight means formed of the exterior of its body portion, such flight means terminating at its lower end in cutting means which when the head is rotated forms an inverted generally conical surface of revolution except for a central space coaxial with said axial cavity.

7. A cutting head in accordance with the foregoing claim 4 and in which the said lower ends of said members normally engage in a downwardly directed V formation and are notched whereby a part of each one engages and overlaps somewhat a part of the other.

8. A cutting head for attachment to a hollow stem earth boring auger, such cutting head being formed with a central body portion having an axial cavity for communicating with the hollow interior of the auger, helical flight means formed on the exterior of said body portion and terminating in cutting means at the lower end portion of the cutting head, means positioned closely above said lower end portion for normally closing said axial cavity to exclude earth during operation of the cutting head, said last-named means comprising at least a pair of resilient sheet metal members mounted at their upper ends respectively at the opposite side walls of said axial cavity and directed downwardly and inwardly and normally into resilient contact with each other at their lower ends, said body portion being formed with apertures through the walls thereof to receive said members when separated and through which apertures earth is discharged by said members from said axial cavity upon such separation, said members being adapted to separate to allow a sampling tool to be advanced down through said axial cavity into the earth below the cutter head, the members being adapted to come together again to close off said axial cavity upon upward withdrawal of the sampling tool.

9. A cutting head in accordance with the foregoing claim 8 and in which said flight means traverses said apertures, the inner portions of the flight means at the regions of said apertures being bevelled to facilitate discharge of material past same from the apertures when said sheet metal members are separated by the introduction of a sampling tool.

References Cited in the file of this patent

UNITED STATES PATENTS

2,170,716	Higgins	Aug. 22, 1939
2,328,948	Bourke	Sept. 7, 1943
2,330,157	Stokes	Sept. 21, 1943
2,544,993	Jackson	Mar. 13, 1951