

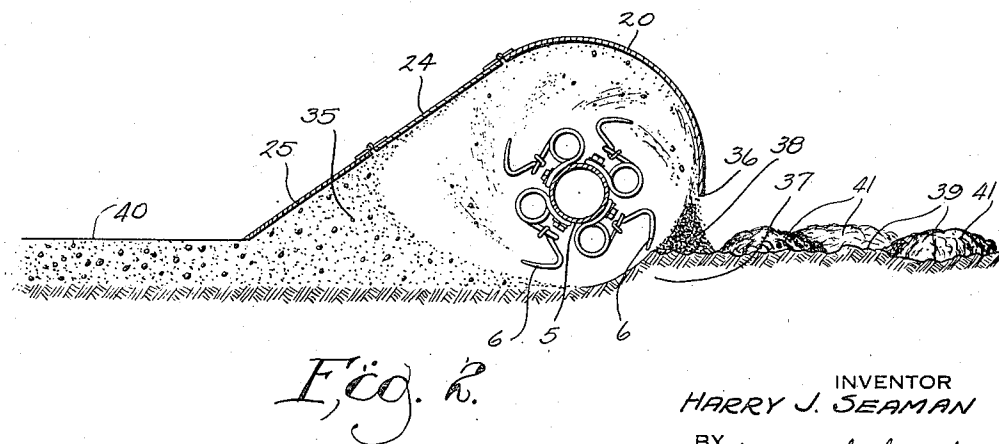
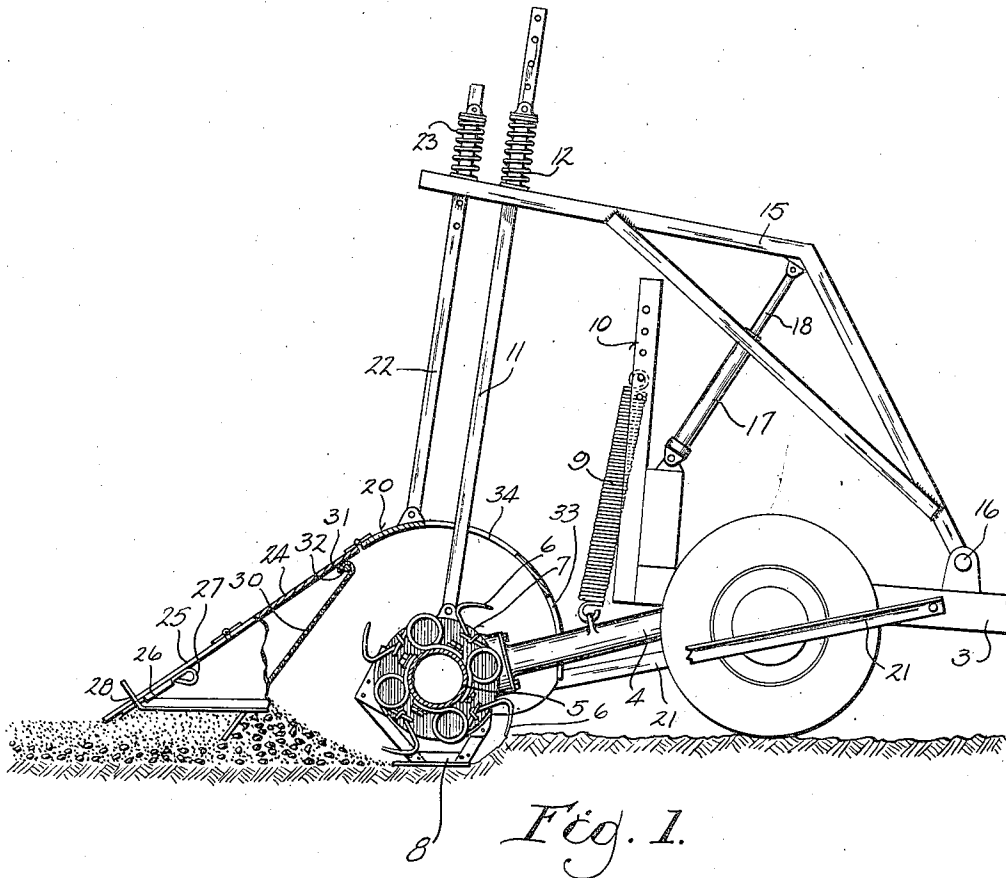
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ART OF MIXING

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## UNITED STATES PATENT OFFICE

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## ART OF MIXING

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1 Claim. (Cl. 94-44)

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This invention relates to improvements in the art of mixing. It is particularly concerned with apparatus and methods for pulverizing and mixing materials in situ.

It is a primary object of the invention to secure in a single traverse of the work a more complete distribution and intermixing of all grades and sizes of particles of material than has heretofore been possible. While the invention is not limited to any specific class of materials or type of mixing operation, it may be exemplified by referring to the use of the invention in making soil-concrete. The use of clean sand, substantially free of clay, used to be thought necessary for the manufacture of strong concrete. In past years, it has been found that ordinary soil mixed with cement will give a very strong concrete provided the soil particles are reduced to sufficient fineness and the cement is distributed through the soil particles sufficiently thoroughly, and the fines, both of soil and cement, are distributed between the coarser particles in such a manner as to leave no voids. When these conditions are satisfied, the resulting concrete is extremely compact and dense and has great strength.

Other typical mixing jobs involve the stabilization of soil with sand asphalt or asphalt emulsion or mixtures of sand with clay, or the mixing of binders with materials other than soil. It has heretofore been proposed to do all of these mixing jobs by traversing the materials to be mixed with a soil tiller of the general type shown in my former Patent 2,214,702, granted September 10, 1940. As compared with the mixing job done by the apparatus there illustrated, I seek to secure greatly improved thoroughness of mixing and distribution by means of the present invention.

It is another object of the present invention to provide for the levelling of the surface traversed by the apparatus to an improved degree, leaving a smooth, level, hard surface irrespective of such substantial irregularities as transverse furrows in the ground over which the process and equipment are operated.

In the drawings:

Fig. 1 is a view partially in side elevation and partially in longitudinal section showing apparatus for the practice of this invention.

Fig. 2 is a diagrammatic view in section showing the apparatus in operation for the practice of the method.

Like parts are identified by the same reference characters throughout the several views.

In general, the apparatus is quite similar to that

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disclosed in my former patent identified above. There is a wheeled frame 3 from which power is transmitted through the housing 4 to a shaft 5 which carries a number of spring tines at 6. This shaft projects laterally from a gear case 7 to which is connected a supporting shoe 8, the shoe being adjustable through means not here pertinent, either clockwise or counterclockwise about the axis of the shaft 5 to determine the level at which the device will operate. The shoe tends to ride substantially horizontally and, according to its angular adjustment, the case 7 and shaft 5 will be supported at different levels with reference to the earth traversed.

A part of the weight of the housing 4, case 7 and the rotary mixing assembly 5, 6, is carried by a tension spring 9 supporting the housing 4 from the post 10 of the frame. Another part of the weight of the assembly is supported by means of link 11 and compression spring 12 from a sub-frame 15 which is pivoted at 16 to the frame and adjustable by means of the hydraulic cylinder 17 and piston 18.

The rotary mixing assembly is enclosed by a hood 20 connected to the frame by means of arms 21 for upward and downward oscillation. The link rod 22 and compression spring 23 partially support the weight of the hood from the sub-frame 15 so that the hood, like the rotary mixing assembly, will partake of the adjustment effected by the hydraulic cylinder and piston 17 and 18. While the general relation of the hood to the mixing assembly is thus approximately maintained, the separate link rod 22 and spring 23 permit the hood to have bodily movement independently of the mixing assembly.

For purely tilling purposes, the hood preferably comprises hingedly yieldable panels 24 and 25 against which the material dislodged by the tines 6 is primarily directed for pulverization. The yieldability of these panels upon the respective hinges permits them to clear stones and other obstructions such as are encountered when the machine is being used for tillage. It is, however, an important feature of the present invention that these panels be latched down to preclude their movement independently of the hood in its entirety. For this purpose, the panel 25 is provided with an ear at 26 through which bolt 27 passes into engagement with the keeper 28 on the side of the hood. This precludes any independent yielding movement of the panels when the apparatus is being used for mixing.

The use of a demountable foraminous plate 30, serving as a screen, is optional. The plate is pro-

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vided with a hook at 31 which may be engaged over a cross rod 32 of the hood. Where the plate is used, it tends to force toward the bottom of the excavation made by the tines 6 such irreducible coarse particles as will not penetrate the apertures of the plate.

While apparatus other than that illustrated may be used to perform the mixing method embodying this invention, the apparatus disclosed is particularly adapted for use in the practice of said method. In order to use it for mixing, as distinguished from tillage, the apparatus is operated with the hood panels 24 and 25 fastened down so that the chamber provided by hood 20 is substantially closed. It is immaterial that the slots 33 and 34 for the housing 4 and the link rod 11 are open. The places where closure is most desirable are at the front and rear. The panel 25 is operated at such a level, as indicated in Fig. 2, as to function as a scraper. Being locked against yielding, it scrapes before it a substantial pile of pulverized material at 35. Thus the chamber within which the rotary mixing assembly functions is not only closed by the panel 25 but also is sealed by the mass of pulverized material 35 scraped ahead of such panel. This results in a very substantial portion of the pulverized material being caused to circulate around the interior of the generally cylindrical chamber in which the rotary mixer is operated. Such material, comprising mostly fines but some coarse material, moves clockwise with the mixing assembly, as viewed in the drawings, and is discharged from the free forward margin 36 of the hood to fall in a transverse windrow directly in the path of the tines 6 of the mixing assembly. Thus, as such assembly rotates at high speed, it not only cuts into the previously unworked material at 37 but, in reaching such unworked material, the tines pass downwardly through the fines and aggregates which have already passed about the hood and lodged in the windrow 38. The windrow 38 approximately, although not necessarily completely, closes the hood 20 at its forward side. As a result of the passage of the tines through this windrow and then through the previously unworked material, a much higher degree of perfect mixing action is secured than would otherwise be possible.

If the panels 24 and 25, or particularly the latter, are left free for hinged movement, as in ordinary tillage, the amount of material making a circuit about the interior of the hood and deposited in the windrow 38 is greatly reduced and the mixing action is correspondingly less effective. Another mixing operation is also less effective under those circumstances. The pile of material scraped at 35 before the panel 25, when the panel is latched down, is in itself a very important factor in securing a perfect mix. The particles in the pile 35 are continually caused to churn over upon each other as the scraper portion 25 of the hood advances. Finally, such particles are forced into intimate contact by the wedging action and weight imposed thereon as the scraper passes over them. When the scraper panel 25 is not fastened down, even a small pebble or lump will lift this panel to discharge a very considerable quantity of the material that would otherwise be scraped forwardly. It is not possible under such circumstances to accumulate any mass of material at 35 because such mass of material, apart from any stone or lump, would of itself effect the lifting of the panel and the discharge of the material.

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It will be apparent that the device and method as disclosed will also effect a levelling operation. As indicated at 39, the material not yet acted upon by the device is, or may be, quite irregular. The surface at 40 of the material compacted and leveled by the scraping panel 25 is smooth and hard. It is even possible to operate transversely of the furrows of a previously plowed field and to leave such a field completely level. The scraping panel 25 operates to accumulate the excess material of the ridges and to deposit such excess material in the furrows.

As will be apparent from the general description of the invention, if the material to be mixed comprises more than one separate ingredient, the several ingredients are aggregated or associated in the path of advance of the mixing implement and hood. For example, where cement or asphalt is to be mixed with soil, or sand is to be mixed with a clay soil, the cement, asphalt or sand may be deposited in piles or windrows 41 so distributed over the surface of the natural soil as to give approximately the correct proportions when mixed. Any number of ingredients may be thus associated, whether or not one or more of these comprises natural soil.

By operating the rotary mixing assembly in a substantially closed chamber and ahead of an inclined scraper edge as herein disclosed, I effectively distribute the particles of differing sizes throughout the mass of material acted upon and effectively compress and compact the material to eliminate voids and secure a perfectly mixed product. Referring again to the soil-cement example chosen to illustrate the invention, a core taken from concrete made of soil and cement mixed in accordance with this invention will be smooth, compact and dense as compared with the relatively coarse, porous and rough concrete produced by apparatus and methods heretofore known.

I claim:

In a device of the character described having a rotary tilling head, means for rotating said head at high speed in a direction to throw tilled material rearwardly and a hood with a rearwardly inclined panel, the combination with said hood and panel, of an inclined foraminous screen mounted within the hood forwardly of the panel and at a steeper angle of inclination than the panel, said screen having openings adapted to pass fine material dislodged by said head and to force coarser material downwardly to be covered by such fine material, and means for releasably securing the panel against change of angular position respecting the hood, said panel having a hinged connection with the hood whereby to be floating when said means is released.

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