A compressing apparatus is provided which comprises a reciprocating driving shaft which drives a pressure foot at one end thereof toward a mass to be compressed, an engaging plate which engages with the driving shaft, a liquid pressure means having a plunger which pushes forth the engaging plate, and means for returning the engaging plate against the plunger while the liquid pressure in the pressure means is released, thereby to permit repeated movements of the pressure foot against the mass.

5 Claims, 3 Drawing Figures
LONG-DISTANCE HIGH-PRESSURE APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a long-distance high-pressure apparatus and more particularly to the apparatus of the type in which liquid such as oil is used as a pressure medium.

Nowadays, pollution caused by a great deal of scrap and trash has become a troublesome problem in urban areas and it has been proposed that such scraps be compressed to solidify them to blocks. To this end, it has been desired to develop an apparatus for compressing the scraps under high pressure through a great distance in a short time.

Conventionally, in order to obtain high pressure, liquid pressure devices, such as oil pressure and water pressure devices have been widely utilized. However, these conventional liquid pressure devices are not suited for compressing materials throughout a long distance under high pressure because the plunger and cylinder of the liquid pressure device necessarily must become large and long.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide a relatively small sized compressing apparatus which enables a pressing operation to take place under high pressure throughout a long distance.

Another object of the present invention is to provide a pressing apparatus operated by liquid medium and suitable for compressing scraps.

According to the present invention, there is provided a pressing apparatus comprising a drive shaft having a pressing foot at one end thereof, an engaging plate which engages with the drive shaft, a liquid pressure means having a plunger which pushes forth the engaging plate, and means for returning the engaging plate against the plunger while the liquid pressure in the pressure means is released.

All of the aforementioned as well as additional features of the present invention will become more clearly apparent from the detailed description thereof, which is to be read with reference to the accompanying drawings.

BRIEF EXPLANATION OF DRAWINGS

FIG. 1 is a vertical sectional view of an embodiment of a long-distance high-pressure apparatus according to the present invention;

FIG. 2 is a view, partly in section, of the apparatus shown in FIG. 1, wherein the apparatus is adapted for compressing scraps in a tower; and

FIG. 3 is a fragmentary perspective view of another embodiment of an engaging plate which may be used in the apparatus according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to FIG. 1, there is disposed in a housing, generally indicated at 1, a long drive shaft 4 having an integral pressing foot 6 at the lower end thereof, the shaft 4 freely passing through a central hole 3 formed in walls of the housing 1. The drive shaft 4 has screw threads 5 on its surface and is threadedly engaged with a central bore formed in the center of the engaging plate 9 disposed in the housing 1. The engaging plate 9 is disc-like and has teeth 9a formed on the outer surface thereof, which mesh with the teeth on an elongated toothed wheel 11. The toothed wheel 11 is supported rotatably by suitable driving means 12 in the housing 1. The drive shaft 4 is prevented from rotating by any suitable means, such as an axially extending groove 4a therein receiving a protrusion 4b on a wall 2 of the housing 1.

Above the engaging plate 9 is disposed a fluid high pressure means, such as an oil pressure device generally indicated at 13. A stationary casing 14 of the oil pressure device 13 has an annular groove 15 and has at the center thereof a bore 16 through which the drive shaft 4 freely passes. In the annular groove 15, an annular plunger 17 is snugly disposed. A bottom portion of which contacts a metal washer 18 on the engaging plate 9.

In FIG. 1, a liquid low pressure means, such as a smaller oil pressure device, generally indicated at 19, is provided below the engaging plate 9. The liquid low pressure means 19 has a stationary casing 20 which has an annular groove 21 in which an annular plunger 22 is snugly disposed. The upper surface of the plunger 22 contacts a metal washer 24 under the engaging plate. The drive shaft 4 extends freely through a central bore 23 of the stationary casing 20.

The above described liquid high pressure means 13 and liquid low pressure means 19 are respectively operated by oil pressure devices 25 and 46 by way of well known valves and oil paths (not shown).

An operation of the apparatus shall be described hereunder. When the engaging plate 9 is forced down by the high pressure means 13 while the oil in the low pressure means 19 is being discharged, from the annular cavity 21, it will carry with it the drive shaft 4 for a distance equal to the length of the stroke of the plunger 17 in the high pressure means 13, thereby to compress materials such as scraps by the pressure foot 6. Then, while the oil in the high pressure means 13 is discharged, the elongated toothed wheel 11 is rotated by the driving means 12 and the engaging plate 9 is supported by the low pressure oil means 19. The elongated toothed wheel 11 meshes with the engaging plate 9, which is rotatable on the drive shaft 4. Since the shaft 4 is held against rotation by the aforesaid groove and protrusion, or other suitable means, the plate 9 will move upwardly while being rotated by the toothed wheel 11. When the engaging plate 9 is lifted upward to a predetermined position, rotation of the elongated toothed wheel 11 is first stopped, and then the oil in the low pressure means is discharged. Thereafter, the high oil pressure means 13 is actuated and then there is repeated the previously described step in which the engaging plate is forced downward. The process as described above is continued repeatedly to attain high pressure compression of material through a long distance.

FIG. 2 shows a scrap and trash treating equipment having a high pressure apparatus shown in FIG. 1. A scrap treating tower 26 constructed firmly on the ground has thicker walls at about the base portion 27 of the tower since a higher pressure is applied to the base portion than to the upper portion thereof. Scrap and trash 29 carried by dump trucks 28 are thrown into the treating tower 26 through an air curtain 30 from a sliding entrance 31 having a guide plate 32 freely movable to pile the scraps constantly in the tower 26.

Both sides of the base portion 27 of the treating tower 26 are closed with plates 34 and 35 with which
blocks 38 and 39 are engaged respectively to prevent the plates 34 and 35 from moving while pressing is carried on. The blocks 38 and 39 are raised by hydraulic lift devices 36 and 37, respectively. Each of the plates 34 and 35 is connected through lateral rods 40 and 41 with other hydraulic pressure devices 42 and 43, respectively.

A long-distance high-pressure apparatus shown in FIG. 1 is contained in a housing 1 at the upper portion of the treating tower 26. In the embodiment of FIG. 2, however, the pressure foot 6b at the lower end of the drive shaft 4 has an annular groove 7 on the upper surface thereof. In the groove 7 there is disposed a drain pump 44 which drains out water coming from the scrap and trash through an annular channel 8 in the pressure foot 6b. The water is drained out through a path 45 in the wall of the treating tower.

When the treating tower 26 is filled enough with scrap and trash, the guide plate 32 is withdrawn and a window 33 is closed to be ready for the following procedure. The engaging plate 9 is supported in the position shown in FIG. 2 by the high pressure oil means 13 and the low pressure oil means 19. The elongated toothed wheel 11 is driven by the driving means 12 to rotate the engaging plate 9 in a direction to move the drive shaft 4 downward. Though the pressure foot 6b of the shaft 4 keeps moving down to press the scrap and trash 29 in the tower 26 by its own weight and screw tension, the pressing force is too small to solidify the scraps. Therefore, after the pressing foot 6b stops advancing downward, the high pressure oil means 13 is actuated to compress the scrap and trash intermittently for a long distance in accordance with the procedures heretofore described.

After the scrap and trash are compressed enough to become a solid block, the toothed wheel 11 is rotated reversely to shift the pressure foot upward. As the engaging plate is supported between the high pressure oil means 13 and the low pressure oil means 19 and is rotated between them, the drive shaft 4 is lifted upward.

Thus, compressed solid block is pushed out by the oil pressure devices 42 and 43 after the blocks 38 and 39 are lowered by the hydraulic pressure devices 36 and 37 to unlock the plates 34 and 35, respectively. The solid blocks which have been pushed out are, if treated with mortar, usable as desirable blocks for various kinds of constructions such as road building, water-break construction, reclaiming work, and so forth. If desired, a steel member 47 having a hook 48 may be prepared at the end of the plate 35 to facilitate the removal of the compressed block from the lower end of the treating tower 26.

After the compressed solid block is carried out, the hydraulic pressure devices 42 and 43 are operated to return the plates 34 and 35 to the predetermined closing places, respectively, and the blocks 38 and 39 are raised upwardly to lock the plates 34 and 35 by the hydraulic lift devices 36 and 37, respectively. Then, the window 33 is opened and the guide plate 32 is extended to be ready for the next throughing of the scrap and trash from the dump truck 28.

According to the present invention, since the long-distance high-pressure apparatus is so constructed as described above, a long-distance pressing almost as long as the length of the driving shaft 4 can be attained. Moreover, since the high liquid pressure means 13 is repeatedly operated, the pressing force can be constant without any relation to the pressing distance.

Furthermore, since the high liquid pressure means 13 acts on the annular plunger 17, which is snugly fitted in the annular recess 15, a balanced and straight pressure can be applied to the engaging plate.

Moreover, since the driving shaft 4 is moved directly by means of the engaging plate 9 and the elongated toothed wheel 11, the pressure foot 6b of the shaft 4 is lowered rapidly to a place where the high pressure is required, and the shaft 4 can be returned swiftly to the upper predetermined place after finishing the pressing operation.

Though the present invention has been described with reference to the preferred embodiment wherein the drive shaft 4 is threadedly engaged with the engaging plate 9, many modifications and alterations may be made. For example, the engaging plate may be divided into two parts, as shown in FIG. 3 at 9b with ribs 49 being disposed on an inner surface of the center bore 10a of the engaging plates. The ribs engage with grooves 50 formed on the surface of the drive shaft 4. These engaging plates 9b are separated from the drive shaft 4 at the lowermost position thereon and are then moved upwardly and inwardly along the lines of the arrows in FIG. 3. In the elevated position, the engaging plates 9b hold the drive shaft 4 firmly by engagement of the above mentioned ribs and grooves. After that, the shaft 4 is advanced downward by the high pressure means 13 as the plunger 17 pushes down the engaging plates 9b. In this embodiment, in place of the elongated toothed wheel 11, a suitable driving means may be used which moves the two-divided engaging plates in a manner as described above. For example, a double-acting fluid-operated piston rod 51 reciprocable in a cylinder 52 may be secured to each of the engaging plates 9b. Suitable valves (not shown) may control the flow of fluid under pressure through flexible conduits 53 and 54. Fluid pressure through conduits 54 will move the pistons in the cylinders to close the engaging plates, and fluid pressure through conduits 53 will disengage the plates 9b when pressure on the other side of each piston is relieved.

Changes may be made in the form, construction and parts from those disclosed herein without in any way departing from the spirit of the invention or sacrificing any of the attendant advantages thereof, provided, however, that such changes fall within the scope of the claims appended hereto.

1 claim:

1. Apparatus for compressing scrap material and the like comprising a driving shaft reciprocable in an axial direction and having a pressing foot at one end thereof, an engaging plate, means interlocking said plate with said driving shaft and movable therewith, high pressure hydraulic means including a plunger adapted to be moved against said engaging plate for moving said plate and shaft in one direction, and means for moving said engaging plate in the opposite direction against said plunger while said shaft remains stationary and the hydraulic pressure in said high pressure means is released.

2. A pressing apparatus as claimed in claim 1, wherein said shaft passes through a central hole in said engaging plate and is engaged therewith; and said plunger of said high pressure hydraulic means is annular shaped and pushes against circumferential portions
of said engaging plate when actuated by said hydraulic means.

3. A pressing apparatus as claimed in claim 2 further comprising a low pressure hydraulic means including an annular plunger which pushes against the opposite side of said engaging plate from the side of said high pressure hydraulic means.

4. A pressing apparatus, as claimed in claim 2, wherein said shaft has screw threads thereon and is threaded engages said central hole in said engaging plate and said engaging plate is a disc, teeth formed on the outer circumference of said disc and wherein said means for moving said engaging plate in the opposite direction includes an elongated toothed wheel rotatable in both directions and meshing with the
teeth on said disc, and means for holding said shaft against rotation, whereby rotation of said toothed wheel will rotate said disc and move it axially of said shaft.

5. A pressing device as claimed in claim 2, wherein said engaging plate is divided into two sections movable toward and away from each other, protrusions in the central hole thereof, and depressions on said shaft engaging with said protrusions when said sections are moved toward each other, whereby said sections may be separated from said shaft in one position of said disc and moved to another position to firmly engage with said shaft upon moving said sections toward each other.

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