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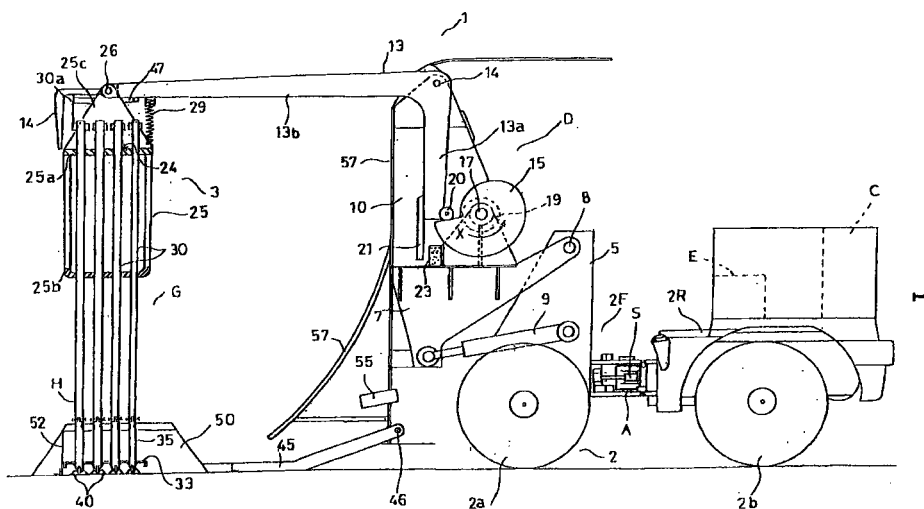
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(54) **MINE DISPOSING MACHINE**

(57) A mine disposing machine, comprising a pressing member which presses the ground so as to explode a mine buried in it and a traveling truck which moves while supporting the pressing member, wherein a pressing member may include gravity pressing type having a component comprising a pad in contact with and pressing the ground, a stem for supporting the pad,

and a rod connected to the stem and giving a vertical movement to the stem, a hammering type giving a forced impact, by a hammering machine, to the rod for supporting the pad, or a roller type for pressing the ground by rollers rolling on the ground.



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Description

Background of the Invention

[0001] The present invention relates to a device for sweeping land mines buried below the surface of the ground, and more particularly to a device for sweeping land mines through spot-by-spot explosion by applying pressure beyond human weight, so that people can safely and usefully exploit the swept land mine fields. Hereinafter, the land mine is referred to as 'mine' and the device is as 'mine sweeper'.

[0002] It is reported that 110,000,000 or more mines still remain undiscovered in the ground in the world, and nearly 24,000 people a year lose their life by the explosion of land mines. In contrast to these unhappy reports, the number of removed mines is only 100,000 pieces a year. This is an issue of worldwide concern.

[0003] The cases of mines are made of iron, plastics, wood, bamboo, and paper. The antipersonnel mine has 1 to 10kg explosive power, and the antitank mine has 10 to 200kg or even to 800kg of explosive power. The mine is exploded by the weight of men or vehicle, the release of pressure, The reduction in tension of a cord or the sensing of electromagnetic wave emitted from a detector. Some sophisticated types of mines are designed to operate through magnetism, acoustic wave, electromagnetic wave, and heat. The antipersonnel mine contains about 50 to 200g of explosive, and the antitank mine contains 4 to 10kg of explosive. For example, 99.9% of the mines used in Cambodia were relatively small antipersonnel pressure-fuse mines each containing about 51g of explosive in a case having a diameter of 78mm and a total weight of about 140g. Some of them can throw metal shells.

[0004] Nowadays the issue of undiscovered mines arouses worldwide concern, and people in the world wait for the early achievement of a safe land mine sweeping method and device. However, the removal of mines involves a lot of danger so long as it is performed by man power. Therefore, a mechanical method is in great demand. In practice, it is done first by detecting mines concealed in the ground by means of a metal bar, called 'plotter' or a metal detector, and then by exploding them after being dug out of the ground. However, a metal detector often wrongly detects other thing than mines, such as a nail or metal objects. Some of mines explode as soon as they are dug out. Military army has developed various kinds of mine sweepers in order to manoeuvre its troops in mine fields. From a military viewpoint the rapid movement of troops has priority over costs, and danger arising from undiscovered mines. Such mine sweepers are not suitable for civilian purposes in the peacetime like today. The Cambodian Government wishes that 99.6% of the mines buried throughout the country should be removed.

[0005] The present invention is directed to solve the problems pointed out with respect to the known meth-

ods and device for sweeping mines, and is to provide a mine sweeper which assures safety and and certainty in getting rid of mines buried under the ground.

Summary of the Invention

[0006] According to the present invention there is a device for sweeping mines buried below the ground which includes a tapping device for applying pressure to the surface of the ground to ignite the fuse of the mine, and a carrier for carrying the tapping device on and along the surface of the ground.

[0007] More specifically, according to a preferred embodiment of the invention, the mine sweeper includes a tapping component unit including a plurality of pads for tapping the surface of the ground, pad supporting stems secured to the upper parts of the pads, rods connected to the stems so as to transmit upward and downward movement to the stems, and a driver unit for moving up and down the component unit so as to utilize a gravity-fall energy, and a carrier for supporting the driver unit.

[0008] According to this embodiment, the carrier is driven to run on the ground to sweep mine fields during which the tapping device continues to apply pressure to the surface of the ground in the form of the weight of the rod component unit. If a mine is present, it explodes on the spot. In this way the mine field is swept spot by spot. The explosion breaks the pads and stems to pieces but they are inexpensive and can be replaced with new ones at low prices.

[0009] According to another preferred embodiment of the invention, the mine sweeper includes a pressure generator for generating a working pressure, a plurality of pads for tapping the surface of the ground, stems for supporting the pads, and a primary cylinder and a plurality of secondary cylinders, wherein the primary cylinder dispenses the pressure generated by the generator to each of the secondary cylinders.

[0010] This embodiment is advantageous in that in addition to the weight or the gravity-fall energy, the pressure generated by the generator is dispensed to the secondary cylinders and evenly applied to the surface of the ground. In this way the mine field is subjected to a sufficient amount of pressure.

[0011] Preferably, the pads are made of a bag filled with water so as to conform to the rugged surface of the ground and give equal pressure thereto. Instead of using the water bag, it is possible to connect the pads to the stems through spherical couplers which are strung thereto, or alternatively, by use of universal joints or rubber axes. In short, the pads are preferably elastic against the surface of the ground.

[0012] The rod component unit including the pads, the stems, and the rods can be employed in plurality, and moved up and down out of phase, so that the carrier is more stable and when they are simultaneously moved up and down, and the size of the driver unit can be

reduced.

[0013] According to a further preferred embodiment of the invention, the mine sweeper includes a carrier running on the ground, a roller component unit provided ahead of the carrier, the roller component unit comprising a vertically movable front roller and a vertically movable rear roller each for pressing the surface of the ground, and a weight and a pressing device located between the front roller and the rear roller so as to apply force and energy to them.

[0014] Preferably, the front rollers and the rear rollers are mounted on the carrier at axially displaced positions so that the rollers run in different courses on the ground so as to sweep the mine fields with no area undetected. Furthermore, when a plurality of roller component units are laterally arranged and assembled by means of common transverse shafts, it is possible to cover a wider range of mine field.

[0015] It is preferred that the carrier be driven by remote control so as to avoid lethal accidents involved in explosions.

Brief Description of the Drawings

[0016]

Fig. 1 is a side view of a mine sweeper embodying the present invention;

Fig. 2 is a front view of the embodiment of Fig. 1;

Fig. 3 is a plan view of a main portion of the embodiment of Fig. 1;

Fig. 4(a) is a partially sectional side view of a tapping component unit used in the present invention;

Fig. 4(b) is a fragmentary cross-section or a main portion of the tapping component unit of Fig. 4(a);

Fig. 5(a) is a plan view of a tapping pad used in the present invention;

Fig. 5(b) is a side view of the tapping pad of Fig. 5(a);

Fig. 5(c) is a rear view of the tapping pad of Fig. 5(a);

Fig. 6 is a partially sectional side view of a water-bag tapping pad;

Fig. 7 is an explanatory view exemplifying the action of the tapping pad against the ground;

Fig. 8 is a side view of another embodiment of the present invention;

Fig. 9 is a cross-sectional view on a larger scale of the embodiment of Fig. 8;

Fig. 10 is a side view of a further embodiment of the present invention;

Fig. 11 is a plan view of a main portion of the embodiment of Fig. 10;

Fig. 12(a) is a side view of a preferred example of the rollers used for the present invention; and

Fig. 12(b) is a vertical sectional view of the roller of Fig. 12(a).

Detailed Description of the Preferred Embodiments

[0017] Referring to Figs. 1 to 4, a first preferred embodiment of the mine sweeper according to the invention will be described:

[0018] A mine sweeper 1 is provided with a carrier 2 which includes a tapping device 3 in front. The carrier 2 has front wheels 2a and rear wheels 2b, and is driven through the operation of a hydraulic device driven by an engine (E). The carrier 2 includes a front part 2F and a rear part 2R which are rotatively coupled to each other by an axle (A). The front part 2F and the rear part 2R are driven by the respective hydraulic cylinders (S) provided on the opposite sides thereof, and when the cylinders (S) are appropriately extended or contracted so as to rotate the front part 2F or the rear part 2R around the axle (A). The carrier 2 is not limited to the illustrated embodiment but the known types can be used.

[0019] The carrier 2 is provided with a controller (C) on the rear part 2R so as to control from a distance (remote control) a drive transmission, and a steering device as well as the hydraulic device and the tapping device 3 by using wires or not.

[0020] The carrier 2 is provided with a column 5 on the front part 2F, and the column 5 is provided with a base frame 7 secured by means of an axis 8. The base frame 7 is connected to the column 5 in its lower part by means of a hydraulic cylinder 9 for lifting the base frame 7. The extension and contraction of the cylinder 9 causes the base frame 7 to ascend and descend around the axis 8.

[0021] The base frame 7 is provided with a bracket 10 to which a lifting arm 13 is rotatively connected by means of a pivot 14. The bracket 10 is provided with a cam 15 rotatively connected by means of a cam shaft 17, which is rotated by a hydraulic motor 19 in the direction (X) indicated by the arrow in Fig. 1.

[0022] The lifting arm 13 includes a vertical part 13a and an arm part 13b laterally extending from the pivot 14, as a whole taking the shape of letter L, seen from the side. The lower end of the vertical part 13a is provided with a cam follower 20 engageable with the profile of the cam 15. The movement of the lifting arm 13 is limited by a stop 21 secured thereto. The lifting arm 13, the hydraulic motor 19, the cam 15, and the cam follower 20 constitute a driver unit (D) for causing a tapping pad, a tapping stem and a tapping rod to move up and down. The stop 21 comes into abutment with a stop block 23 situated under the cam 15.

[0023] The lifting arm 13 is provided with a rod holder 25 rotatively connected through a triangular plate 25c joined to the top end of the lift art 13b by means of a pivot 26. The rod holder 25 includes an upper plate 25a and a lower plate 25b each having apertures 24 through which tapping rods 30 are passed. One end of the upper plate 25a is connected to the lifting arm 13 (the arm part 13a) by means of a coil spring 29. The downward swing (declining) of the lifting arm 13 around the pivot 14 is

limited by a stop 14 secured to its top end.

[0024] The upper plate 25a holds tapping rods 30 in its apertures 24, wherein each of the tapping rods 30 are prevented from passing through the apertures by the ends 30a of the rods expanded beyond their diameter, or by fixing nuts to each end of the rods 30. When the rod holder is raised, the rods 30 are suspended.

[0025] Each of the tapping rods 30 is provided with a tapping stem 35 in its lower part. More specifically, the extended end 30a of the rod 30 is fitted in the recess 35b of the stem 35, as shown in Fig. 4(a), and hooks 36a on the rod 30 and hooks 36b on the stem 35 are mutually connected by means of rubber rings 38 in a state in which the stem 35 is suspended from the rod 30. The stem 35 is provided with ring-shaped groove 35k where the stem 35 can be easily broken when the mine is exploded. The stem 35 has its lower end 35e shaped like a sphere so as to conform to a semi-spherical recess 40a of a tapping pad 40, thereby enabling the stem 35 to roll stably in the recess 40a even if the carrier runs on rugged surface of the ground. The combination of the spherical end 35e and the semi-spherical recess 40a constitutes a spherical rotary coupler J1.

[0026] The tapping pad 40 is made of soft material such as rubber, and a plurality of pads (16 pieces in the illustrated embodiment) are closely laid on a soft sheet 41 made of rubber or similar material. Each stem 35 stands on the recess 40a by connecting hooks 39 on the stem 35 to hooks 39a on the pad 40 by means of strings or rubber bands 42. The sheet 41 has a larger area than the total pads 40, and its edges 41a are held inward as shown in Fig. 3 wherein the edges of contiguous edges are joined by means of a wire 41b (Fig. 4(a)).

[0027] The tapping rod 30, the tapping stem 35 and the tapping pad 40 constitute a tapping component (or a rod component) unit (H). The position of each component (H) is defined by the upper plate 25a and the lower plate 25b which are mutually maintained in parallel. Fig. 3 shows a composite (G) which includes sixteen tapping component units (H), that is, four component units (H) in each of the rows. As shown in Fig. 2, a desired number of composites (G) (in the illustrated embodiment four composites) are arranged in parallel, and are suspended from one or more lifting arms 13 arranged in parallel. The more the composites (G) are laterally arranged, the wider working area can be secured.

[0028] A slidable guide frame 45 is connected to the carrier 2 by means of a pivot 46 at its root portion, the guide frame extending ahead of the carrier 2. The composites (G) are mutually separated by partitions 50 arranged in parallel as shown in Fig. 2, so as to prevent them from interfering with each other. If a single composite (G) is used, it will be unnecessary to use the partition 50 but it is nevertheless useful for positioning the composite (G) exactly in its lower portion. As desired, the guide frame 45 can be provided with a stone remover (not shown) and a wire hook (not shown) whereby a wire-fuse type of mine is exploded. They can

have any type or any kind. The composite (G) can have any number of rod components, and any number of composites can be used depending upon the conditions of the circumstances.

[0029] The carrier 2 is provided with a monitor TV camera 55 for watching the conditions of the tapping pads 40 and the ground. The video signal taken by the camera 55 is used for conducting remote control. A protective cover 57 protects the camera 55 against flying fragments from an exploded mine. The cover 57 is slightly concave toward outside so as to reduce damage due to flying fragments.

[0030] To operate the mine sweeper 1 the carrier 2 is driven to run while the driver unit (D) is driven to tap on the ground. The operation is performed by remote control. If any mine is present under the tapped ground, it will explode by the tapping pressure. When the mine is exploded, the tapping sheet 41, the tapping pad 40, the tapping stem 35, etc. are broken but they are inherently consumer products, and can be inexpensively replaced. Little damage is inflicted upon other components. A blast of explosion causes the tapping rod 30 to rise up. However, the shock is reduced by a buffer plate 47.

[0031] When a plurality of lifting arms 13 are used with each having the composite (G), their synchronous movement is likely to impose a large weight upon the carriers 2, thereby causing imbalance among the lifting arms 13. To solve it, it is preferred to move up and down the lifting arms 13 out of phase, that is, differently in time, which reduces the output of the hydraulic motor 19. It does not mean that the lifting arms 13 should be moved one by one, and it is possible to move them by two or three units.

[0032] In the illustrated embodiment the driver unit (D) employs a cam mechanism for moving up and down the lifting arm 13 which supports the tapping component units (H). This driving system utilizes the gravity-fall energy of the tapping component unit, and instead of it, other device can be used; for example, the up and down movement can be obtained by extending and contracting a hydraulic cylinder. In some cases, the lifting arms 13 per se are secured to be motionless, and instead of it, an eccentric rotor is provided at their top ends to effect the ups and downs of the arms 13.

[0033] Fig. 5(a), 5(b) and 5(c) illustrate a modified version of the tapping pads and a method for supporting them. The pad 40 is secured to the end of the tapping stem 35 by means of a double-axle universal coupler J2 where the end of the stem 35 and an intermediate piece 61 of the coupler J2 are rotatively connected to each other by means of a first axle 62, and the intermediate piece 61 and a bar 65 are rotatively connected to each other by means of a second axle 66. The axles 62 and 66 cross at right angles to each other, so that the pads 40 can freely decline or fluctuate in accordance with uneven surfaces of the ground. The pads 40 are placed on a soft sheet 41 in the same manner as previously described.

[0034] The bar 65 has both ends spherically shaped at 65a and 65b so as to be adapted for insertion in recesses 40a of the pads 40, wherein each of the recesses 40a has a spherically concave inward surface. The pad 40 is provided with hooks 39a with which rubber rings 68 are engaged through hooks 67 secured to the bar 65, thereby preventing the pads 40 from dislocating.

[0035] Fig. 6 shows another modified tapping pad 70 which is uniquely provided with a water bag 71 housed in a casing 72 which is open downward. The casing 72 is provided with a recess 72a in which the spherical ends of the bar 65 rotatively rest, and the bars 65 are connected to the stem 35 by means of a double-axe universal coupler J2 in the same manner as described with respect to the tapping pads 40. The hooks, the rubber rings, and the sheet are substantially the same as those used for the pads 40. Water is poured into the bag 71 through an inlet 71a which projects from the casing 72 and is closed by a plug 71b.

[0036] The water bag 70 is flexible, and can easily conform to the surface of the ground, thereby covering a relatively wide area.

[0037] Fig. 7 shows a situation in which the ground is pressed by the tapping pad 40. The illustration shows that even if the surfaces of the ground is uneven, the pad 40 can conform to them because of its elasticity, thereby constantly tapping the surface of the ground below which a mine (B) is buried. The mine (B) will not explode until a gap (t) collapses under pressure.

[0038] Now, referring to Figs. 8 and 9, a modified version of the mine sweeper of the invention will be described:

[0039] The mine sweeper 101 includes a tapping device 103 in front of a carrier 102 which runs on front wheels 102a and rear wheels 102b. The wheels 102a and 102b are driven by an engine (E) which also drives a hydraulic cylinders (S). The carrier 102 includes a front part 102F and a rear part 102R which are connected to each other by means of a vertical shaft (A). By operating the hydraulic cylinders (S), either the front part 102F or the rear part 102R is rotated around the shaft (A). The carrier per se is not limited to the illustrated embodiment but known carriers can be used.

[0040] The rear part 102R of the carrier is provided with a remote controller (C) designed to control the running power transmission, The steering device, the hydraulic device and the tapping device from a distance using a wire or not.

[0041] The carrier 102 is provided with a column 105 to which an upper arm 110 is connected at its one end and the other end thereof is rotatively connected to a bracket 112 by means of a pivot 113. A link 115 is rotatively connected to the upper arm 110 by means of a pivot 116 at its one end, and connected to a lower arm 120 by means of a pivot 121 at the other end. The lower arm 120 is connected to a hydraulic cylinder 123 connected to the bracket 112 by means of a pivot 124. The

lower arm 120, the upper arm 110, and the link 115 constitute a parallel linkage. These arms 110 and 120 ascend and descend as they remain in parallel under the action of a hydraulic cylinder 125 secured to the column 105.

[0042] The tapping device 103 is carried on the the bracket 112, and carries a striker 130 as a presser; as the striker a commercial stone breaker can be used. The striker 130 is mounted within a holder block 103a designed to increase the weight of the tapping device 103. Between a cover 103b covering the holder block 103a and the top of the striker 130 there is provided a shock absorbing spring 104. A fluid pressure dispenser 135 is provided at the lower part of the striker 130. The dispenser 135 is provided with a primary hydraulic cylinder 136 and a plurality of secondary hydraulic cylinders (the illustrated embodiment has 16 pieces) 137, wherein the primary cylinder 136 and the secondary cylinders 137 are connected to each other through a passage 139. The fluid (L) in the primary cylinder 136 is pressurized by action of a piston 136a when the striker 130 strikes the piston 136a by its rod 130a.

[0043] Instead of the striker 130, any kinds of striking tool can be used, such as a known vibrator, and a road stamping device currently available in commerce.

[0044] The same number of secondary cylinders 137 are arranged as that of the ground tapping pads. Each of them has a smaller inside diameter than that of the primary cylinder 136, and holds liquid in the top space of its piston 137a. A tapping stem support frame 138 is connected to the dispenser 135 by means of bolts. The frame 138 is made of plastics such as vinyl chloride, designed to prevent a possible buckling of the tapping stems 140 which are movably passed through apertures produced in the frame 138a.

[0045] When the piston of the primary cylinder 136 is hit by the striker 130, the fluid pressure is distributed into each of the secondary hydraulic cylinders 137 through the passage 139, thereby causing each of the cylinders 137a to descend. The piston 137a of each secondary cylinder 137 is connected to a piston rod 137b whose lowest end is passed through a recess 140c produced in an upper part of a tapping stem 140. Hooks 141 and 142 are provided on the piston rod 137b and the tapping stem 140, respectively, and these hooks 141, 142 are tied by means of rubber bands or strings 143 so that the piston rod 137b and the stem 140 are securely united.

[0046] The lowest end of the tapping stem 140 has its lowest end 140a secured to a tapping pad 145 through a double-axe universal coupler J2 in the same manner as described on the first embodiment; therefore, a detailed description will be omitted for simplicity. In this second embodiment the piston rod 137 of the secondary cylinder 137 is a counterpart or the tapping rod 30 in the first embodiment, and constitutes a rod component unit (equal to the tapping component unit (H)) together with the tapping stem 140 and the tapping pad 145.

[0047] Preferably, an electrical pressure detector (not shown) may be provided between the lowest end 137b of the secondary cylinder 137 and the bottom of the recess 140c of the tapping stem 140, so as to ascertain that a sufficient pressure has been given to the tapping pad 145.

[0048] In operating this version of the mine sweeper, while the carrier 102 is driven to run by remote control using a wire or not, the striker 130 strike to primary cylinders 136 at a particular frequency which depends upon the speed of the carrier 102; the frequency being normally a few times to a few tens a second. The blows on the primary cylinders pressurize the fluid therein, and the pressurized fluid flows into each or the secondary cylinders 137 via the passage 139.

[0049] When the tapping device 103 descends toward the ground, the tapping pads 145 come into contact with the surface of it, and then they press it with strengthened force under the hydraulic pressure. If a mine is buried where the carrier runs, it is sure to explode. The explosion breaks all the members of the tapping component units to pieces but they are cheap materials and can be readily and inexpensively replaced.

[0050] In the illustrated embodiment the primary cylinder is pressed by a hydraulic striker but a pneumatic striker or any other can be used on condition that it can generate a sufficient pressure. The number of component units included in a composite (G') can be selected; in the illustrated embodiment 16 (4 x 4) pieces of tapping pads are used but the number is not limited to it.

[0051] It is possible that the parallel linkages constituted by the upper arm 110, the lower arm 120 and the link 115 are arranged in parallel in several pieces, such as four, and each of them is provided with tapping component units (G'). The use of a plurality or linkages will be advantageous in covering a wider mine field, as described with reference to Fig. 2.

[0052] Now, referring to Figs. 10, 11 and 12, a third modified version of the invention will be described:

[0053] Briefly, the mine sweeper 201 is operated on a roller system instead of using the tapping rods 30 and the tapping stems employed in the first embodiment. The mine sweeper 201 is provided with press bars 205 on opposite sides, the bars being capable of ascending and descending. The forward end of the press bars 205 are connected to a lateral shaft 207 carrying a casing 210, which is a component part of a roller section (R). The casing 210 is provided with two pairs of roller supports 212, each pair being mutually in parallel. The casing 210 has a bottom which consists of a front part, and a rear part axially displaced from the center of the front part, as shown in Fig. 11. The axially displaced position of the front part and the rear part is to ensure that the rollers take different courses under which different mines are present. The detail will be described below. The front part and the rear part are respectively provided with two pairs of roller support arms 212 arranged in parallel. The roller support arms 212 are connected to

arm plates 213 through axles 214 and shear pins 215, and the arm plates 213 support roller shafts 216 on which front rollers 217 and rear rollers 218 are rotatively carried.

[0054] The casing 210, the roller support arms 212, the arm plates 213, and the rollers 217, 218 constitute a roller component unit (RG). As referred to above, the reason why the front part and the rear part are axially displaced from each other's centers is that the rollers 217 and 218 run in and along different courses even though their running courses slightly overlap each other. Since the press bars 205 are vertically movable, it is possible to raise the roller section (constituted by the roller component unit (RG)) above the carrier so as to avoid interfering with the ground.

[0055] The casing 210 has an opening 210a through and in which a root portion 220a of a weight 220 is secured by means of bolts. The casing 210 and the root portion 220a are provided with vertically elongated holes 219 through which the lateral shaft 207 is passed, so that when the carrier runs over a wrong object such as stone, the shaft 207 is allowed to ascend in and along the elongated holes 219. As shown in Fig. 11, the front part and the rear part of the casing 210 are separated from each other by a distance (d) which allows the component units (RG) arranged in parallel to swing without interference. The casing 210 is provided with a counter-balancer 223 at its rear portion which helps the raised forward roller 217 apply its weight to a mine buried in raised ridges of the ground.

[0056] The weight 220 is provided with a hydraulic cylinder 221 having a piston 222 which is hit by a striker 230 slidably mounted within a cylindrical housing 235 secured to the weight by bolts and closed by a cover 236. The counter-blow from the strikes by the striker 230 is absorbed by a spring 237.

[0057] The striker 230 can be any kind or type if it can apply pressure to the cylinder 221; for example, a vibrator, a road stamping tool or the like of a conventional form.

[0058] Figs. 12(a) and 12(b) show various types of rollers. The roller shown in Fig. 12(a) is a tyre made of a water bag and a hub 240 of plastics. The water bag can be made of rubber, filled with water. Of course, the water bag can be replaced with an ordinary pneumatic rubber tyre.

[0059] In practice, when the carrier 202 is advanced under remote control, each roller runs on the ground taking different courses because of the axially displaced arrangement. Owing to the fact that the rollers take the different courses, the mine sweeper can sweep a wider range or mine field without leaving undetected spots.

[0060] While the mine sweeper runs on the ground, the rollers are continuously supplied with blows and energy from the striker 230 through the cylinder 221, in addition to the pressure imparted by the weight 220, 223. In this manner a sufficient pressure is applied to explode mines below the ground. As the rims of the roll-

ers are made of water tubes, the blows are certainly transmitted to the ground.

[0061] Upon explosion, the rollers 217 and the arm plates 213 are broken to pieces by dint of the shear pins 215, so that little damage inflicts upon the mine sweeper and the carrier. The broken parts and components are made of inexpensive material, and can be easily substituted at low prices.

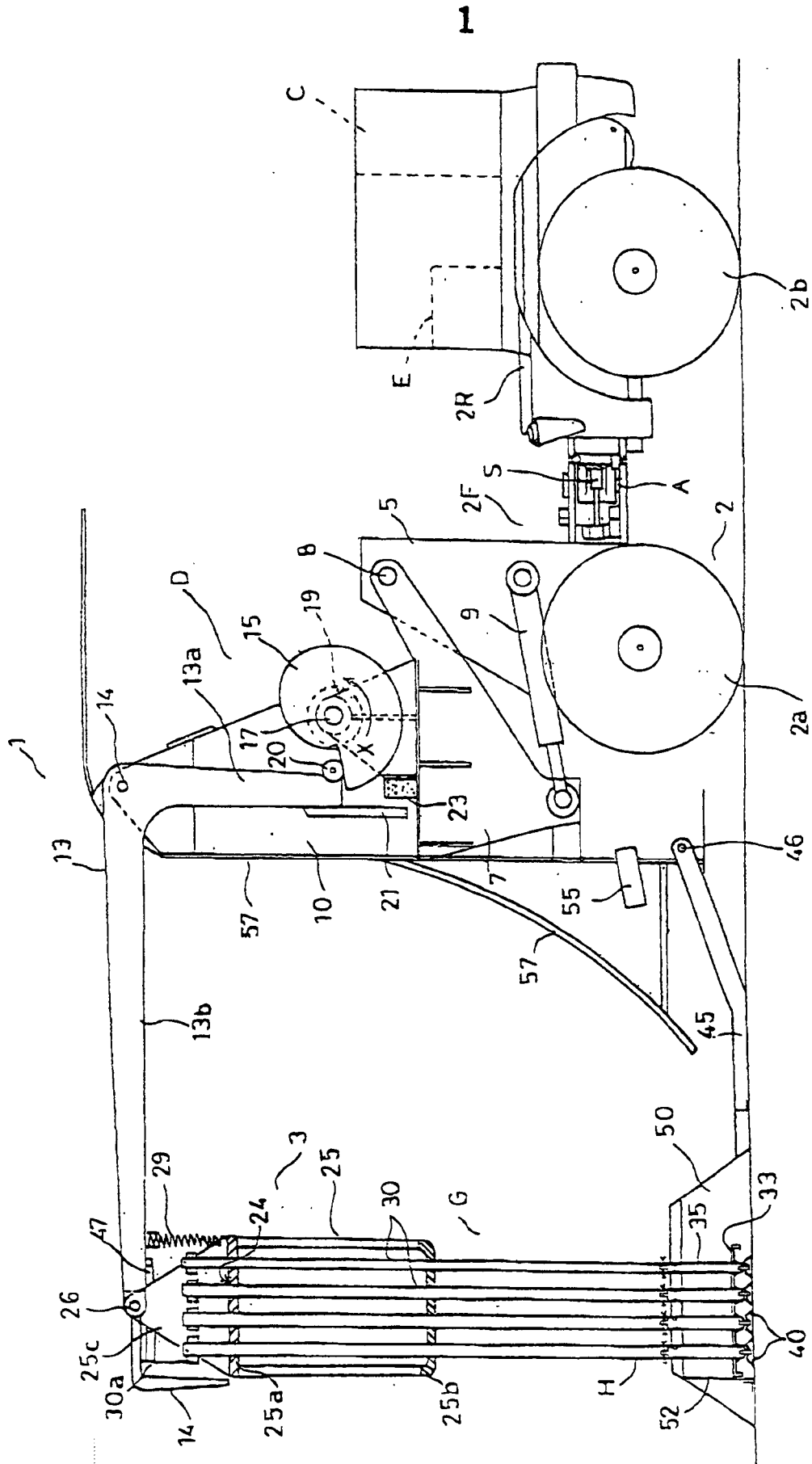
[0062] Of the mines of current worldwide concern anti-personnel mines containing 50 to 100g of explosive are commonest. Upon explosion they project lethal fragments in all directions. It sometimes occurs that discovered mines explode for unanticipated reason. When antitank mines are swept, every counter-measure should be taken to protect the sweeping people by employing a remote control system equipped with a monitor camera, a periscope, or a backview mirror.

Industrial Applicability of the Invention

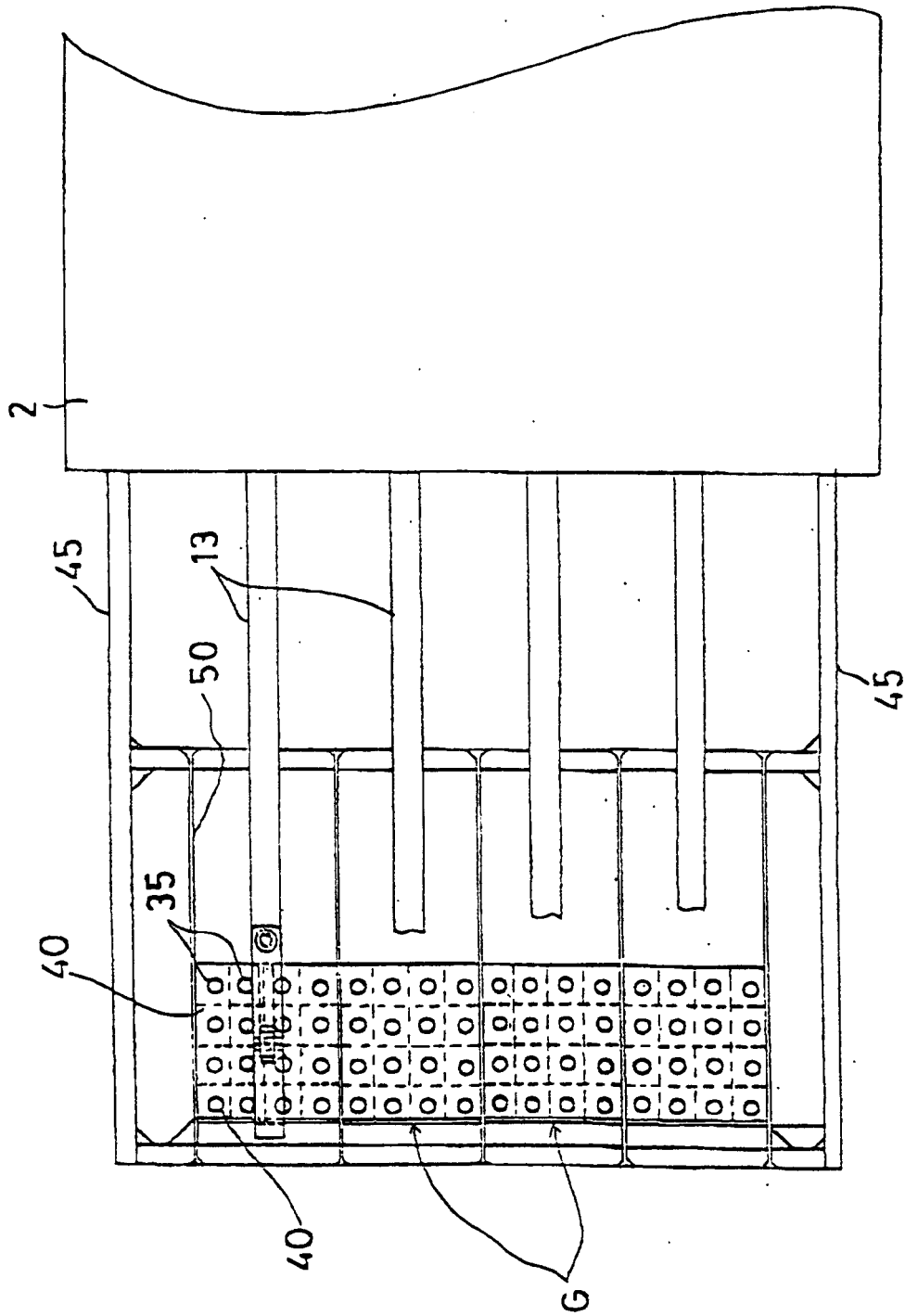
[0063] The mine sweepers of the present invention can be mass-produced in the same manner as ordinary industrial machinery, and cannot require special expensive components. They only employ an inexpensive press device unit such as tapping pads and rollers. The mine sweeper can explode mines spot by spot in a wide range by applying pressure beyond human weight. In this way mine fields can be safely swept, so that the lands can be changed into safe agricultural fields.

Claims

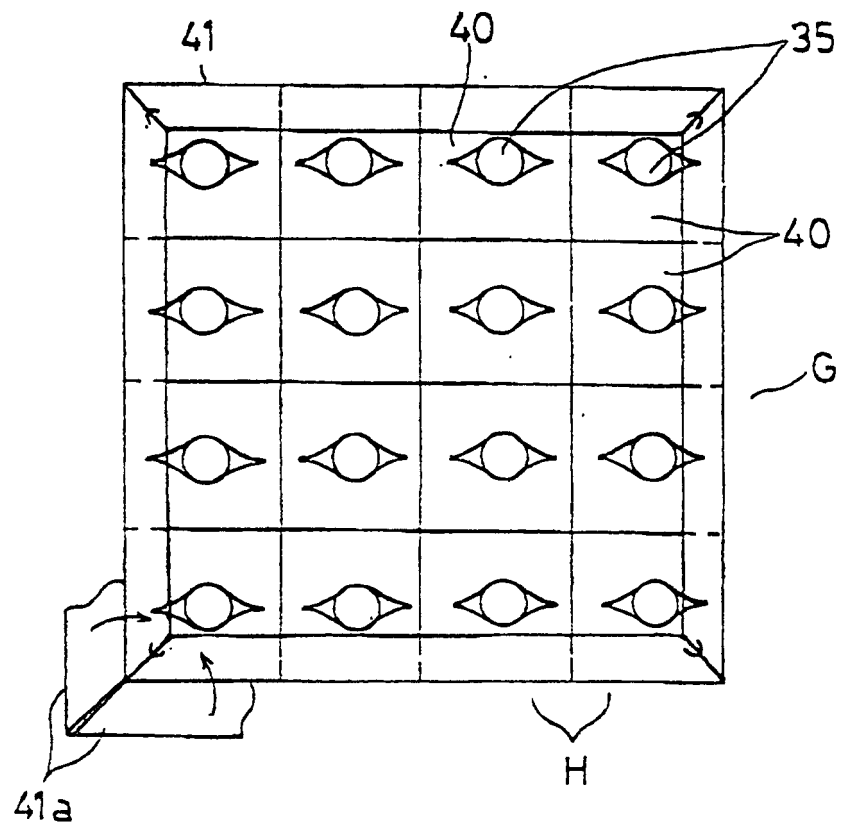
1. A device for sweeping land mines, the device comprising a tapping component unit including a plurality of pads for tapping the surface of the ground, and pad supporting stems secured to the upper parts of the pads, rods connected to the stems so as to transmit their ascent and descent to the stems, a driving unit for moving up and down the component unit so as to utilize a gravity-fall energy, and a carrier for supporting the driving unit.
2. A device for sweeping land mines, the device comprising a pressure generator, a plurality of pads for tapping the surface of the ground, stems for supporting the pads, and a primary cylinder and a plurality of secondary cylinders, wherein the primary cylinder dispenses the pressure generated by the generator to each of the secondary cylinders.
3. The device according to claims 1 or 2, wherein each of pads is connected to the respective stems through universal couplers to swing up and down.
4. The device according to any of claims 1 to 3, wherein the pads are made of soft material such as rubber or plastics, and wherein each of the pads is rotatively connected to the respective stems.
5. The device according to any of claims 2 to 5, wherein each of the pads comprises a bottom-opened casing and a water-filled bag placed in the casing.
6. The device according to any of claims 2 to 5, wherein each of the pads comprises a bottom-opened casing and a water-filled bag placed in the casing.
7. A device for sweeping land mines, the device comprising a carrier running on the ground, a roller component unit provided ahead of the carrier, the roller component unit comprising a vertically movable front roller and a vertically movable rear roller each for pressing the surface of the ground, a weight located between the front roller and the rear roller so as to apply weight to them, and a pressing device for applying pressure to each of the front roller and rear roller intermittently.
8. The device according to claim 7, wherein the roller component unit is provided in plurality and arranged side by side, and wherein the rollers laterally adjacent to each other are connected by means of a common shaft.
9. The device according to claims 7 or 8, wherein the front roller and the rear roller are axially displaced from each other so as to enable them to run in different courses.



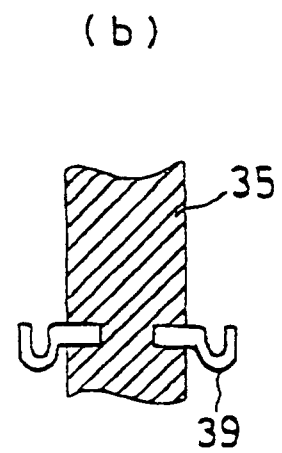
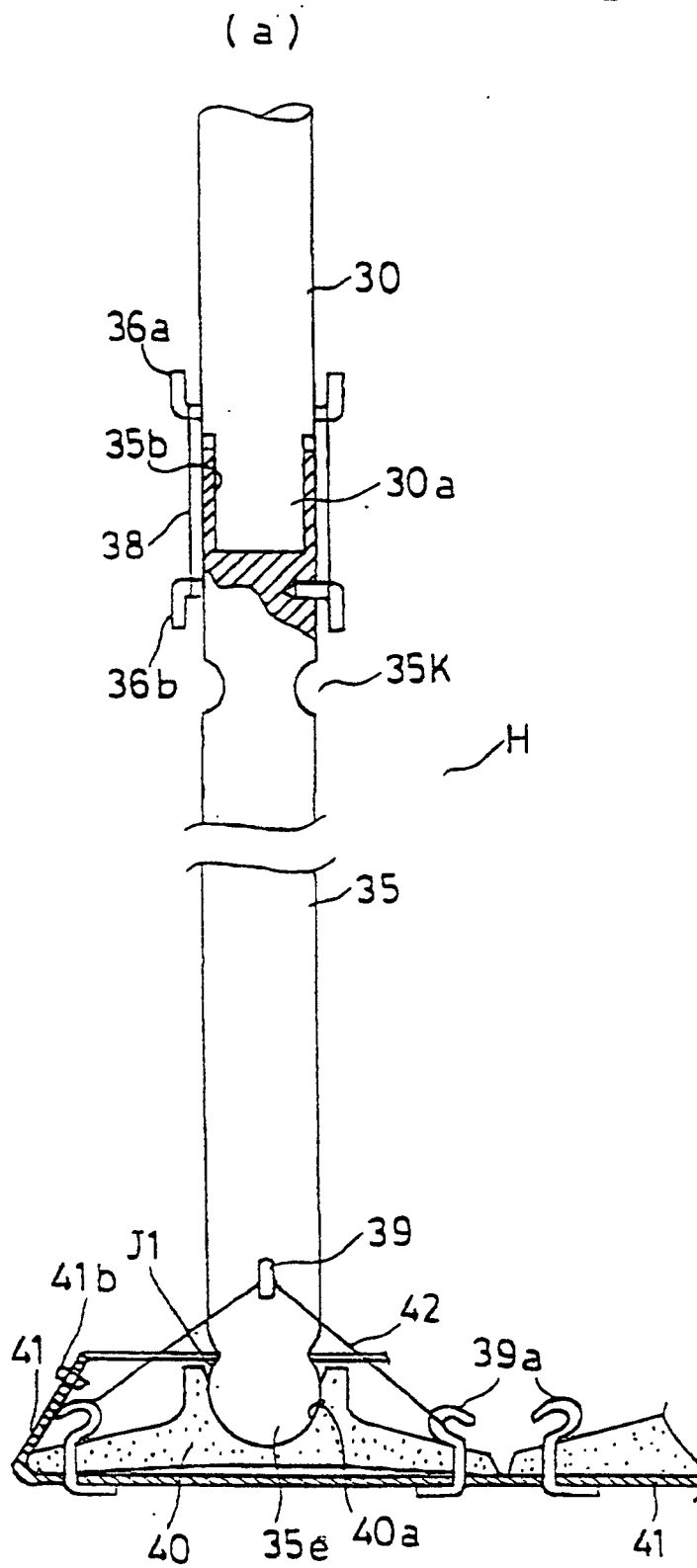
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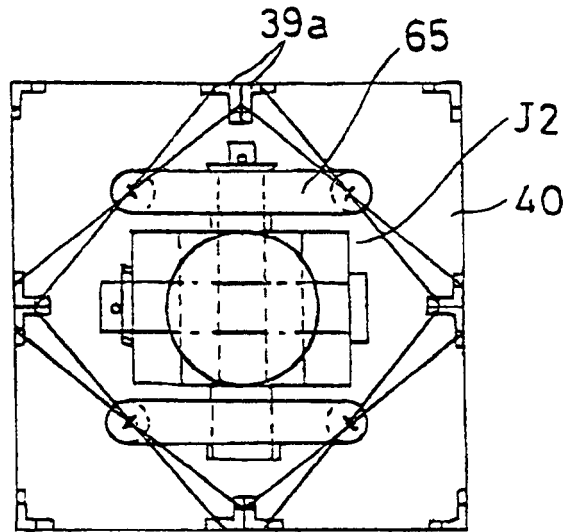


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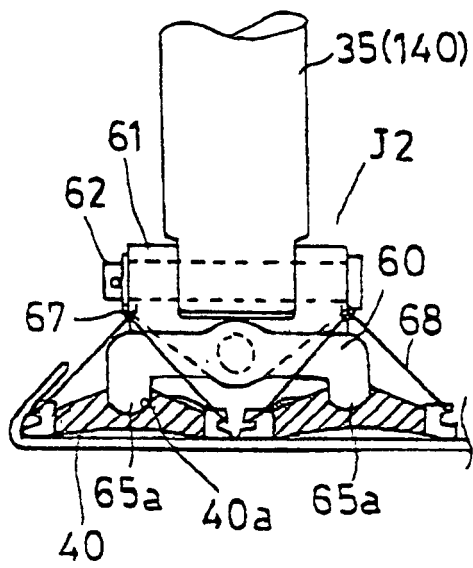


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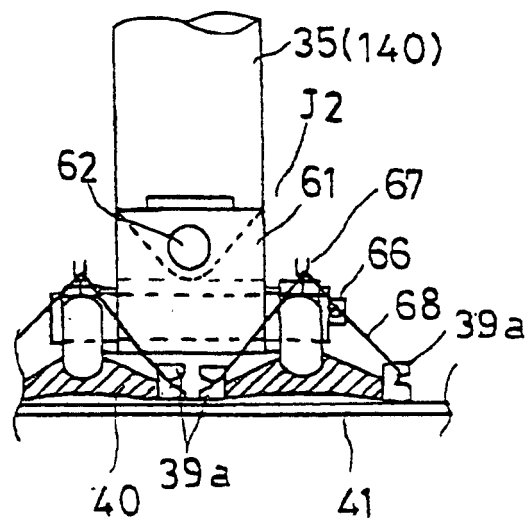
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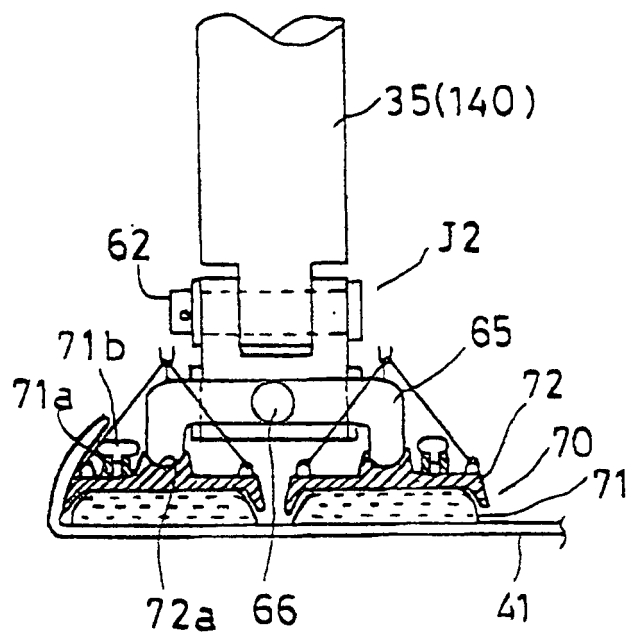
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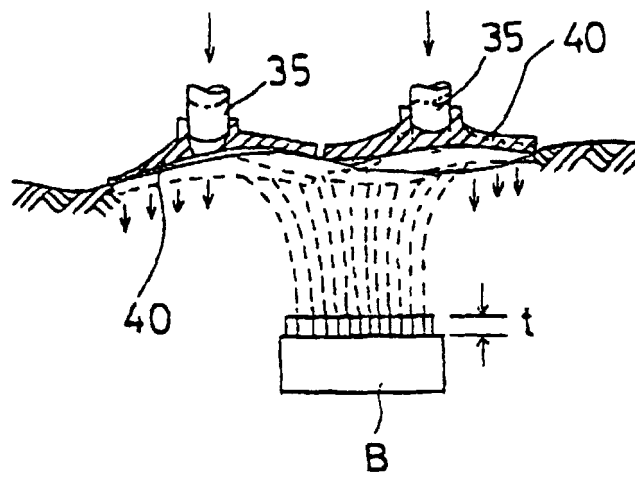
(c)



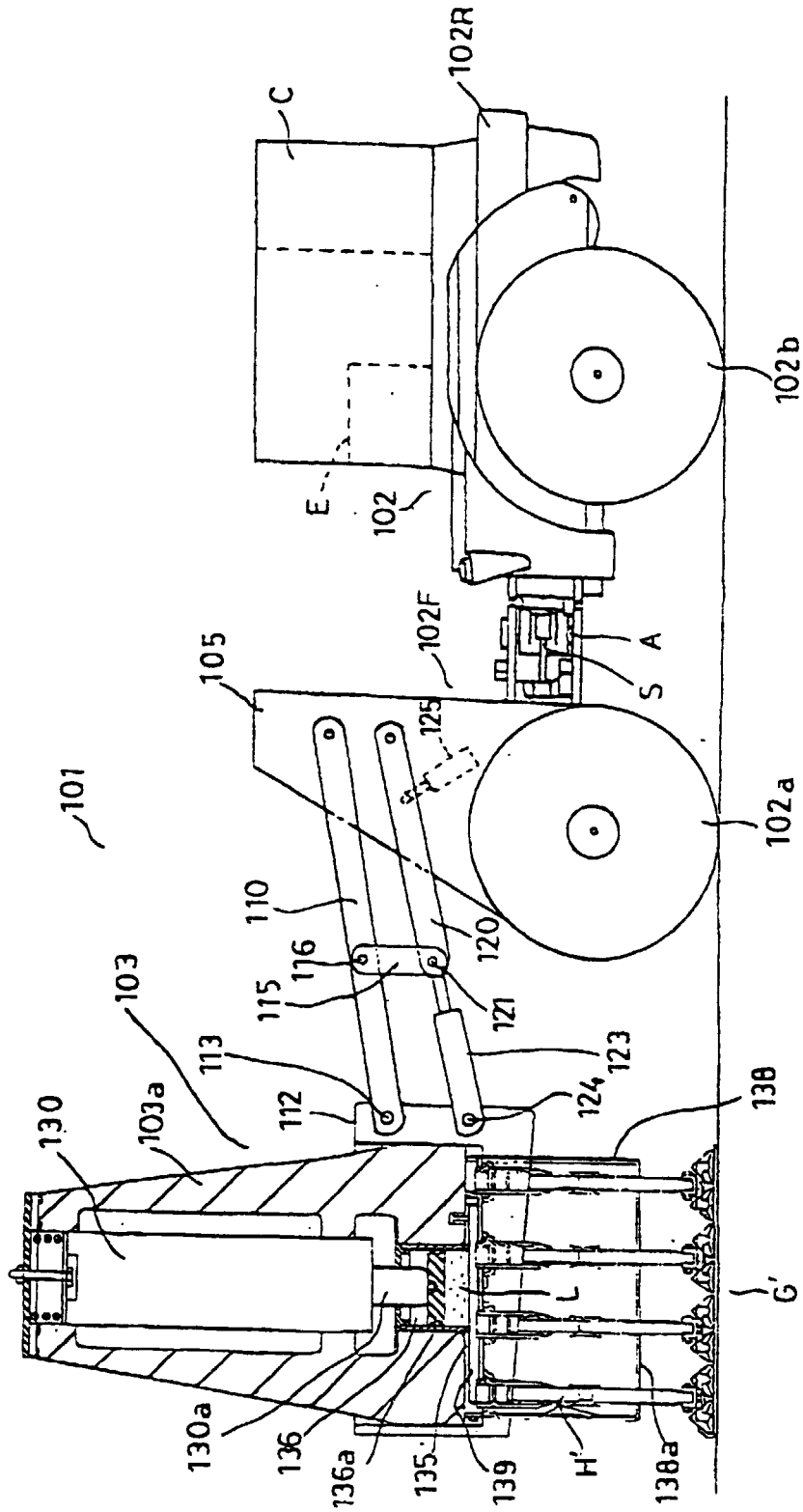
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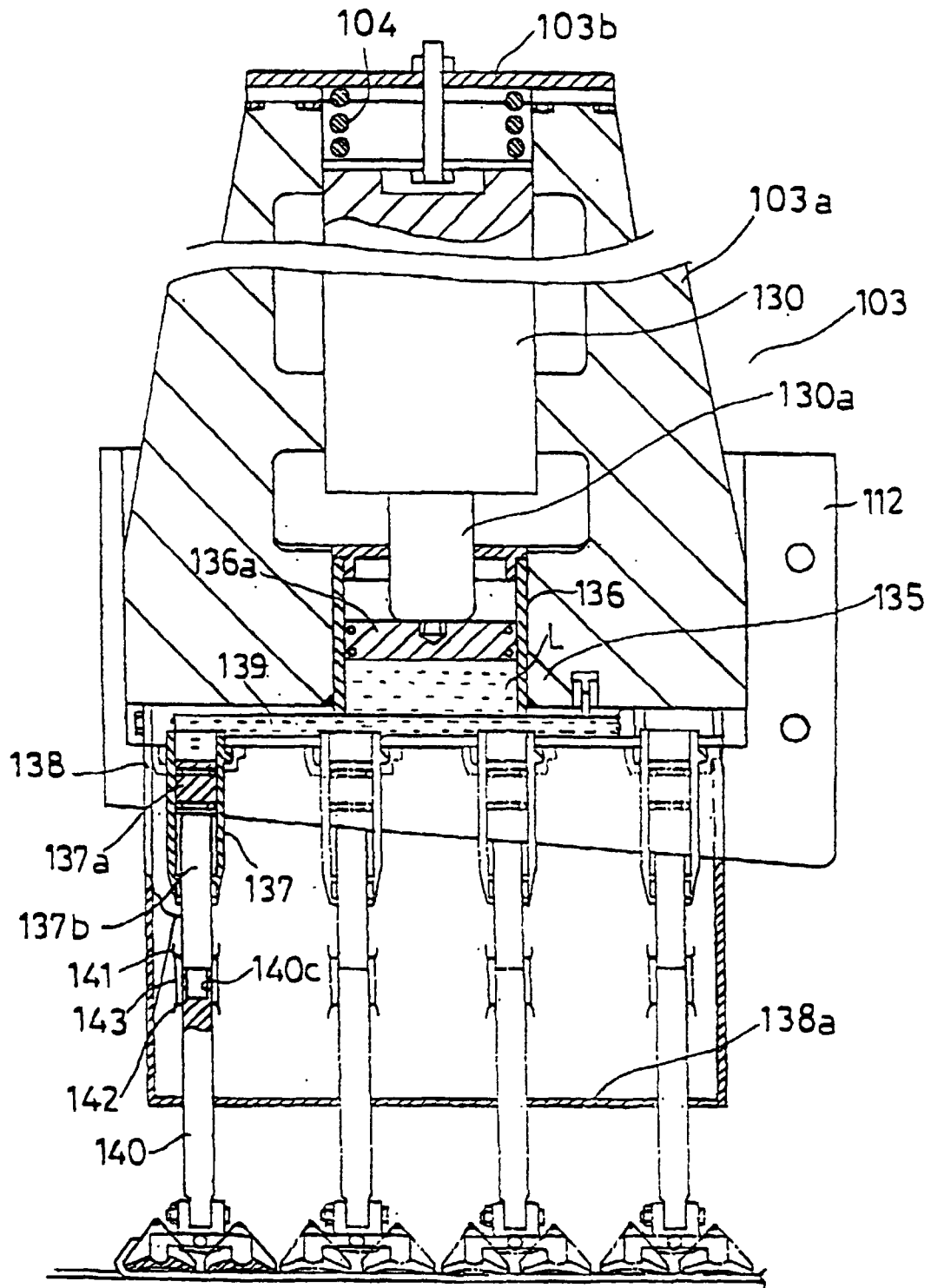
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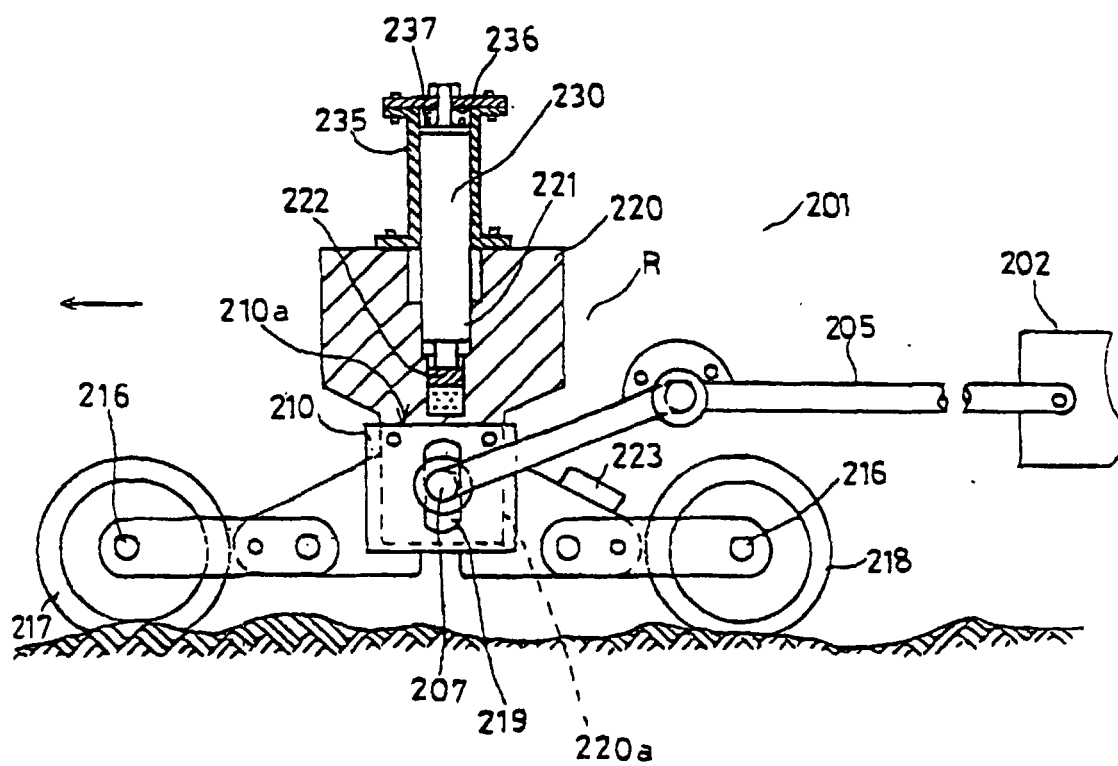
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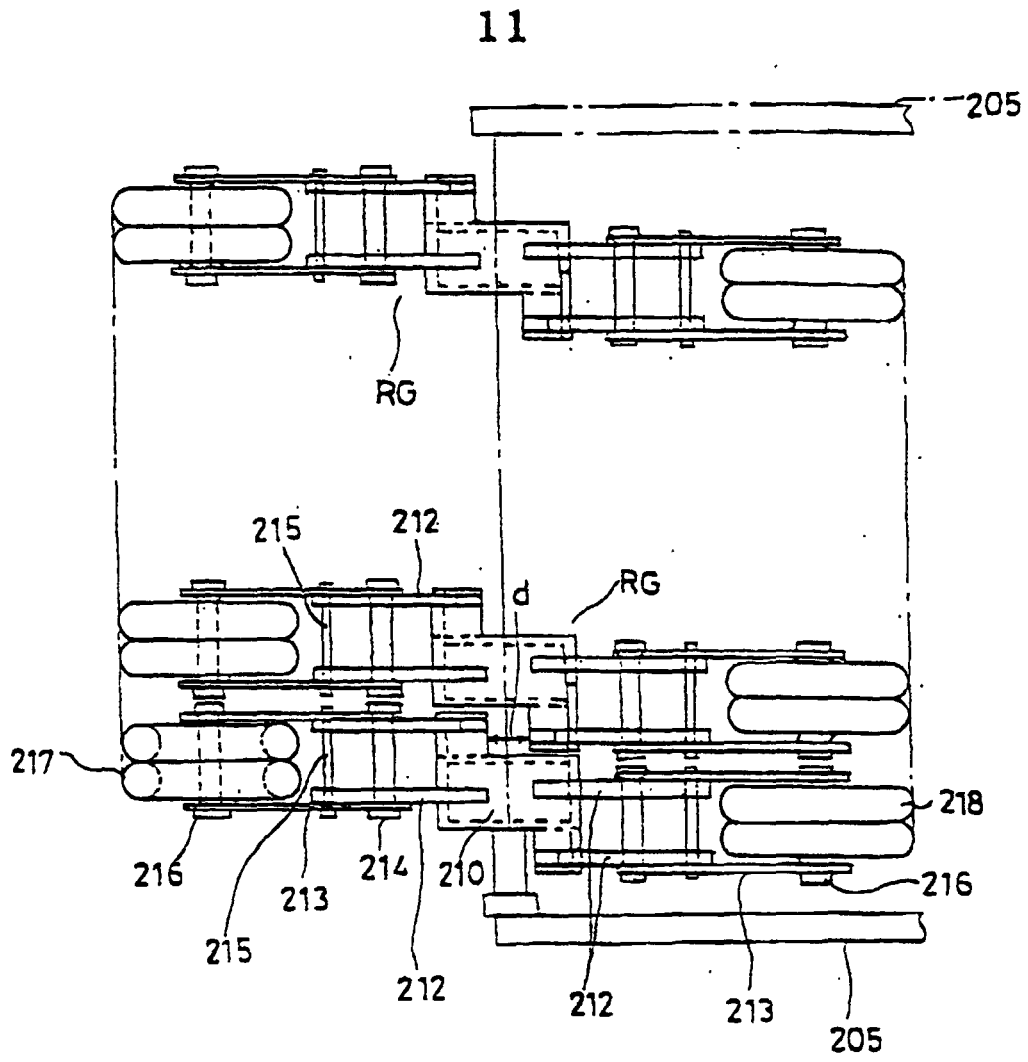


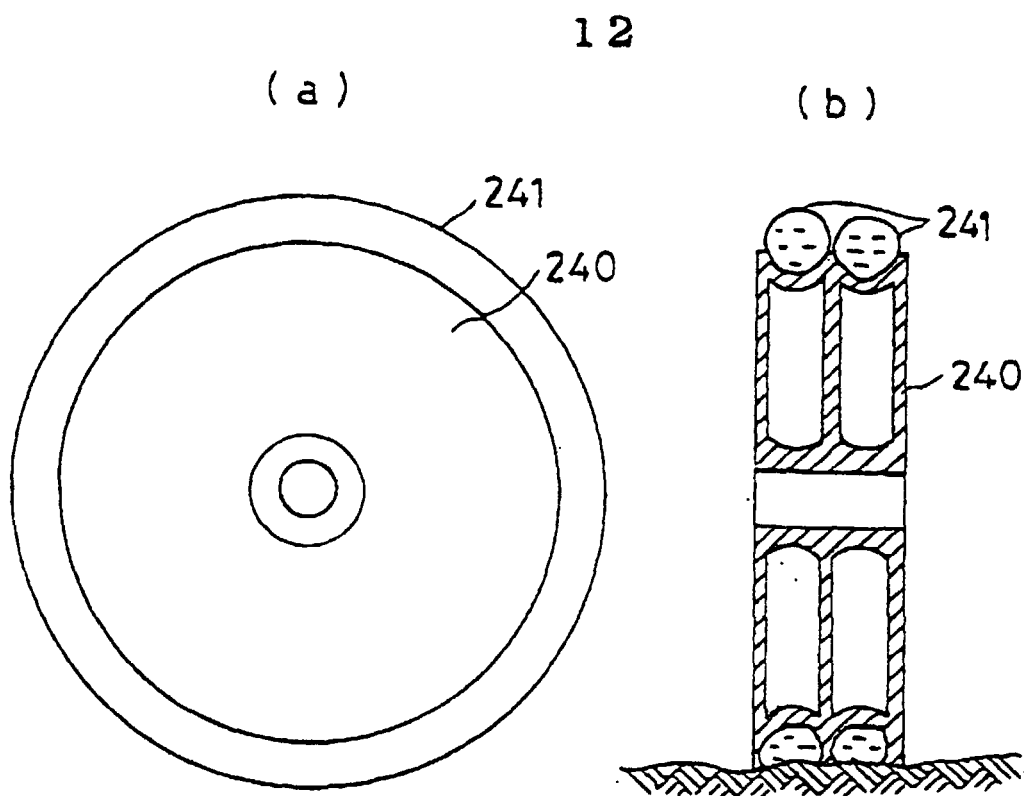
9



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/01909

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁶ F41H11/16		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁶ F41H11/12-11/16		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1999 Toroku Jitsuyo Shinan Koho 1994-1999 Kokai Jitsuyo Shinan Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 8-320199, A (Maruma Jusharyo K.K.), 3 December, 1996 (03. 12. 96)	1-9
Y	JP, 6-42899, A (The Japan Steel Works,Ltd.), 18 February, 1994 (18. 02. 94)	1-6
Y	JP, 6-26795, A (The Japan Steel Works,Ltd.), 4 February, 1994 (04. 02. 94)	1-6
Y	JP, 6-26796, A (The Japan Steel Works,Ltd.), 4 February, 1994 (04. 02. 94)	7-9
Y	JP, 6-55093, U (Nobumasa Yoshida), 26 July, 1994 (26. 07. 94)	7-9
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 8 July, 1999 (08. 07. 99)		Date of mailing of the international search report 21 July, 1999 (21. 07. 99)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)