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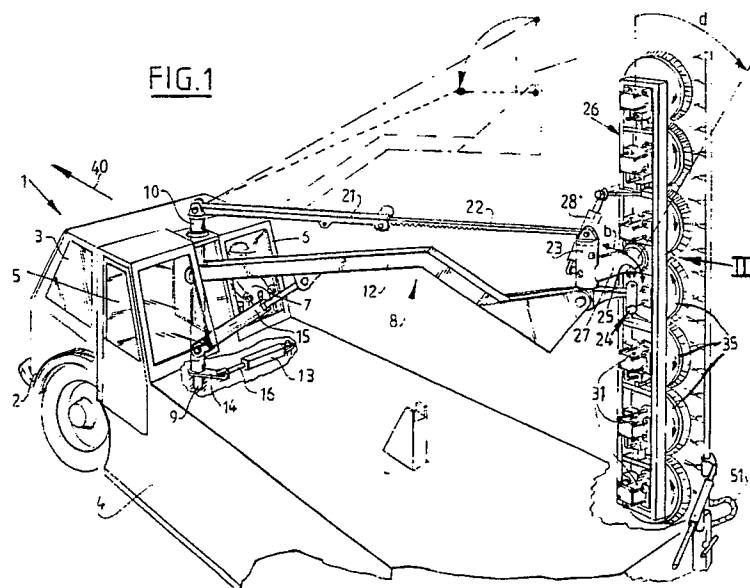
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54 **Washing vehicle.**

57 The invention relates to a washing vehicle (2), particularly for washing a curved tunnel wall. By causing a boom (12) to pivot in a vertical plane and by making the brush carrier (26) arranged on the boom (12) rotatable round a vertical shaft the washing brushes (35) can be set in any desired position. Each brush (35) is driven by its own hydro-motor

(31). Washing liquid is fed from a single pump (96) to a distributor means (32). Washing liquid can hereby be carried up with a single hose connection (33). Achieved as a result of these steps is a maximum flexibility of the position of the brushes (35) relative to the tunnel wall.



The invention relates to a washing vehicle for washing a wall extending in lengthwise direction, in particular a tunnel wall, an arm construction inclinable and sideways pivotable by pressure cylinders, at least one brush driven rotatably by a hydro-motor on a brush carrier at the free end of the arm construction and spray means for spraying liquid detergent.

Such a washing vehicle is known from the Dutch patent application 8001377. Such a washing vehicle is used particularly in tunnels. The invention has for its object to improve the known washing vehicle in two respects.

On the one hand, when it is wished to increase the number of brushes on the brush carrier in order to increase productivity, the problem arises that when a tunnel wall is not entirely flat the brushes for cleaning the wall no longer need to come to lie in one plane. In the case of sunken tunnel elements the cross section of the tunnel is largely rectangular. With drilled tunnels however, as is the case in mountainous regions, the tunnel wall is curved. In the latter case only a very few brushes that are placed in series can lie in one plane.

When the number of brushes situated in one row is increased, the further problem arises that the number of feed hoses for the central hydro-pump to the separate motors of the brushes becomes very large and begins to form an obstruction.

Another intended object is to offer a solution for the fact that the vehicle which moves through the tunnel does not precisely follow a line parallel to the wall. This can have various causes, for example the virtual impossibility of steering the vehicle in this way, a change in the position of the road surface relative to the wall, and the like.

The invention has for its object to provide a solution for the stated drawbacks.

This is achieved according to the invention by the steps according to the appended claims.

The invention will be elucidated with reference to the annexed drawings. In the drawings:

fig. 1 shows a partly perspective view of the vehicle according to the invention;

fig. 2 shows a sectional view of a detail II from fig. 1;

fig. 3 is a rear view of the vehicle according to the invention; and fig. 4 shows a diagram of the propelling means and the hydraulic installation.

The apparatus according to the invention comprises a vehicle 2 in the form of a truck chassis with driver's cabin 3. On this chassis is arranged a superstructure 4 which comprises two control cabins 5, 6 for an operator 7. The control cabin 6 is used during washing of a wall which, as seen in the travel direction 40 of the vehicle, is located on the right side thereof. The cabin 5 is used during washing of a wall on the left side. The apparatus 1

further comprises a brush-moving mechanism 8 with which the brushes 35 are held against a wall for washing.

The brush-moving mechanism 8 comprises a main spindle 9 fixedly connected to the superstructure 4. Mounted rotatably about the main spindle 9 is a main spindle tube 10. A boom 12 is connected pivotably to the main spindle tube 10 by means of a bearing 11. Also attached to the main spindle tube 10 is a swivel arm 14 on the end of which grips a piston rod 16 of a pressure cylinder 13, which pressure cylinder 13 is in turn pivotably connected to the superstructure 4. The pressure cylinder will be called hereafter the swivel cylinder 13. The pressure cylinder 15, hereafter to be called the inclining cylinder 15, is connected pivotably to the main spindle tube 10. The piston rod 17 of the inclining cylinder 15 is in turn pivotably connected to the boom 12. Furthermore, an arm 21 is connected pivotably to the main spindle 9, which arm displays an extendable gear rack arm 22. Arranged on the free end of the boom 12 is a spindle sleeve 23 which also engages pivotably on the arm 22. By means of the plunger 24 and the connecting piece 25 connected to the sleeve 23, the sleeve 23 can perform the rotation indicated with the arrows b. Arranged in the sleeve 23 are openings for placing pins locking the brush arm in the horizontal position. These pins are placed when the brush arm assumes a position against the roof of the tunnel. In this position the plunger 24 can absorb only small forces. The brush arm 26 is connected to the sleeve 23 by means of the arm 27. Using the brush arm cylinder 28 the arm can perform the movement indicated with the arrows d, rotating around the arm 27.

Each brush 35 is driven by its own hydro-motor 31. All hydro-motors for the respective brushes are connected via a distributor means 32 and two flexible hoses 33 to the common hydro-pump for all the motors.

Each brush 35 with associated motor is axially movable, guided by guide rods, of which two 200 and 201 are visible. The brush 35 is biased thereby by pressure provided by the control cylinder 202. The brushes 35 (see fig. 3) can therefore assume the contact position with the wall because they are pressed against the wall. Each brush 35 is arranged pivotably relative to the rotatable drive shaft using the cardan coupling 37. Through this construction the brushes can individually assume the desired axial position, for example when encountering a thickening of a wall 204.

As is shown in fig. 4, the propelling means comprise a motor 67 and, connected and coupled thereto, a gearbox 68 which has an output shaft 69. The propelling means further comprise a gearbox 70 coupled to the output shaft 69 of the gearbox

68, to which gearbox 70 are further connected a hydro-pump 71, a hydro-motor 72 and, via a cardan shaft 73, the rear shaft 74 connected to the driven wheels. The gearbox 70 comprises a primary shaft 86 with a toothed wheel 77 arranged for sliding thereon by means of a key connection 80, a secondary shaft 79 with a fixed toothed wheel 78, a first auxiliary shaft 75 with a fixed toothed wheel 76 and a second auxiliary shaft 82 with a toothed wheel 81 arranged for sliding thereon by means of a key connection 83. The output shaft 69 of the gearbox 68 is coupled to the primary shaft 86 of the gearbox 70. The hydro-pump 71 is coupled to the first auxiliary shaft 75, the hydro-motor 72 is coupled to the second auxiliary shaft 82 and the cardan shaft 73 is coupled to the secondary shaft 79. By means of a system of rods 84 the slidable toothed wheels 77 and 81 can be simultaneously pushed in opposing directions onto the respective shafts 86 and 82. In the position of the system of rods 84 shown in fig. 4 the output shaft 69 of the gearbox 68 is directly coupled to the driven shaft 74 because the toothed wheels 77 and 78 are in mutual engagement. Neither of both toothed wheels 76 and 81, which are coupled to the hydro-pump 71 and the hydro-motor 72 respectively, are in engagement with a toothed wheel. The toothed wheels in the gearbox 70 are set in this position when the vehicle 2 travels over the road to an object for washing.

By adjusting the switch lever 87 of the system of rods 84 in the direction of the arrow 85 the slidable toothed wheels 77 and 81 respectively are pushed in the direction indicated by the arrow 88 and the arrow 89 on the respective shafts 86 and 82. The engagement between the toothed wheels 77 and 78 is hereby broken and the toothed wheel 77 engages with the toothed wheel 76. Toothed wheel 81 simultaneously engages with toothed wheel 78. The result now is that the output shaft 69 of the gearbox 68 is coupled to the hydro-pump 71 via the toothed wheels 77 and 76. The driven shaft 74 is coupled to the hydro-motor 72 via the toothed wheels 78 and 81. In other words: the motor 67 drives the hydro-pump 71, the hydro-motor 72 is fed with oil under pressure from the hydro-pump 71 and drives the rear shaft 74.

As can be seen from fig. 4, the gearbox 68 is provided with a take-off drive gear 90. The power take-off 91 is connected to a drive gear 92 which has two output shafts 93 and 95 respectively. Coupled to the output shaft 93 are a number of hydraulic pumps 94 for controlling the pressure cylinders of the apparatus. One hydro-pump 96 for all brushes 35 jointly is coupled to the output shaft 95. Moreover, a washing agent pump 99 which draws in washing agent from a tank 101 is driven from the output shaft 93 of the drive gear via a belt

drive mechanism 97. Arranged in series in the outlet line 173 of the pump 99 are a normally opened valve 103 and a normally closed valve 104. The common hydro-pump 96 is coupled via a flexible hose connection 33 to the distributor means 32 for supply of drive fluid to the hydro-motors of the brushes.

Achieved with the construction according to the invention is maximum flexibility in the possible position of the brushes relative to the tunnel wall. The brush can assume the optimal position against the tunnel wall independently of the other brushes and the vehicle has a relatively great degree of freedom relative to the tunnel wall and the brush arm.

Claims

1. Washing vehicle for washing a wall extending in lengthwise direction, in particular a tunnel wall, an arm construction inclinable and sideways swivellable by pressure cylinders, at least one brush driven rotatably by a hydro-motor on a brush carrier at the free end of the arm construction and spray means for spraying liquid detergent, **characterized in that** the arm construction is formed by a boom (12) rotatable around a vertical shaft (10) and pivotable in a vertical plane and that the brush carrier (26) is rotatable around a vertical shaft (23) relative to the free end of the boom.

2. Washing vehicle as claimed in claim 1, **characterized in that** the boom is pivotable in a vertical plane by means of a control mechanism provided with a gear rack.

3. Washing vehicle as claimed in claims 1, 2, **characterized in that** a plurality of vertically disposed brushes are placed on the brush carrier, each hydro-motor (31) is connected to a distributor means on the brush carrier and that from a single pump drive (96) fluid is fed to the distributor means (32).

4. Washing vehicle as claimed in claim 3, **characterized in that** each brush with the associated motor is axially slidable independently relative to the brush carrier.

5. Washing vehicle as claimed in claim 4, **characterized in that** each brush is biased in an axial outward direction.

6. Washing vehicle as claimed in claim 5, **characterized in that** the bias is provided by a pressure medium provided by a control cylinder.

7. Washing vehicle as claimed in claims 1-6, **characterized in that** each brush is rotatable around a horizontal shaft on the telescopic shaft.

8. Washing vehicle as claimed in claims 1-7, **characterized in that** each brush is connected to its drive shaft through a cardan joint.

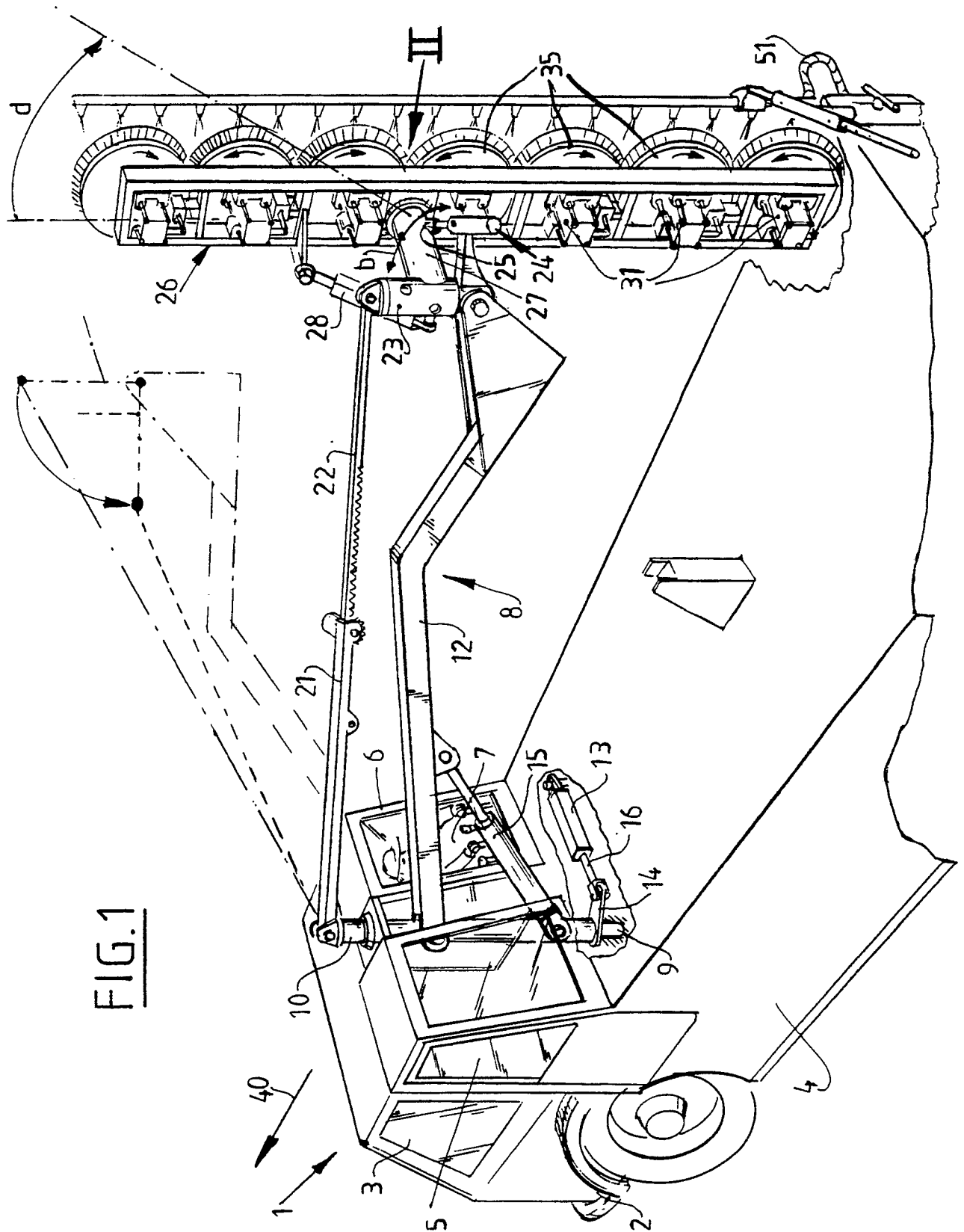
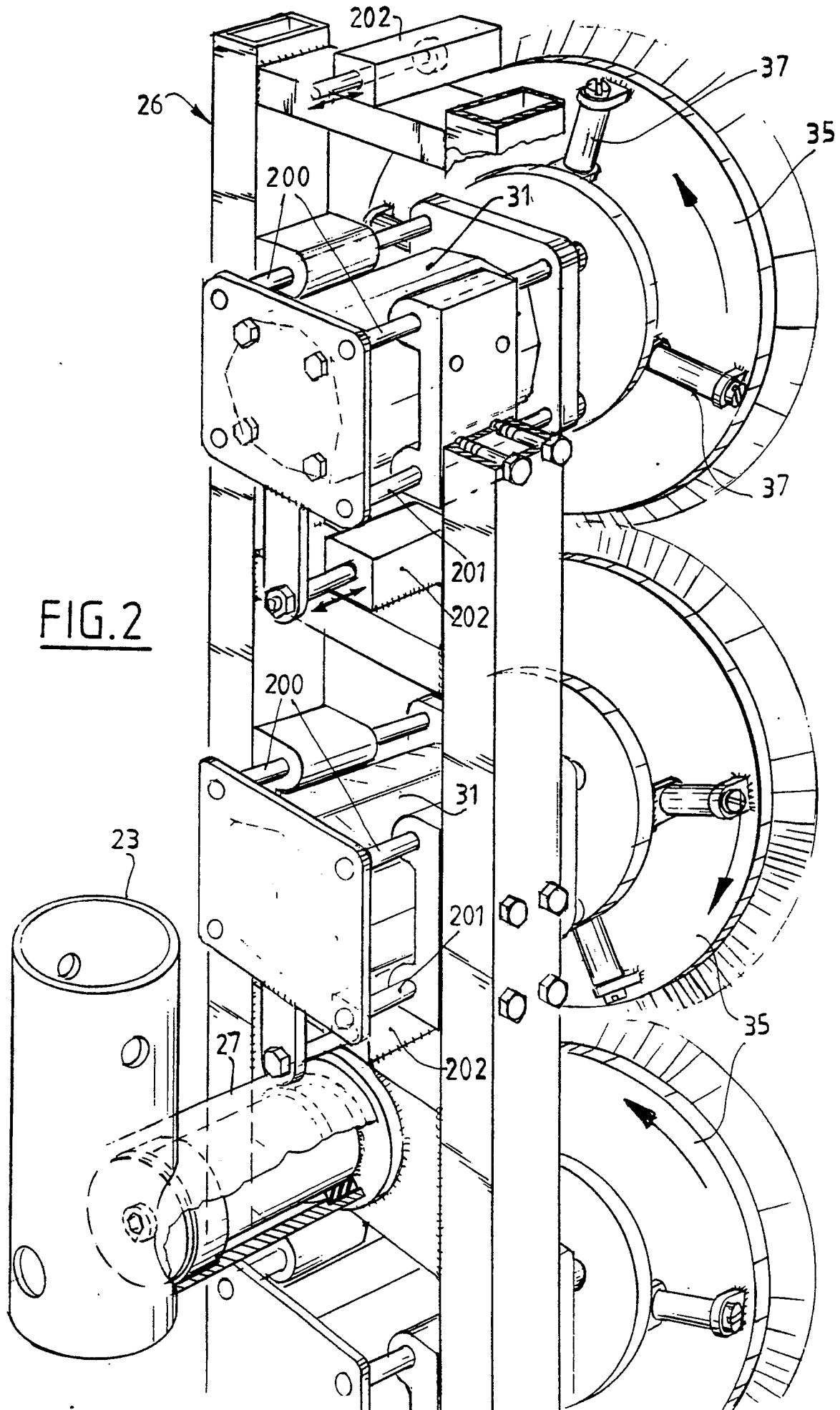


FIG. 2



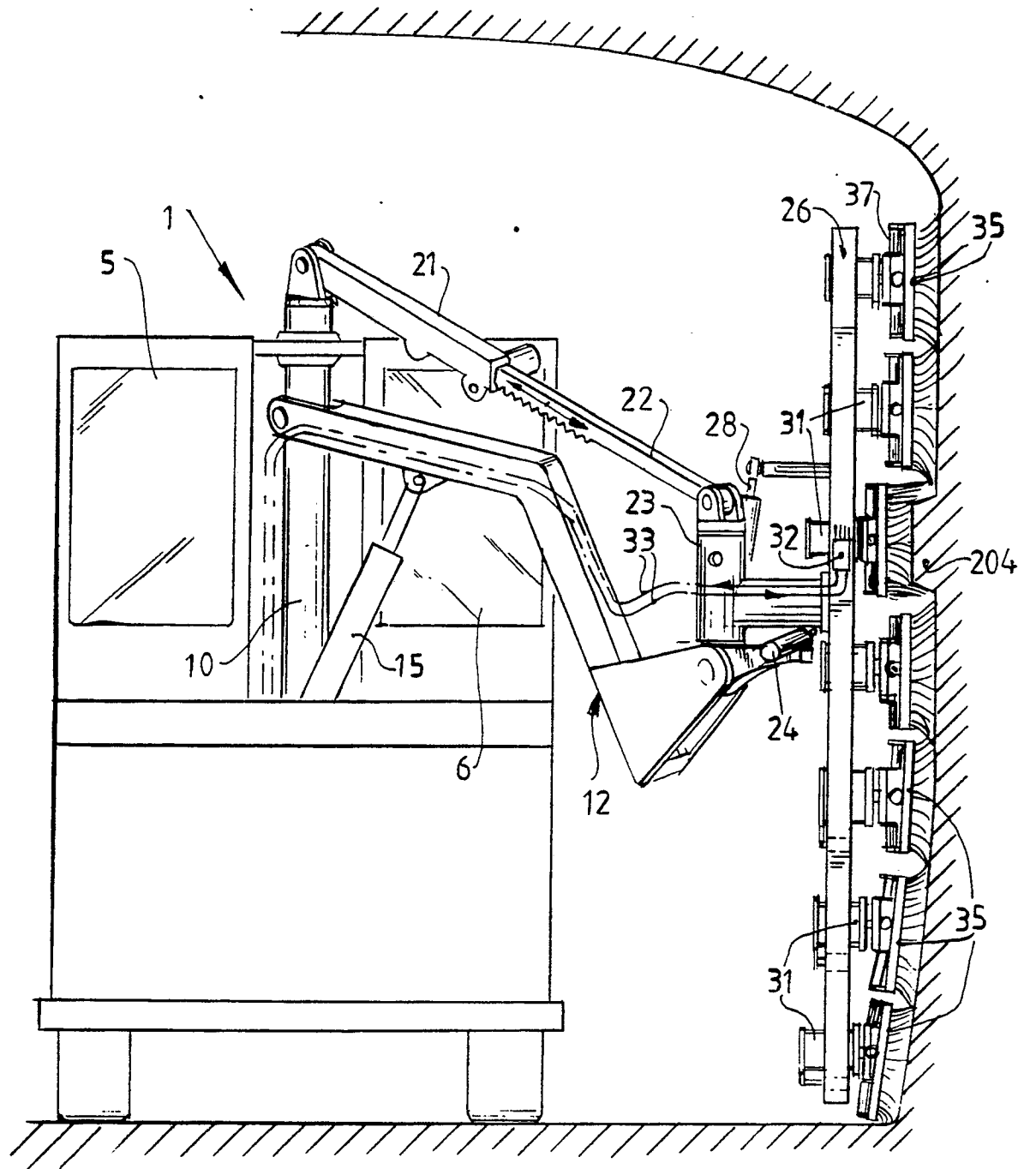


FIG.3

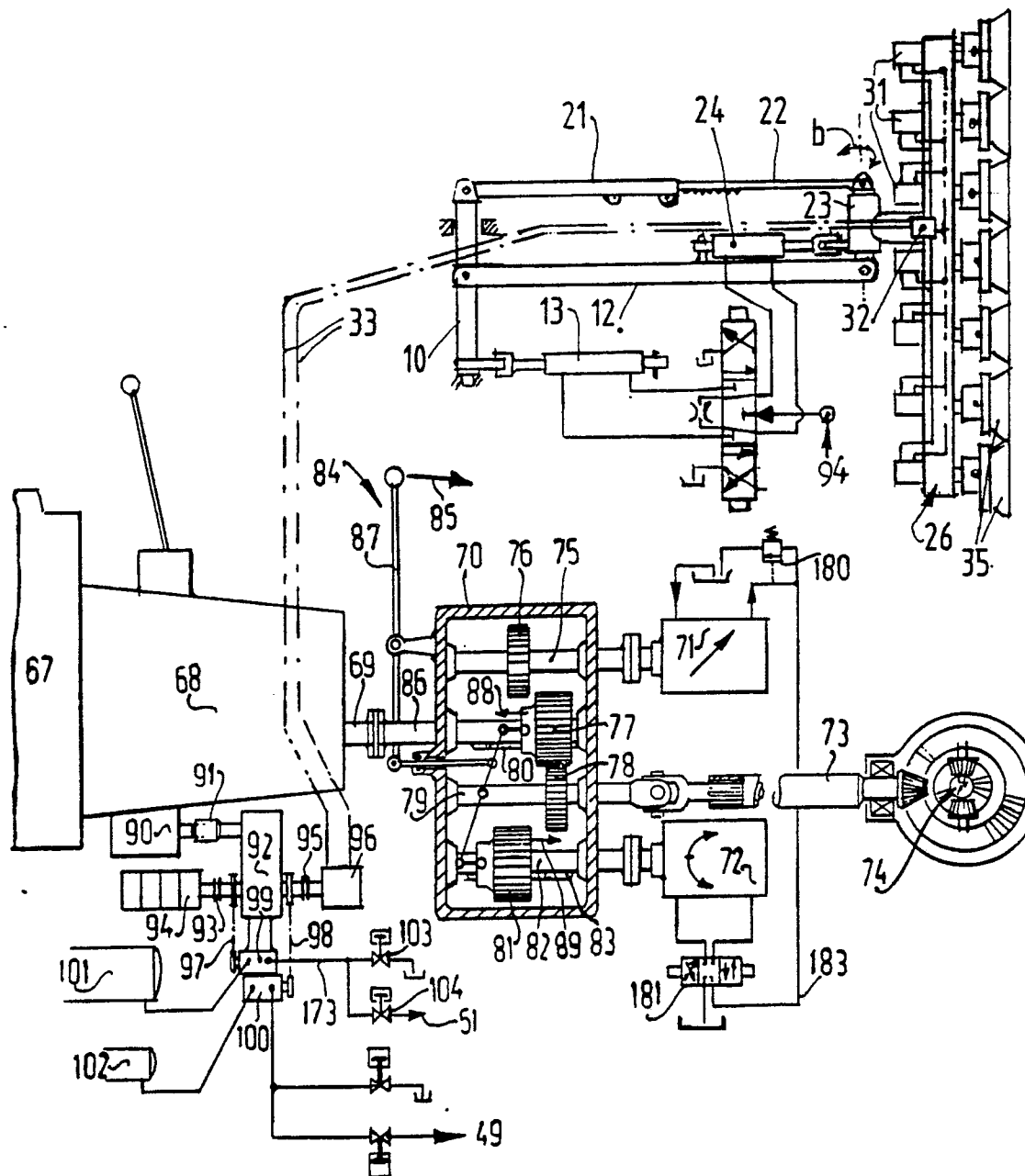


FIG. 4



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,Y	NL-A-8 001 377 (VAN DER VALK) * Whole document * ---	1	E 01 H 1/00
Y	FR-A-2 584 747 (LE MAT-DE VOIRIE) * Page 9, lines 17,18; figures 1,2,5 * ---	1	
A	FR-A-2 370 824 (MARTIN) * Page 4, lines 8-29; page 7, lines 11-25; figures 1A,5 * -----	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 01 H B 64 F E 04 S A 47 L E 01 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-05-1990	Examiner DIJKSTRA G.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			