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(54) Projectile provided with a plurality of explosive charges.

(57) A projectile (1) provided with a plurality of explosive charges (2) which are separable from each other and stacked one on top of another with the interposition of spacers (4) to define a cylindrical body (5) and has a support base (6) for supporting the explosive charges (2), these being fixed to the latter by three ties (12) of which two are constituted by a single cable (17) and the third is constituted by a cable (17') having one end connected to an intermediate point on the cable (17) and its opposite end connected to an actuator device (9) housed in the support base (6) and arranged to cause the separation of the explosive charges (2) under the control of a command system (10).

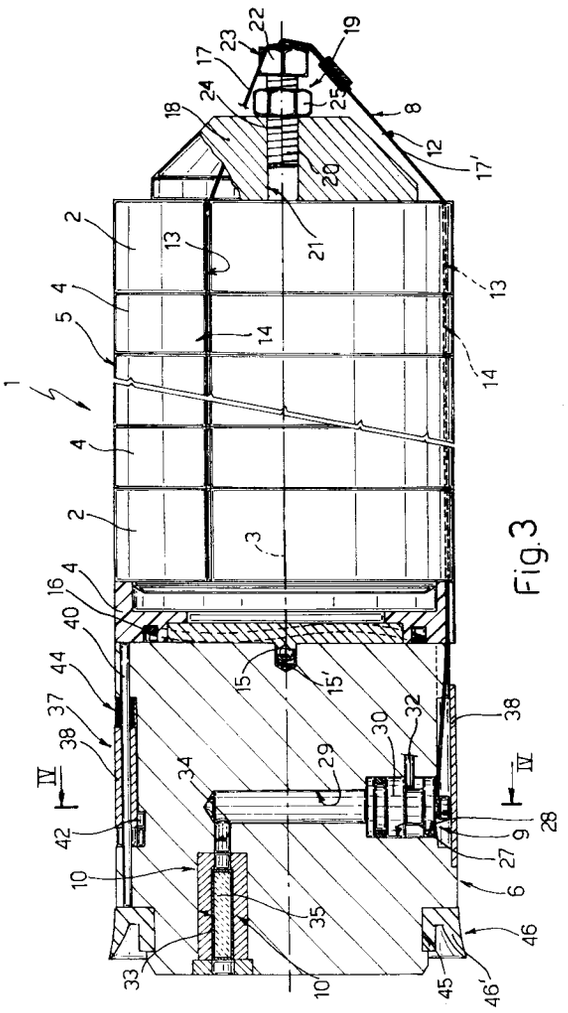

Fig.3

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The present invention relates to a projectile having a plurality of explosive charges.

As is known, the distribution or dispersion of explosive charges, for example mines, over the ground is achieved mainly by launching the explosive charges themselves by means of a mortar launch system having one or more launch apertures and utilising pressurised gas produced by the combustion of a propellant.

Generally several explosive charges of the same type are launched at a time, these being housed in a casing which is shaped in the same way as an ordinary projectile and closed at its rear end by a base which is releasably coupled to the casing. The space within the casing is divided by a plate into two chambers of which a rear one houses the explosive charges and the front one, formed in the tip of the casing, houses a pyric charge. The launch is achieved by introducing the casing into a launch tube of the launching system and expelling it forcedly therefrom. During the launch, the pyric charge is triggered and generates a thrust on the plate and, through the mines, on the base which becomes detached from the casing and enables the mines themselves to leave the casing.

The launch configuration previously described has two disadvantages. First of all, the presence of the casing although on the one hand providing a better air penetration factor than that of charges which are simply stacked on one another, without outer protection, on the other hand has a weight which cannot be neglected compared with the weight of the charges themselves and hence, obviously, reduces the range for a given initial thrust. As is known, the range may be increased solely by increasing the initial velocity which is limited on the one hand by a limiting velocity beyond which an increase in the range cannot be obtained due to the aerodynamic characteristics of the mine and, on the other hand, by the fact that the launch force cannot exceed a respective limiting threshold which is in fact dependent on the maximum value of the reactive force which can be withstood by the launch system.

Moreover the use of a casing involves additional costs which affect the overall production costs to an extent which cannot be disregarded.

Finally the embodiment described has a practical disadvantage which further reduces the range of each individual explosive charge. In fact, following the disconnection of the base from the casing, the explosive charges are expelled from the casing itself in the opposite direction from the direction of advance of the casing and hence, at the outlet from the casing, the advance velocity of each individual mine is reduced by the component of relative velocity of the mine with respect to the casing.

The object of the present invention is to provide a projectile having a plurality of explosive charges which enables the disadvantages described above to be resolved, and in particular enables the range of the individual mines to be increased, other things being equal, while at the same time being simple and cheap to put into practice.

According to the present invention there is provided a projectile of the type having a plurality of explosive charges separable from each other and actuator means for causing the separation of the explosive charges, characterised in that the explosive charges are stacked together and define a substantially cylindrical body which rests on a support base, the actuator means being housed at least partially within the support base, the projectile including anchoring means for anchoring the explosive charges controllable by the actuator means, the anchoring means partially surrounding the explosive charges so as to attach them to the support base.

The invention will now be described with reference to the appended drawings which illustrate a non-limiting embodiment, in which:

Figure 1 is a side elevational view of a preferred embodiment of a projectile according to the present invention;

Figure 2 is a plan view of the projectile taken on the arrow of A of Figure 1;

Figure 3 is a sectional view of the projectile of Figure 1 on an enlarged scale;

Figure 4 is a section taken on the line IV-IV of Figure 3, on a smaller scale; and

Figure 5 is a drawing similar to Figure 4 illustrating a detail of Figure 4 in a different operative condition.

In Figures 1 and 3, a projectile indicated 1 includes a plurality of separable explosive charges 2, in this particular case mines, stacked on each other along an axis 3 of symmetry of the projectile 1 itself with the interposition of a plurality of spacers 4 which together with the explosive charges 2, form a cylindrical body 5.

This cylindrical body 5 is supported by a support base 6 which constitutes part of the projectile 1 and to which the explosive charges 2 are anchored by an anchoring device 8. An actuator device 9 (figure 3) is interposed between the latter and the support base 6 and is arranged to act under the control of a control system 10 (Figure 3) to enable the explosive charges 2 to separate. The support base 6 is provided with a circumferential seat 45 in its face opposite the cylindrical body 5, engaged by a sealing washer 46 for the launch gas. The sealing washer 46 surrounds the support base 6 and has a lip 46′ for interacting with an inner face (not illustrated) of a launch aperture (not illustrated) during the launch phase in order to confine the launch gases and allow the support base 6 to behave in the manner of an ordinary piston.

As illustrated in Figures 1, 2 and 3, the anchoring device 8 includes three ties 12, preferably steel

strands, equiangularly spaced from each other (Figure 2) and extending outside the explosive charges 2 and their spacers 4. More particularly, the ties 12 engage respective axially aligned grooves 13 and 14 formed in the outer peripheries of the explosive charges 2 and the spacers 4 respectively in order to bind the charges 2 and the spacers 4 together against relative rotation. These latter also have centring projections 15 (Figure 3) engaged in respective axial seats 15′ formed both in the explosive charges 2 and in the support base 6, and an elastic element 16 (Figure 3) compressed elastically between the respective spacer 4 and the adjacent explosive charge 2 and arranged to facilitate the separation of the explosive charges 2 from each other.

Still with reference to Figures 1 to 3, two of the three ties 12 are constituted by a single cable 17 whose ends are fixed to the support base 6, while the other tie 12 is formed by a cable 17′ having one end firmly connected to an intermediate point on the cable 17 on the opposite side of the explosive charges 2 from the support base 6 and its opposite end connected to the actuator device 9.

Still with reference to Figures 1 and 3, an ogival-shaped aerodynamic deflector element 18 is disposed at the opposite end of the projectile 1 from the support base support 6 with respect to the explosive charges 2 and between the last of the explosive charges 2 and the ties 12. A device 19 for regulating the tension in\ the ties 12, and consequently the force with which the explosive charges 2 are packed together, is located between the last of the explosive charges and the ties 12. In this particular case, the device 19 comprises a threaded screw 20 having an end portion engaged in an axial hole 21 (Figure 3) formed in the aerodynamic deflector element 18 and a head 22 outside the aerodynamic deflector element 18 provided with a seat 23 (Figure 3) for housing a portion of the ties 12. A nut 25 is screwed onto a threaded portion 24 of the screw 20 and acts against an axial outer surface of the deflector element 18.

As illustrated in Figure 3, the support base 6 has a substantially cylindrical shape with a cylindrical cavity 27 extending radially, substantially orthogonally of the axis 4 and defining an outer seat 28 and an inner chamber 29 with a smaller diameter than that of the seat 28. The latter houses the actuator device 9 constituted by a piston 30 which is arranged to move between a withdrawn position in which it engages the seat 28 in a fluid tight manner and is fixed against an inner shoulder 31 of the seat 28 itself by a pin 32 coupled to the support base 6, and an extended position in which it projects from the support base 6. This piston 30 is firmly connected to a free end of the cable 17′ whose opposite end is connected to the cable 17.

Still with reference to Figure 3, the chamber 29, as well as communicating with the seat 28, also communicates with an axial chamber 33 traversed by a duct 34 and housing a pyric charge (not illustrated). The axial chamber 33 houses the control system 10 which, in addition to the pyric charge (not illustrated), includes a pyric time delay 35 arranged to be triggered by the launch gases generated during the launch of the projectile 1 and in turn arranged to trigger the pyric charge (not illustrated) housed in the chamber 29 after a predetermined delay.

Still with reference to Figure 3, and in particular to Figures 4 and 5, the projectile 1 includes a stabiliser device 37 carried by the support base 6 and including three fins 38. Each of the fins 38 is pivotally connected to the support base 6 by means of a respective pin 40 extending parallel to the axis 3 and is arranged to be moved between a first operative, closed position, in which it contacts the support base 6 (Figure 4) and a second operative, open position illustrated in Figure 5 in which it contacts a respective angular abutment 41 (Figure 1) fixed to the support base 6 and has a radial projection 42 (Figures 4 and 5) which, as a result of an axial movement of the fin 38 itself, engages a respective retaining seat 43 (Figure 4). More particularly, the movement of each fin 38 from the first to the second operative position is facilitated by a torsional flexure spring 44 (Figures 1 and 3) interposed under torsion between the support base 6 and the respective fin 38.

In use, the projectile 1 is introduced into a launch aperture (not illustrated) with its fins 38 in their first operative positions, and forcedly expelled therefrom. At the outlet of the launch aperture (not illustrated) the fins 38, as a result of the torsional flexure of the spring 44, move to their second operative positions and act in their proper capacity as guides for the projectile 1.

At the same time as the projectile 1 is expelled, the launch gas generated in the launch aperture (not illustrated) activates the pyric delay 35 which, after a predetermined period of time, in particular the period of time necessary to enable the projectile 1 to reach a predetermined range and height, such as to allow the optimum distribution of the explosive charges 2 over the ground, triggers the pyric charge (not illustrated) housed in the inner chamber 29 by means of the duct 34. The gas generated in the chamber 29 in turn exerts a thrust on the piston 30 such as to enable the pin 32 to be cut by the piston 30 itself and the latter to be expelled from its seat 28. The expulsion of the piston 30 results in the slackening of the cable 17′ whose opposite end is connected to the cable 17, and hence deactivates the anchoring device 8 and causes the immediate the separation of the explosive charges 2 from each other and from the support base 6.

From what has been described above it is clear that the projectile 1 has the following advantages. First of all, the characteristics of the anchoring device 8 enable a projectile to be formed which, other characteristics being equal, and in particular for given aerodymanic characteristics, is extremely light and

hence can be launched with a relatively low thrust, and hence which can thus easily be withstood by the launch unit (not illustrated) and with a launch velocity limited solely by the maximum range limit value.

Moreover, the structural characteristics enable the explosive charges 2 not only to be released at a predetermined instant which can be varied according to the requirements for the dispersion of the charges 2 over the ground, but more particularly to be released in a manner such as not to cause variations, in the velocity of the charges 2 themselves, and particularly a reduction in their velocity, after the release phase.

Finally, the projectile 1 is very simple and practical in structure and relatively cheap to manufacture.

Finally, it is clear that the projectile 1 described above may be modified and varied without thereby departing from the field of protection of the present invention. In particular, the manner in which the explosive charges 2 are fixed together against relative rotation may be varied. For example, the explosive charges 2 and the spacers 4 need not be provided with lateral seats 13, 14 engaged by ties 12 and the angular fixing could be achieved by providing a pair or more of projections engaged in respective retaining seats instead of the single centring projection 15. Thus the projections would fulfil the double function of centring and angular fixing and hence the three ties 12 of stranded metal could be eliminated and a single pair of straps could be provided for the sole purpose of clamping the pack of explosive charges 2 and their spacers 4 together. Moreover, the spacers 4 need not constituted by bodies separate from the explosive charge 2 but could be formed integrally with their explosive charges 2.

Finally, the actuator device 9 need not be completely housed within the support base 6 but could extend partially outside the support base 6 itself.

Claims

1. A projectile (1) of the type having a plurality of explosive charges (2) separable from each other and actuator means (9) for causing the separation of the explosive charges (2), characterised in that the explosive charges are stacked together and define a substantially cylindrical body (5) which rests on a support base (6), the actuator means (9) being housed at least partially within the support base (6), the projectile (1) including anchoring means (8) for anchoring the explosive charges (2) controllable by the actuator means (9), the anchoring means (8) partially surrounding the explosive charges (2) so as to attach them to the support base (6).

2. A projectile according to Claim 1, characterised in that the anchoring means (8) include at least one pair of ties (12) at least one of which is attached to the actuator means (9).

3. A projectile according to Claim 2, characterised in that the anchoring means (8) include at least one seat (13) formed in an outer periphery of each of the explosive charges (2) and engaged by a portion of a corresponding tie (12) to prevent relative rotation of the explosive charges (2) with respect to one another and with respect to the support base (6).

4. A projectile according to Claim 3, characterised in that the actuator means (9) include a piston (30) arranged to be displaced between a retracted position in which it is axially fixed in a respective seat (28) formed in the support base (6) and an extended position in which it is outside the support base (6) itself and to which is connected one end of one of the ties (12).

5. A projectile according to Claim 4, characterised in that the actuator means (9) are actuated by control means (10) including a pyric charge housed in a respective chamber (29) communicating with the seat (28) for the piston (30), and a pyric time delay (35) arranged to be triggered by a launch gas for the projectile (1) and arranged to trigger the pyric charge after a predetermined period of time from the instant at which the projectile (1) is launched.

6. A projectile according to any one of the preceding Claims, characterised in that it includes stabiliser means (37) fixed to the support base (6), the stabiliser means (37) including at least three fins (38) fixed to the support base (6) and arranged to take up a first operative position in which they contact the support base (6) and a second operative position in which they are fixed angularly with respect to the support base (6), resilient means (44) being interposed between the fins (38) and the support base (6) for moving the fins (38) from the first to the second operative position.

7. A projectile according to any one of the preceding Claims, characterised in that a spacer (4) is disposed between one explosive charge (2) and the adjacent one.

8. A projectile according to Claim 7, characterised in that the spacer (4) is provided with first centring means (15) for cooperating with respective second centring means (15′) carried by a respective explosive charge (2) and by the support base (6), the spacers (4) also having a seat (14) aligned ax-

ially with a respective said seat (13) formed in the explosive charges (2) and engaged by the ties (12).

9. A projectile according to Claim 8, characterised in that it includes resiliently compressed elastic means (16) for exerting a force facilitating the separation of the explosive charges (2) from each other.

10. A projectile according to any one of the preceding Claims, characterised in that it includes an aerodynamic deflector element (18) on the opposite side of the support base (6) from the explosive charges (2).

11. A projectile according to Claim 10, characterised in that the ties (12) are anchored at an intermediate point to the aerodynamic deflector element (18).

12. A projectile according to Claim 11, characterised in that the anchoring means (8) include three ties (12), two of which are constituted by a single cable (17).

13. A projectile according to Claim 11, characterised in that it incudes a device (19) for regulating the tension in the ties (12), the regulating device (19) being interposed between the ties (12) and the aerodynamic deflector element (18).

14. A projectile according to any one of the preceding Claims, characterised in that the explosive charges (2) are mines.

15. A projectile according to any one of the preceding Claims, characterised in that the support base (6) has a seat (45) engaged by a sealing washer (46), the sealing washer (46) being arranged to confine the launch gas in use.

16. A projectile according to Claim 7, characterised in that the spacers (4) are integral with respective said explosive charges (2).

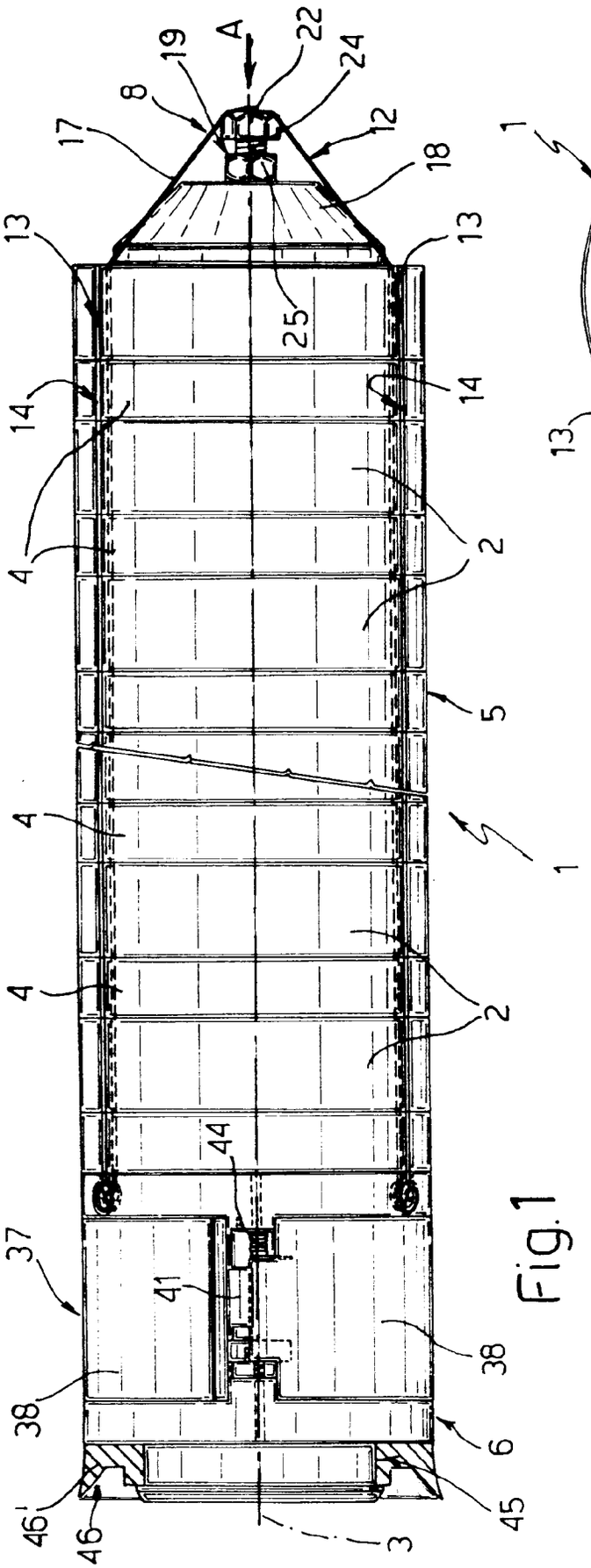
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Fig.1

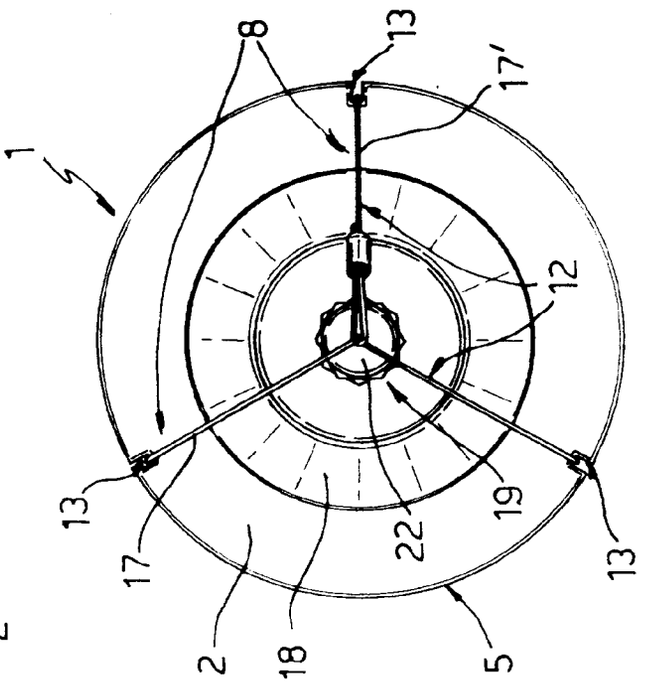
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Fig.2

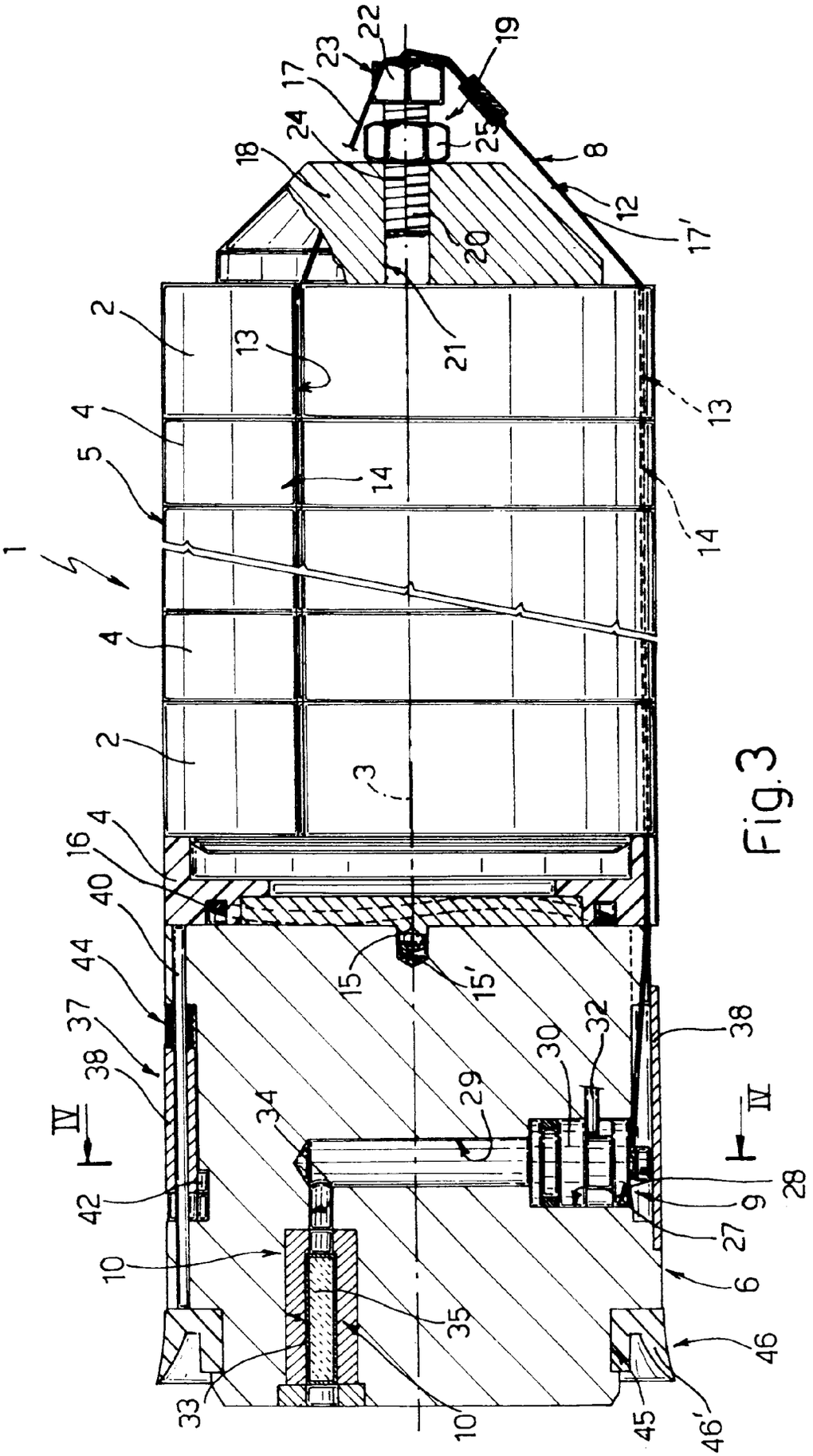
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Fig.3

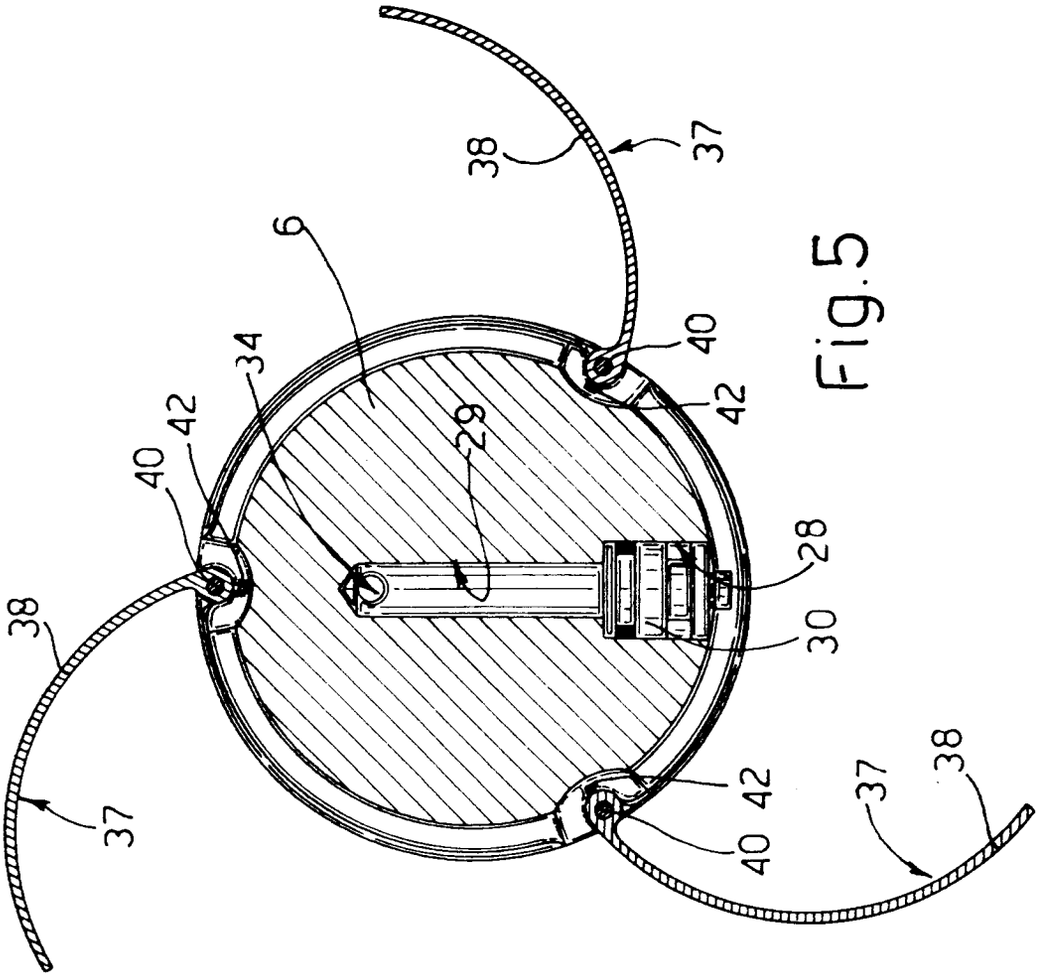
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Fig.5

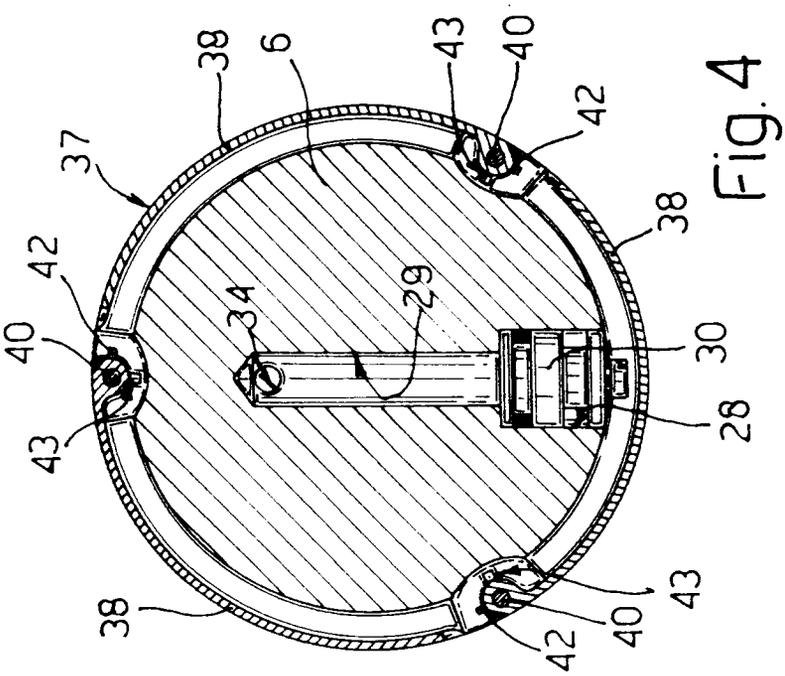
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Fig.4

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EUROPEAN SEARCH REPORT

Application Number EP 92110995.5

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)
A	DE - A - 3 542 051 (DIEHL GMBH & CO) * Totality * --	1-3, 10,11	F 42 B 12/62
A	FR - A - 2 144 917 (SOCIETE D'ETUDES, DE REALISATIONS ET D'APRLI-CATIONS TECHNIQUES) * Page 1, line 23 - page 2, line 5; page 2, line 5 - page 3, line 14; fig. 5-7 * --	4,6, 10,14	
A	US - A - 4 119 037 (ROMER et al.) * Totality * ----	6,7, 10,14	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 42 B 12/00
F 42 B 30/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	27-10-1992	KALANDRA

CATEGORY OF CITED DOCUMENTS

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