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(54) Ballistic projectile-arrester having a regeneration and recovery system for the projectile braking material.

(57) A ballistic projectile arrester, suitable for fires with small arms as well as with arms of other kinds, particularly in indoors firing grounds or shooting-galleries, comprising a projectile impact structure consisting of a granular material in the form of a heap (5) and a regeneration and/or recovery system for said granular material, with the respective separation of the projectiles, characterized in that said regeneration and/or recovery system for said granular material comprises vibrating means (8;27) as well as conveyor means so as to cause said material to move and to be conveyed, and means (11; 12) for recovering the material; delivery mechanical means (13) which convey said granular material together with the fired projectiles toward separation means (15) in which said projectiles are collected; and feeding conduit means (20) for conveying the granular material back to the feeding chamber (18); and in that air pre-riltering means (19) are provided downstream said conveyor (44) for intercepting granules still suspended in the air stream, as well as first conduit means (20) making filtered air and powder fines to flow toward filtering means (21) for causing said powders to settle; second conduit means (23) departing from said filtering means (21), such second conduit means (23) conveying the air stream under the heap of granular material; and in that said vibrating means (8;27) and conveyor means are arranged according to the angle of slide of the material mass.

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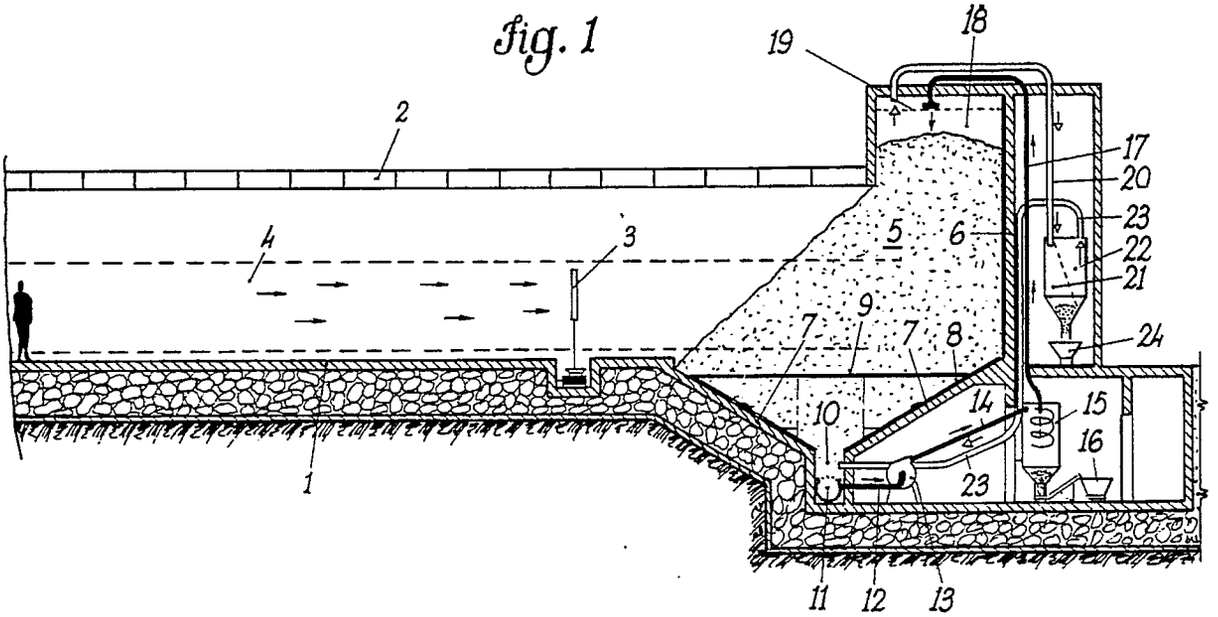
Fig. 1



BALLISTIC PROJECTILE-ARRESTER, HAVING A REGENERATION AND/OR RECOVERY SYSTEM FOR THE IMPACT MATERIAL, SUITED TO FIRES WITH SMALL ARMS OR OTHERS, IN PARTICULAR IN INDOORS FIRING GROUNDS.

The present invention relates to a ballistic projectile-arrester having a regeneration and/or recovery system for the impact material, said projectile-arrester being suitable for firing with small arms or with arms of other kinds, in particular in indoors firing grounds or shooting-galleries. More particularly, the present invention relates to a ballistic projectile-arrester for small arms that are capable of shooting high kinetic energy projectiles, said projectile-arrester comprising, as a slowing down structure, a granular material system which is preferably fireproof and allows a soft impact with the projectile and the dissipation of said kinetic energy in a fully safe way, as well as a system that allows the granular material to be recovered and the fired projectiles to be eliminated.

As it is well known, a large number of the most various structures have been adopted up to the present time as ballistic projectile-arresters, which structures are effected by serious practical drawbacks and pollution problems.

For instance, the less sophisticated structures realized up to now, consisting in projectile-arresters made up of walls or stacks of wood, or of piles of pneumatic tires, heaps of sand, embankments, and so on, show the drawbacks of the requirements of a costly and careful maintenance, and of a poor reliability from the safety viewpoint.

Some types of projectile-arresters already known at the present time, consist essentially of a metal impact surfaces which convey. with no possibility of return of the projectiles thanks to their suitable geometric shapes, the projectiles and the respective freg ments towards a deceleration or kinetic energy dissipation chamber, where they are finally collected. With such a kind of arrangement, the projectile impact onto the metal causes a large production of fragments, dusts and lead vapors.

It is well evident that the most serious or dangerous drawback of the projectile-arresters of the metal type that remains unsolved is the drawback of the formation of dusts and of lead vapors generated during the strong impact, which is partially inelastic, between the high kinetic energy projectile and the sloping metallic plate onto which the projectile shatters.

Moreover, though the projectile-arresters of the metallic type do not present the unsolvable problem of the rebound, they present, at least at a certain distance, some features of lack of safety for the personnel.

A further serious drawback is the problem of disposal of said lead vapors, as their direct dispersal into the environments would surely give incalculable damages. On the other hand, the disposal of said noxious vapors through a filtering or an analogous system cannot be proposed because of the very high investment and plant costs, as for instance the need for skilled personnel in the use of the necessary specialized equipment.

A further type of projectile-arrester employed at the present time is that of the non metallic type (i.e., that employing wooden crosspieces, pneumatic tires, sand, etc.), which types present a series of drawbacks that caused the same to be abandoned. Indeed, such projectile-arresters are poorly reliable for the personnel and in addition they become easily saturated with lead and fragments or debris; moreover, they are inconvenient in their maintenance because of the frequent and costly interventions as well as of the periodic substitution of the whole impact structure, be such structure made up of crosspieces, pneumatic tires, rubber slabs etc., or of any other material in traditional use.

More particularly, sand embankments give rise, in addition to lead saturation, also to a persisting dust cloud consisting or siliceous dusts that obscure the end part of the shooting-gallery.

Earth banks are suitable for outdoor firing grounds only, which because of various reasons, are progressively giving way to the indoor grounds.

It is therefore well evident that there is a need for a ballistic projectile-arrester according to the present invention which can obviate, as a result of its structural and functional characteristics, the drawback of dusts and lead vapors formation as well as the drawback of their disposal, as no equipment is to be provided for filtering the smokes or the dust clouds. Moreover, the maintenance problems are simultaneously avoided by means of the employment of the self-regenerating impact system with the projectiles fired.

In the U.S. patent No. 2,411,026 it is described a "Firing range butt" particularly suitable to butts firing ranges used in testing airplanes. The structure described provides two conveyors, respectively horizontal and vertical with respect to the sand, that provides to carry the sand and projectiles toward a screen, where projectiles are separated, and to carry the sand on the top of the heap.

Conner et al. solution cannot provide or reduction of the amount of impact material because the "sand chamber" 48 is completely filled with our immense quantity of sand.

Thus, the above solution, in order to obtain a

good projectile absorption, without becoming saturated, requires a large space.

Main object of the present invention is that of providing a ballistic-projectile arrester solving drawbacks set before and realizing a regeneration system that allow to obtain a better separation of granular material from projectiles, by means of supporting and conveyor means that are so designed to allow a better and more regular conveying of the mixture of granular material and projectiles. These advantages are obtained providing said supporting and conveyor means arranged according to the angle of slide of the material, so that, during the conveying, lower internal frictions among the single particles and between the particles arc the projectiles are obtained.

With the solution proposed according to the present invention, a ballistic projectile arrester is obtained that allows to have a projectile absorption structure taking up as little space as possible and, at the same time, capable of absorbing a large quantity of projectiles without becoming saturated, maintaining the impact material circulating at a constant rate.

A further object of the present invention is that of supplying a regeneration system which is advantageously realized with a closed air cycle so that the need is avoided of restoring air and of providing interchanges and contacts with the air of the firing ground itself.

It is therefore a specific object of the present invention a ballistic projectile-arrester suitable for fires with small as well as with other types of arms, particularly in the case of indoors firing grounds or shooting-galleries, comprising a projectile impact structure consisting of a granular material in the form of a heap and, a regeneration and/or recovery system for said granular material, with the respective separation of the projectiles, said regeneration and/or recovery system comprising vibrating means as well as conveyor means so as to cause said material to move and to be conveyed, and means for recovering the material, delivery mechanical means which convey said granular material together with the fired projectiles towards separating means in which said projectiles are collected, and feeding conduit means for conveying the granular material back to the feeding chamber characterized in that air pre-filtering means are provided downstream said conveyor conduit means for intercepting granules still suspended in the air stream, as well as first conduit means making filtered air and powder fines to flow towards filtering means for causing said powders to settle, second conduit means departing from said filtering means, such second conduit means conveying the air stream under the heap of granular material.

Said granular material regeneration system can also be associated to other similar units, according to the particular structural needs of the firing ground in which the ballistic projectile-arrester is provided according to this invention, said units being in a suitable number as regards the length of the granular material heap in the transverse direction.

More particularly, according to the present invention, said vibrating and conveyor means are formed by sloping walls located under the heap of the material, some electrovibrating means suitably spaced apart from one another being provided on said walls.

In another embodiment of the present invention, said vibrating and conveyor means are made up of a steel plate provided below the heap of the granular material, at a slope about the same as that of the exposed edge of said heap, some vibrating means being provided under said plate which cause the material to move towards a passage provided below the same.

The present invention will be disclosed in the following according to some specific embodiments of the same with particular reference to the enclosed drawings, wherein:

Figure 1 shows a longitudinal vertical cross-section of a first embodiment of the projectile-arrester according to the present invention;

Figure 2 shows the functional schematic arrangement of the regeneration system units of the projectile-arrester according to Figure 1 ; and

Figure 3 shows a second embodiment of the projectile-arrester according to the present invention.

In Figure 1 the floor 1 and the covering ceiling 2 can be observed both being realized with high strenght reinforced concrete and lined with anti-wear steel, which make-up, together with the slide walls, the shooting-gallery.

The target for the firing practice is pointed out by 3, whereas the zone 4 enclosed within dotted lines points out the zone where the 90% of the projectiles trajectories is reasonably likely to occur.

The heap 5 of the slowing down material is kept on its rear side by a ballistic steel plate 6 , whereas it is collected and supported on the bottom side by the sloping walls 7 which are lined with steel plates. On the rear wall 7 the electrical vibrating means 8 are applied.

A safety grate 9 made up of ballistic steel is provided at a position above said walls 7.

A passage 10 is shown at the bottom of the channel formed by said walls 7., which passage runs in the transverse direction with respect to the shooting-gallery (see also Figure 2), the take-up openings 11 being arranged along said passage; four such openings are provided in Figure 2, which

are connected, through a pipe 12, to a delivery pump 13.

A pipe 14 departs from said pump 13 , said pipe serving the purpose of conveying the granular material mixed with the projectiles into the separator 15 that collects such projectiles which, in their turn, are next taken out by means of a carriage 16.

The conduit 17 departs from the separating unit 15 , such conduit conveying the granular material into the feeding chamber 18 . A pre-filter 19 intercepts the granules possibly present as suspended matter because of the turbulence, allowing the dusts only to pass that are carried by the conveying fluid.

Conduit 20 takes the conveying fluid and the fines to a filter 21, said dusts being settled onto the bottom of the same. The filtered air passes from chamber 22 to the pipe 23 through which it reaches the passage 10. The air is taken up again, saturated with granules, at that point through the suitable openings and then put again in the circulation.

It is evident from the schematic arrangement shown above that the whole ballistic projectile-arrester, with its materials and the conveying fluid for the granules, does not interact with the environment within the firing ground, and it does not give rise to polluting wastes into the environment within said firing ground.

Number 24 points out the collection carriage for the powders of the granular material.

Figure 3 illustrates finally a further vibrating system which provides a steel plate 25, in an almost parallel position with respect to the exposed surface 26 of the heap 5 , the vibrating means 27 being provided below said plate for conveying the granular material towards the passage 28.

The projectile, once fired, reaches the target 3 in about 1/10 sec., then it reaches the surface 7 of the deceleration mass consisting of the granular material in which it loses its kinetic energy by friction with the granules, so as to be decelerated till it stops at a distance from the exposed surface 7 that excludes the possibility of any rebound.

On the ground of tests carried out by the Applicant said safety is warranted also in case a volley is fired at the projectile-arrester, with any type of fire-arm officially approved for firing grounds, even from a distance of 2-3 m.

Such feature is assured by the fact that the heap of the stopping material, as soon as the projectile passes through it, closes by effect of gravity before the other projectiles arrive, even in case of volleys.

When the firing tests are started, all the regeneration system components are activated and are kept operating by means of the mere operation of a push-button (not shown).

The results of some firing tests carried out by the Applicant are reported for illustrative purposes:

TEST I

Material to be tested: 20 foam rubber in the form of bags of heavy polyethylene
Arm: lightweight automatic rifle "F.A.L.", 7.62 gauge NATO, with SMI 9.30 g projectile
Firing distance: 40 m
Direction of the projectiles: at right angles to the material to be tested
Position of the shooter: on the ground in yard
Results: the first 5-6 projectiles were stopped after going through a thickness of about 1.30-1.50 m of the material with no appreciable deformation.

TEST II

Such test was performed with the same material, the same arm, the same direction of the projectiles and the same position of the shooter, from a distance of 15 m.

Results: the results obtained were similar to those obtained in TEST I, the only difference being an average penetration higher of about 10-20 cm.

TEST III

This test was performed with the same material, the same arm, the same direction of the projectiles as well as the same position of the shooter as in the preceding tests, but the firing distance was 10 m and two tracer projectiles were also employed.

Results: no measurable higher penetration occurred, and no appreciable consequences were observed as a result of the retention of the two tracer projectiles within the material.

The present invention has been disclosed according to some specific embodiments of the same, but it is to be understood that modifications and changes can be introduced into the same by those skilled in the art without departing from the scope of the invention.

Claims

1. A ballistic projectile arrester, suitable for fires with small arms as well as with arms of other kinds, particularly in indoors firing grounds or shooting-galleries, comprising a projectile impact structure consisting of a granular material in the form of a heap (5) and a regeneration and/or recovery sys-

tem for said granular material, with the respective separation of the projectiles, characterized in that said regeneration and/or recovery system for said granular material comprises vibrating means(8;27)- as well as conveyor means so as to cause said material to move and to be conveyed, and means (11, 12) for recovering the material; delivery mechanical means (13) which convey said granular material together with the fired projectiles toward separation means (15) in which said projectiles are collected; and feeding conduit means (20) for conveying the granular material back to the feeding chamber (18); and in that air pre-filtering means (19) are provided downstream said conveyor (17) for intercepting granules still suspended in the air stream, as well as first conduit means (20) making filtered air and powder fines to flow toward filtering means (21) for causing said powders to settle; second conduit means (23) departing from said filtering means (21) such second conduit means (23) conveying the air stream under the heap of granular material; and in that said vibrating means (8;27) and conveyor means are arranged according to the angle of slide of the material mass.

2 . A ballistic projectile arrester according to claim 1 characterized in that said vibrating and conveyor means are made up of sloping walls (7) below the material heap, some electrical vibrating means (8) being provided on said walls (7).

12. A ballistic projectile-arrester according to claim 10 characterized in that said vibrating and conveyor means consist of ballistic steel plates (52) arranged inside said heap of material and sloping at almost right angles with respect to the line of slope of the exposed surface of the heap of granular material, such means consisting also of vibrating units (53).

3. A ballistic projectile-arrester according to claim 1 characterized in that said vibrating and conveyor means consist of a steel plate (25), provided in the lower part of the heap of granular material, and at a slope about the same as that of the exposed edge of said heap, some vibrating means (27) being provided below said plate (25) so as to cause the motion of the material towards a passage (28) provided in the lower part.

4. A ballistic projectile-arrester according to any of claims 1 - 3, characterized in that said regeneration system for said granular material is provided in the form of a plurality of such units arranged side by side.

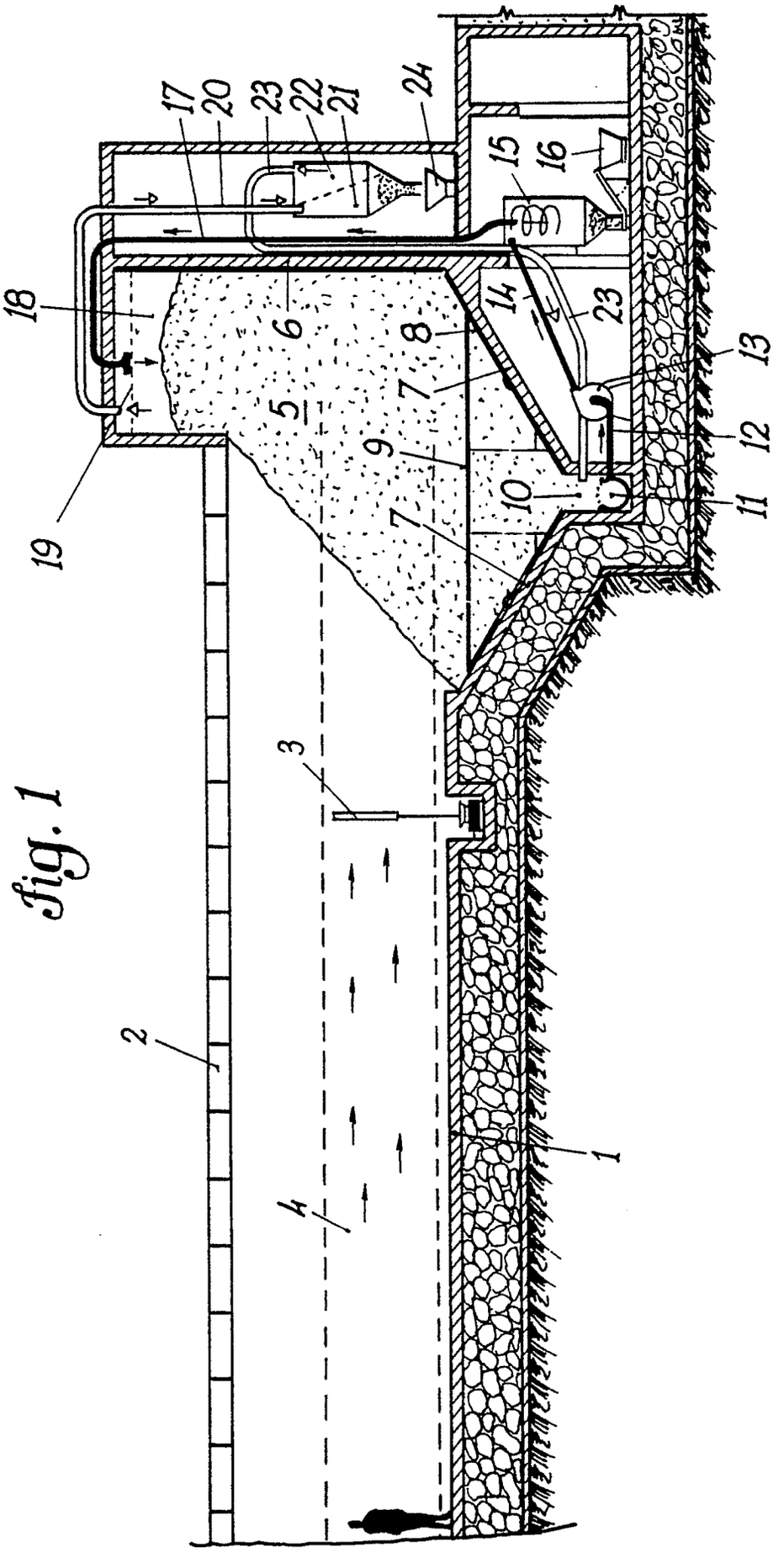


fig. 1

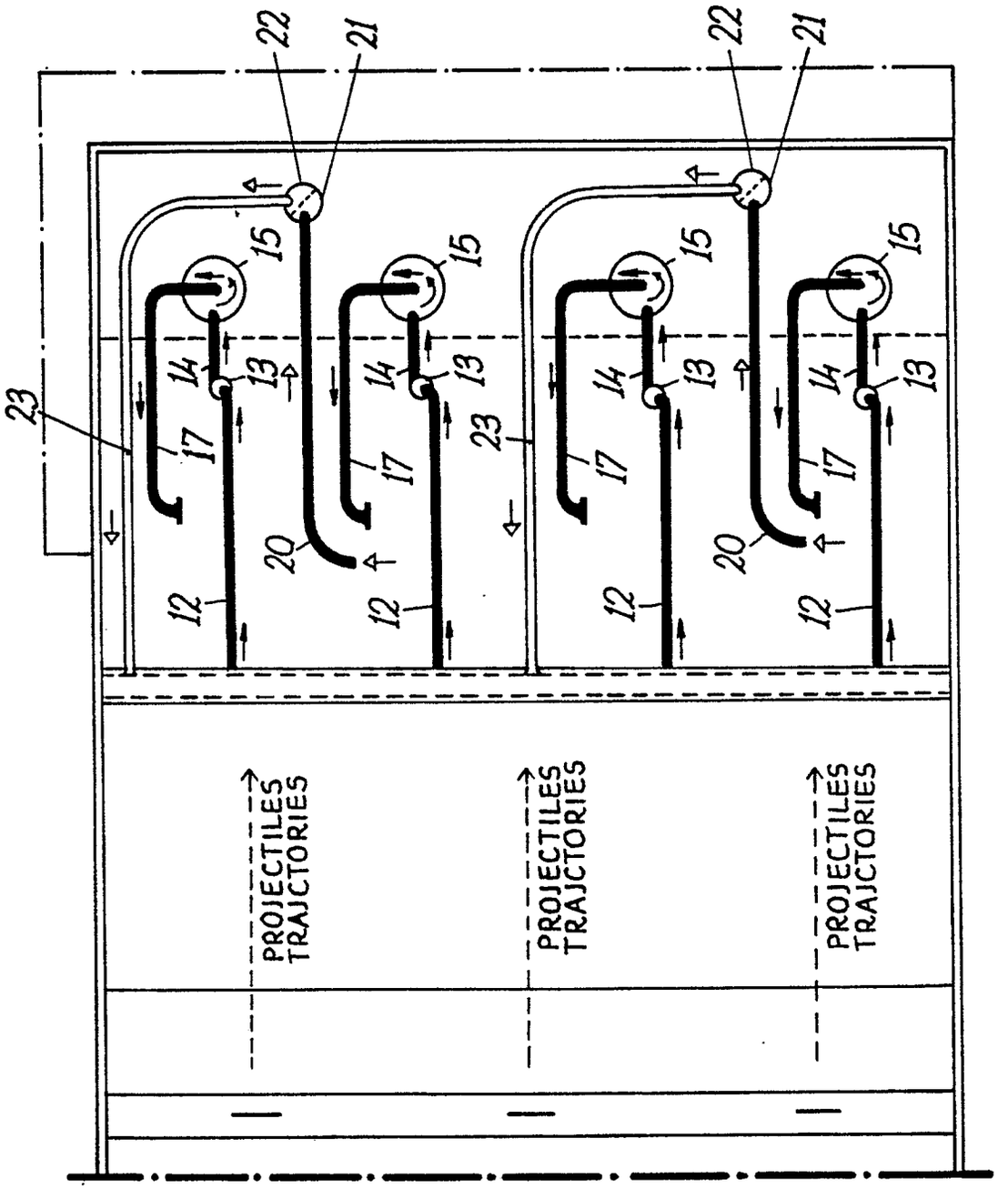

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fig. 2

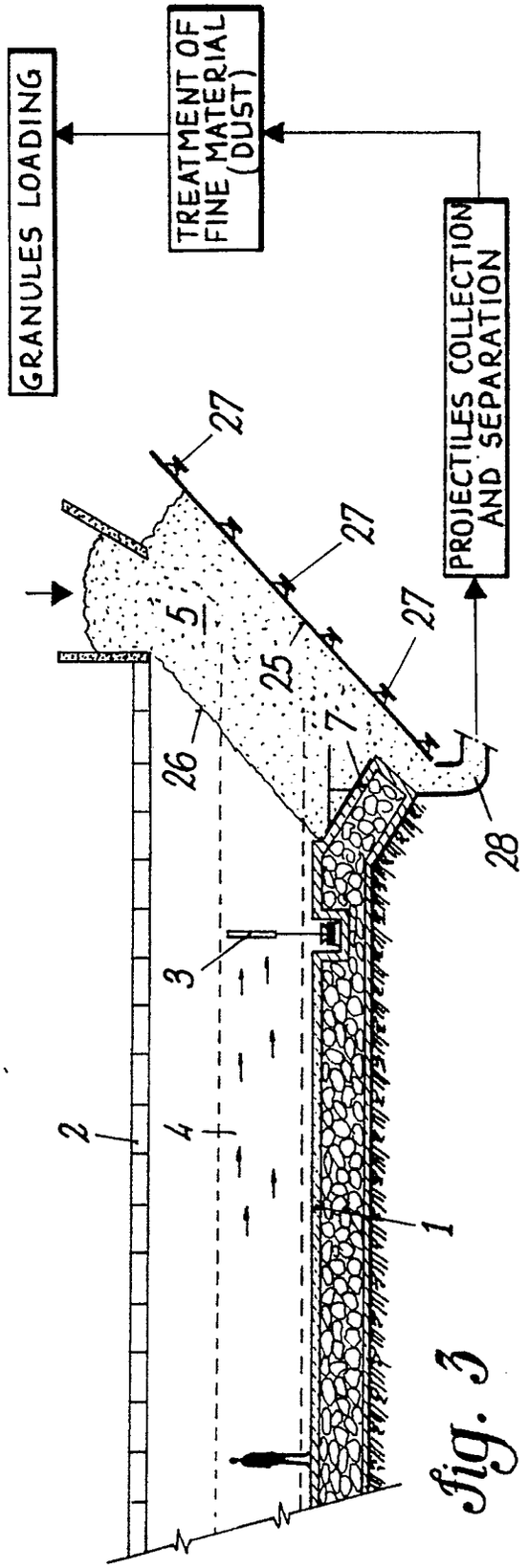
GRANULES LOADING
TREATMENT OF FINE MATERIAL (DUST)
PROJECTILES COLLECTION AND SEPARATION
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Fig. 3