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(54) Knock down blast cleaning machine.

(57) A blast cleaning machine in which abrasive grit is projected at high velocity against a surface to be cleaned and which can be broken down in to sub-assemblies enabling a machine to be passed through narrow openings, for example into an oil tank and reassmebled for use more readily than conventional machines of a fully-welded or fully bolted construction. The projection and reclaim channels are removably mounted on a machine base in the form of a cradle adapted to support the channels in a desired relative angular position.

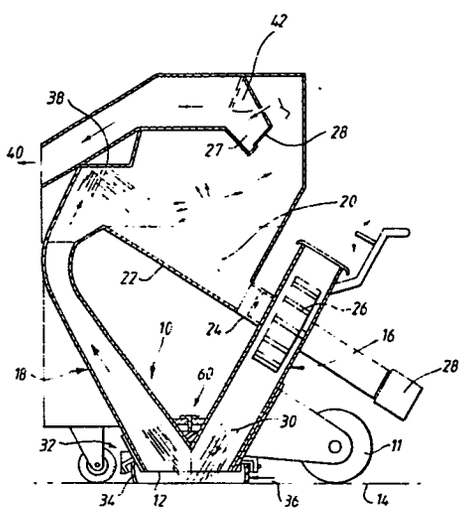

Fig 1.

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This invention relates to a surface cleaning machine of the kind in which abrasive grit is projected at high velocity against a surface to be cleaned. Thus the surface is subjected to an abrasive blast which is produced, for example, by a vaned blast wheel rotating at high speed, to fling or project abrasive grit with great force onto the surface so as to blast clean from it all dirt. Various machines of this kind referred to are known, see for example British Patent specifications Nos. 1,496,268; 1,542,495; 1,575,577 and 1,575,478.

The machines described in the above mentioned patent specifications all have an enclosure with an opening therein, sealing means disposed around so as to contact the surface to be cleaned and so as to substantially retain abrasive grit and remvoed dirt within the enclosure, a projecting device for projecting abrasive grit and removed dirt at high velocity along an incident path defined by a projection channel leading to the opening, onto a zone of the surface to be cleaned and from the surface zone along a rebound path defined by reclaim channel. The incident path and the rebound path and hence also the projection channel and the reclaim channel, are both inclined at an

acture angle relative to the surface. Rebounding grit and dirt travel along the reclaim channel, and this may be aided by mechanical means such as brushes or baffles, or by establishing an air flow through the reclaim channel, to a point in the machine whereat the dirt is separated from the grit and the grit returned to a hopper or the like from whence it is recycled to the projecting device.

The abrasive grit is usually fine steel shot. Dirt to be cleaned from the surface may be of various kinds, for example, dust, oil, paint, rust or other contaminants or coverings and mixtures of them: these will be referred to herein for brevity as "dirt".

From the foregoing it will be appreciated that machines of the kind referred to are useful for cleaning a wide variety of surfaces such as floors, the decks of ships or offshore platforms and oil storage tanks. In the latter case not only has it proved useful to use machines of the kind referred to for cleaning (e.g.) rust and paint from the exterior of the tank, but it is from time to time necessary also to clean inside the tank.

Surface cleaning machines, however, are generally of a fully welded construction such that it is not possible to insert sufficiently large machines through the standard

24" or 30" manholes provided in oil storage tanks. In the past contractors have even resorted to cutting a hole in the tank in order to gain access for the machine. Some machines of a bolted construction have been built but it has provided inconvenient and very time consuming (approximately, two man-days) to break down the machines and reassemble them within the tank.

According to the present invention we propose a surface cleaning machine of the kind referred to and comprising an enclosure with an opening therein, sealing means arranged so as to substantially retain abrasive grit and removed dirt within the enclosure, a projecting device for projecting abrasive grit at high velocity along an incident path, defined by a projection channel leading to the opening, onto a zone of the surface to be cleaned, and from the surface along a rebound path defined by a reclaim channel, through which spent grit is returned to a hopper for recycling to the projecting device CHARACTERISED IN THAT the projection channel and the reclaim channel are removably mounted on a machine base adapted to support the said channels, in a desired relative angular position.

The sealing means may comprise resilient seals or sealing plates arranged around the opening and biased into

contact with the surface or when the abrasive is metallic, e.g. shot, may comprise magnetic means operable to establish a magnetic field tending to prevent grit escaping from the blast zone.

In a preferred embodiment, the machine base is in the form of a cradle adapted to receive and support the projection channel and the reclaim channel in the desired relative angular position. The machine base or cradle may define the said opening, and end edges of the projection and reclaim channels may abut one another at the transition of the incident and rebound paths.

In a preferred embodiment, however, the lower ends of the projection and reclaim channels abut one another to define the said opening and are carried in a tapered seat defined by inclined supports on the channel. A seal is preferably provided to cover the abutting edges of the two channels at the transition between the incident and rebound paths, and may be urged into the external crevice between the reclaim and projection channels, by a clamp or the like which bridges the base between the two channels.

By virtue of the present invention, a surface cleaning machine can readily be broken down into sub-assemblies of a size suitable for handling and insertion into oil tanks or the like. Further, it enables machines to be manufactured more cheaply since the sub-assemblies, the projection and reclaim channels in particular, can be of a fully welded construction with consequent savings in manufacturing costs as compared with the conventional bolted construction which would otherwise be required in cases where it is required to disassemble the machine.

Another advantage of the present invention is that a subassembly which has become worn or damaged can be removed for repair and replaced by another subassembly so considerably reducing the time a machine need be out of service.

The resilient seal around the periphery of the blast zone is preferably carried by the cradle, not, as in conventional machines, mounted directly on the enclosure. Consequently, the projection and reclaim channe ls may constitute or form part of separate sub-assemblies which can be removed and replaced

without disturbing the integrity of the seal.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings of which

Figure 1 is a cross section of a surface cleaning machine;

Figures 2 and 3 are side and plan views respectively of the machine in Figure 1 but in a partly disassembled form;

Figure 4 is a cross-section on AA in Figure 3;

Figure 5 is a cross-section on BB in Figure 3; and

Figure 6 is a cross-section on CC in Figure 5.

Referring to Figure 1, the surface cleaning machine shown therein is adapted for cleaning a substantially flat horizontal surface and has an enclosure 10 in which is an opening 12 confronting the surface 14 and which includes a projection channel 16 and a reclaim channel 18 respectively leading to and from the opening 12. Abrasive grit 20 stored in a hopper 22 is fed at a rate controlled by means 24, to a centrifugal blast wheel 26 mounted within the projection channel. The blast wheel 26 is driven by a motor 28 to deliver a stream 30 of abrasive particles at high velocity along an incident path defined by the projection channel 12, inclined at an acute angle relative to the surface. Abrasive grit strikes the surface 14 and rebounds along a rebound path, also at an acute angle relative to the surface, defined by the reclaim channel 18.

Both the projection channel 16 and reclaim channel 18 are seated in and supported by a cradle 32 which is provided with resilient sealing means 34 around the periphery of the opening 12. The sealing means 34 contacts the surface 14 and serves to prevent the escape of spent particles from the enclosure.

A stream of air 36 is, however, drawn into the enclosure through the sealing means so that air flows over the blast zone and upwardly through the reclaim channel 18, which gradually diminishes in cross-section in the direction of the air flow. Thus, the air-flow is accelerated during flow along the reclaim channel 18, so at least partly compensating for the loss in kinetic energy of the rebounding grit. The energy of the rebounding grit together with the force exerted thereon by the accelerating air flow is sufficient to carry the spent grit through the reclaim channel 18 until at a point in the enclosure 10 above the hopper 22, the stream impinges upon a baffle 38. On impact, dirt carried by the grit is separated therefrom, and flows together with dirt already entrained in the air flow to an exhaust outlet 40. The air can then be passed through a dust collector (not shown) to remove foreign material picked up from the surface being treated. The grit rebounds from the baffle 38 into the hopper 22 and from there can be recycled to the blast wheel 26.

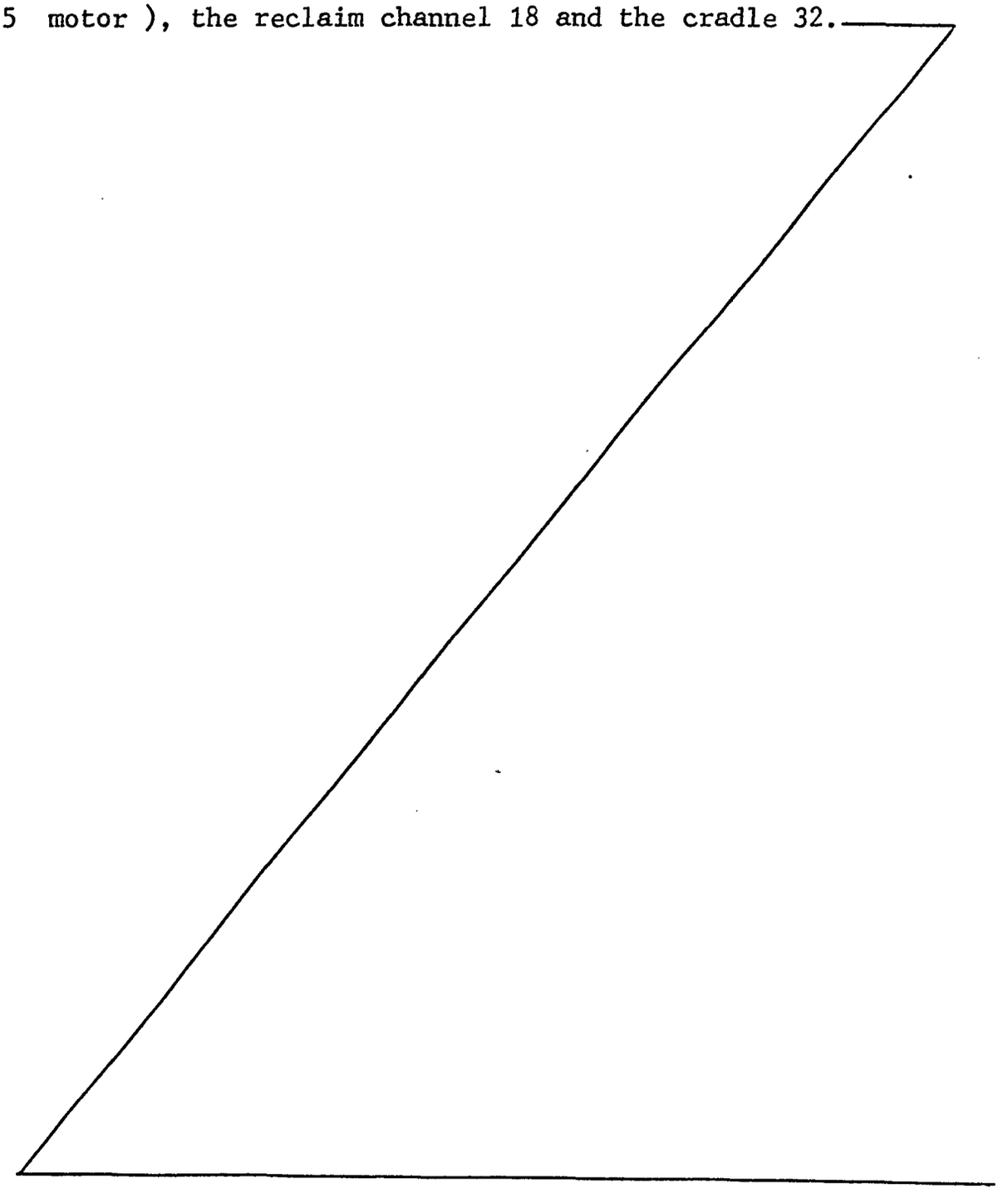
A secondary reclaim stage may be required since, as the air proceeds towards the exhaust outlet 40, it carries with it a small quantity of spent grit. In the machine shown in Figure 1, the exhaust flow is decelerated in passing through an expanded area 42. The entrained grit then falls under gravity into a trough 27 having an adjustable gate 28. Grit accumulates in the trough 27 and eventually trickles through the gate 28 and falls back into the storage hopper.

The surface cleaning machine described above operates in an entirely conventional manner but unlike conventional machines can be disassembled into sub-assemblies for ease of repair or replacement of worn or damaged parts and to facilitate introduction of the machine into otherwise inaccessible locations.

Figures 2 to 4 show the machine of Figure 1 with the upper part of the enclosure 10, the hopper, the wheels 11, blast wheel 26, drive motor 28, and other moving parts removed to leave a generally V-shaped structure which can readily be broken down into three sub-assemblies, namely the reclaim channel 18, the projection channel 16 and the cradle 32.

When it is required to pass the machine through a narrow opening, the wheels, blast wheel and motor etc. need

not be removed although this may be done if necessary. For most practical purposes, the machine can be broken down into four sub-assmblies, namely, the hopper, the projection channel 16 (including the blast wheel and motor), the reclaim channel 18 and the cradle 32.



The cradle 32 has a rectangular frame built of side seal housings 50 interconnected by front and rear end plates 52 and 54. Within the frame, at the front end thereof, is mounted a support plate 56 and, at the rear end thereof, a support plate 58, the two plates 56 and 58 being convergent to provide a downwardly tapering seat for the reclaim and projection hannelss. When seated in the cradle 32, the projection and reclaim channels 16, 18 are supported by the plates 56 and 58 at the desired relative inclination with the lower ends of channels 16 and 18, in abutment so as to define the opening 12 as shown in Figure 4.

To secure the channels 16 and 18 to the cradle a clamping bar 60 is provided. This bridges the two side seal housings, to which it is secured by bolts, and bears upon and may be bolted to abutments 63 and 65 welded respectively to the two channels 16 and 18, so as to urge the channels into the downwardly tapering seat in the cradle. The clamping bar 60 is formed by welding together two right-angle sections to form a T-section and the vertical limb of the T-sections extends downwardly between the abutments 63 and 65 into contact with a sealing member 62 formed of polyurethane or other suitable sealing material, which is pressed into the crevice between the two channels 16 and 18.

A further seal is provided between the cradle 32 and the two channels 16 and 18 along each side thereof. This seal is, in each case, formed by resilient sealing strip 64 which is compressed between a flange 66 welded to the channel (16 or 18) and the top of the associated side seal housing 50. The sealing member 62 and the sealing strip 64 serve to seal against the egress of grit and dirt and also the escape of air from within the enclosure.

The construction of the sealing arrangement surrounding the opening is not shown nor will it be described in detail. Certain details are however shown in Figure 5 and 6. The side seal housings 50 contain spring-loaded sealing plates 70 which are urged downwardly into contact with the surface. In addition a resilient skirt (not shown) depends from the exterior of each of the side seal housings for contact with the surface. Extending between the side seal housings at the front of the cradle 32 are two sealing strips 72 and 74 of flexible material and at the rear of the cradle is a row of brushes 76 through which the stream of air 46 is drawn into the blast zone.

CLAIMS:

1. A surface cleaning machine of the kind in which abrasive grit is projected at high velocity against a surface to be cleaned and comprising an enclosure with an opening therein, sealing means disposed around the opening so as to contact the surface to be cleaned and so as to substantially retain abrasive grit and removed dirt within the enclosure, a projecting device for projecting abrasive grit at high velocity along an incident path, defined by a projection channel leading to the opening, onto a zone of the surface to be cleaned, and from the surface along a rebound path defined by a reclaim channel, through which spent grit is returned to a hopper for recycling to the projecting device, CHARACTERISED IN THAT the projection channel and the reclaim channel are removably mounted on a machine base adapted to support the said channels in a desired relative angular position.

2. A machine according to claim 1 wherein the machine base is in the form of a cradle adapted to receive and support the projection and reclaim channels in the desired relative angular position.

3. A machine according to claim 1 or claim 2, wherein the

lower ends of the projection and reclaim channels abut one another to define the said opening and are received in a tapered seat defined by inclined supports on the cradle.

4. A machine according to any one of claims 1 to 3 and comprising a sealing member covering the abutting edges of the two channels at the transition between the incident and rebound paths.

5. A machine according to claim 4 wherein the sealing member is urged into the external crevice between the reclaim and projection channels, by a clamp or the like which bridges the base between the two channels.

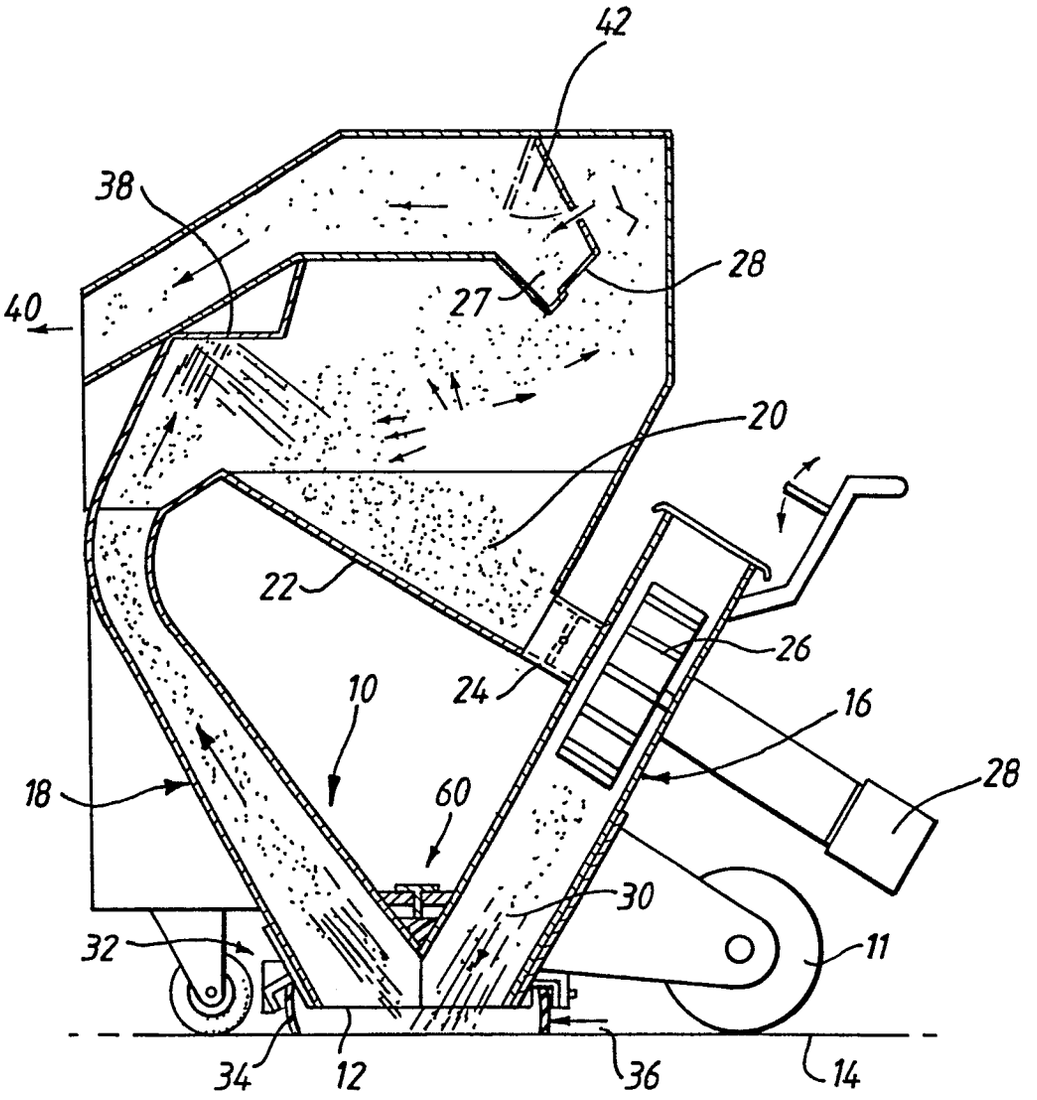


Fig.1.

Fig.2.

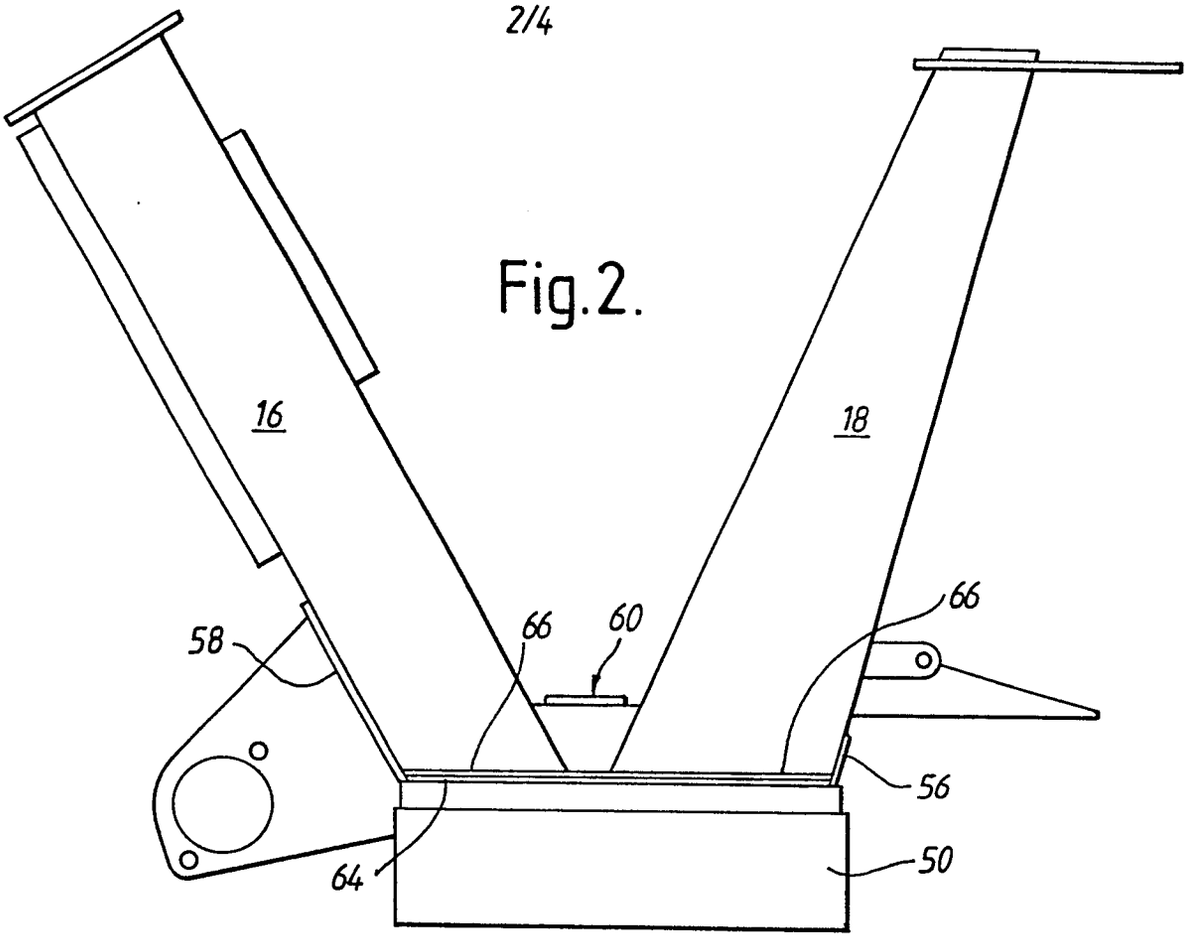
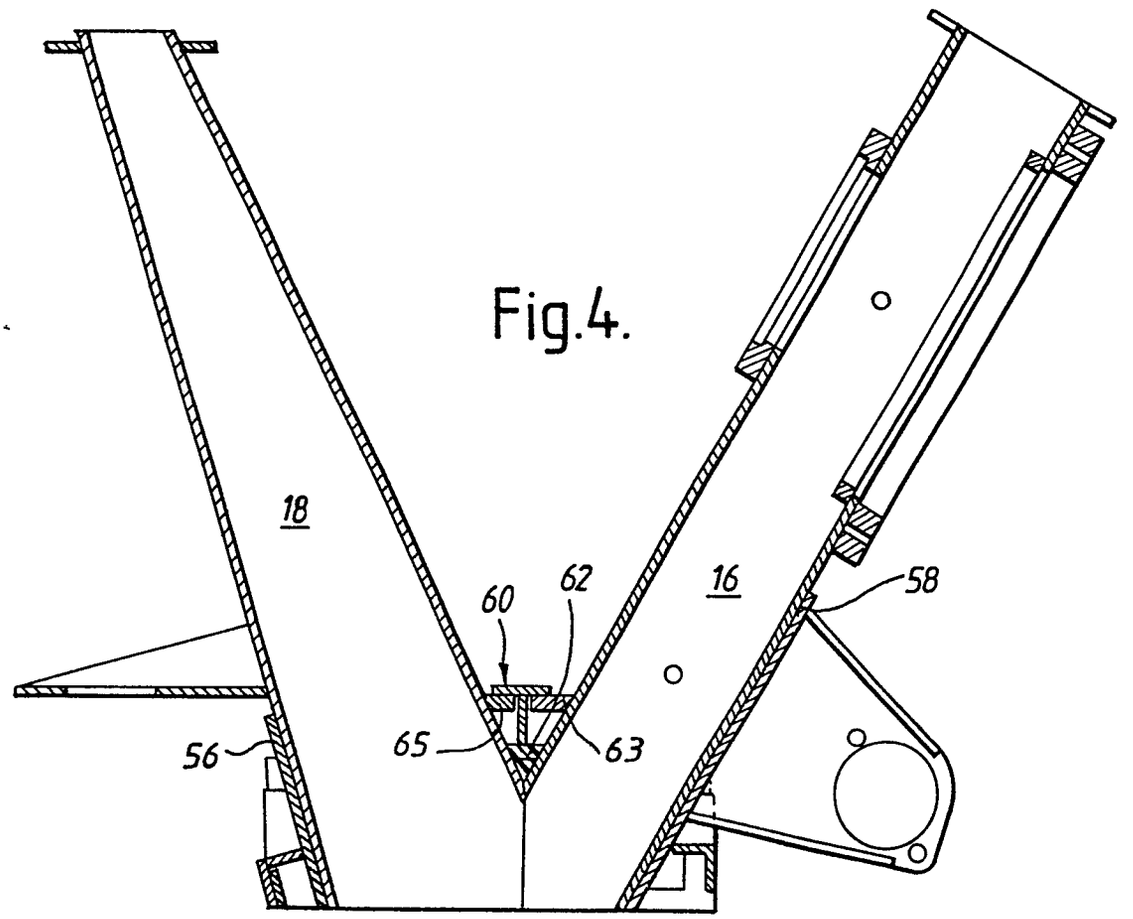


Fig.4.



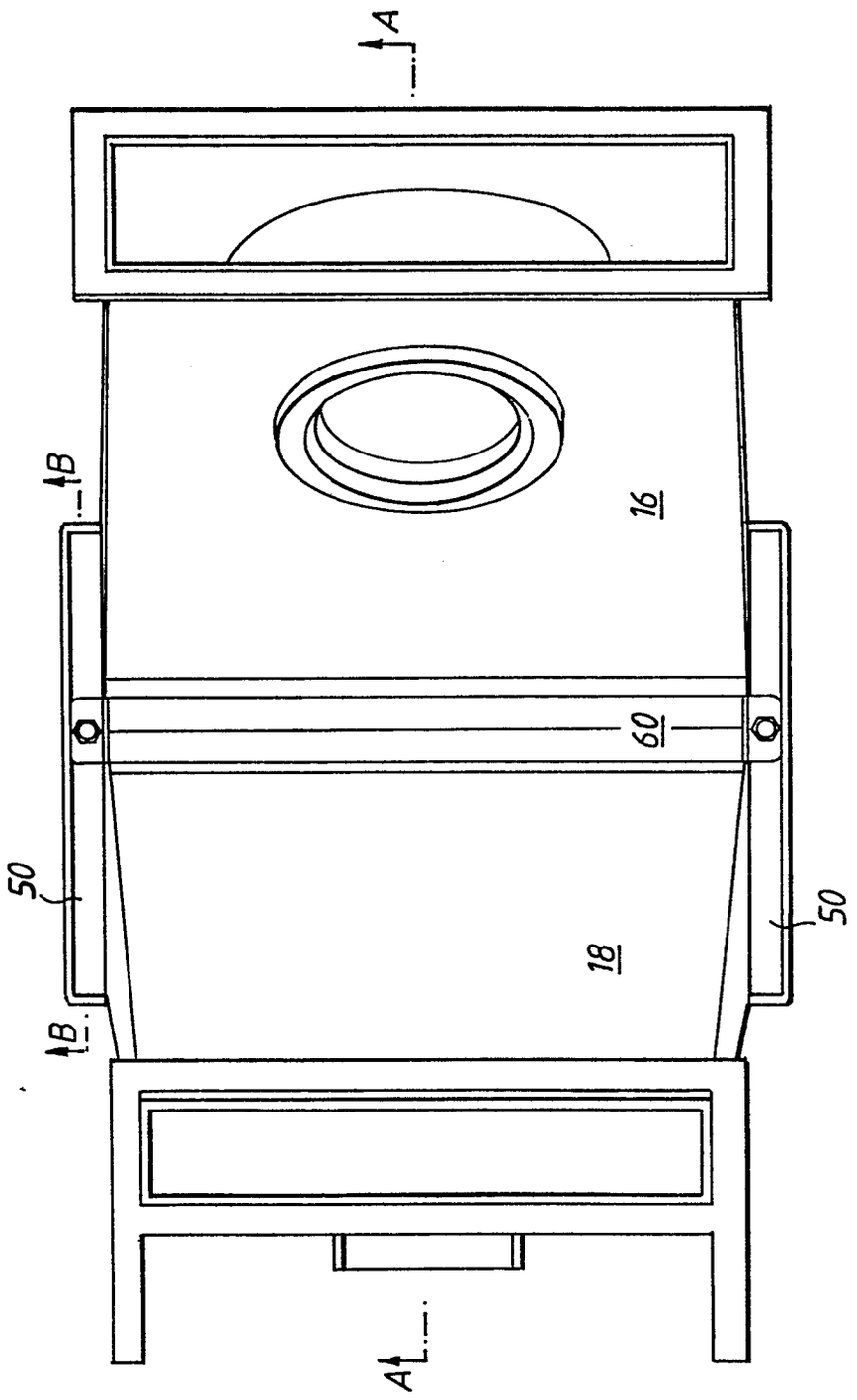


Fig.3.

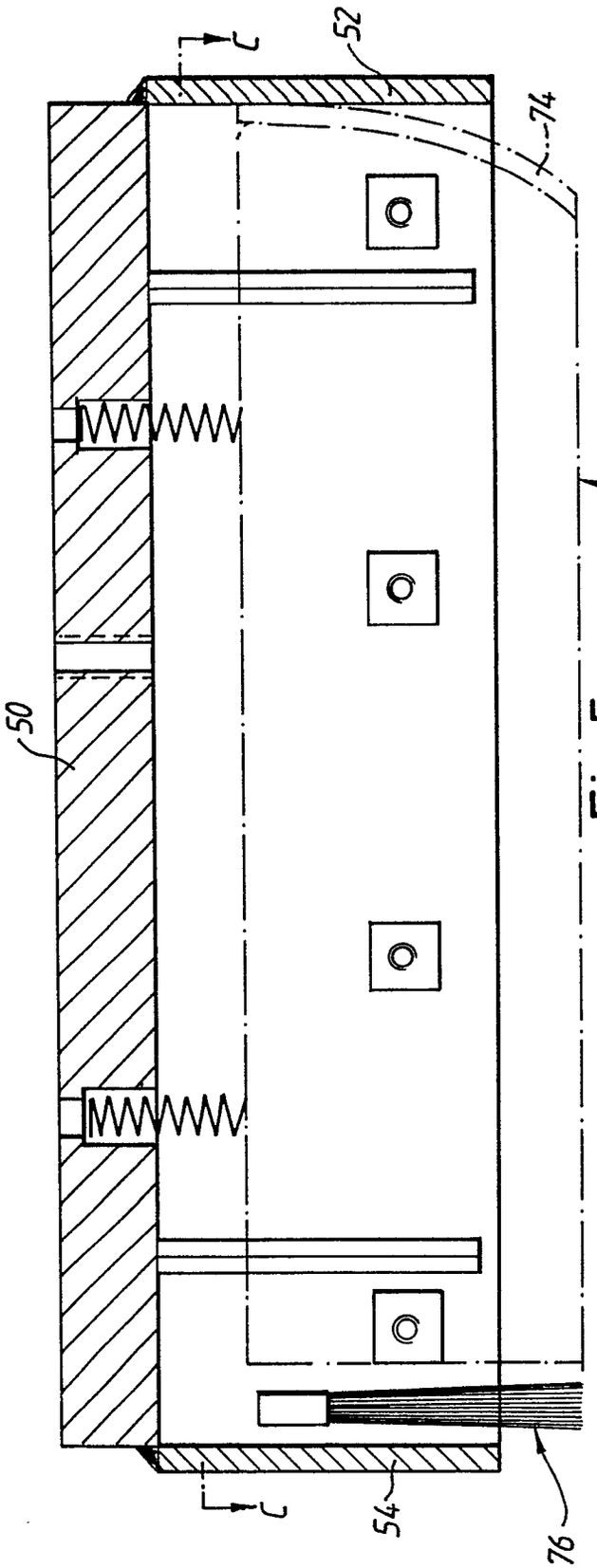


Fig.5.

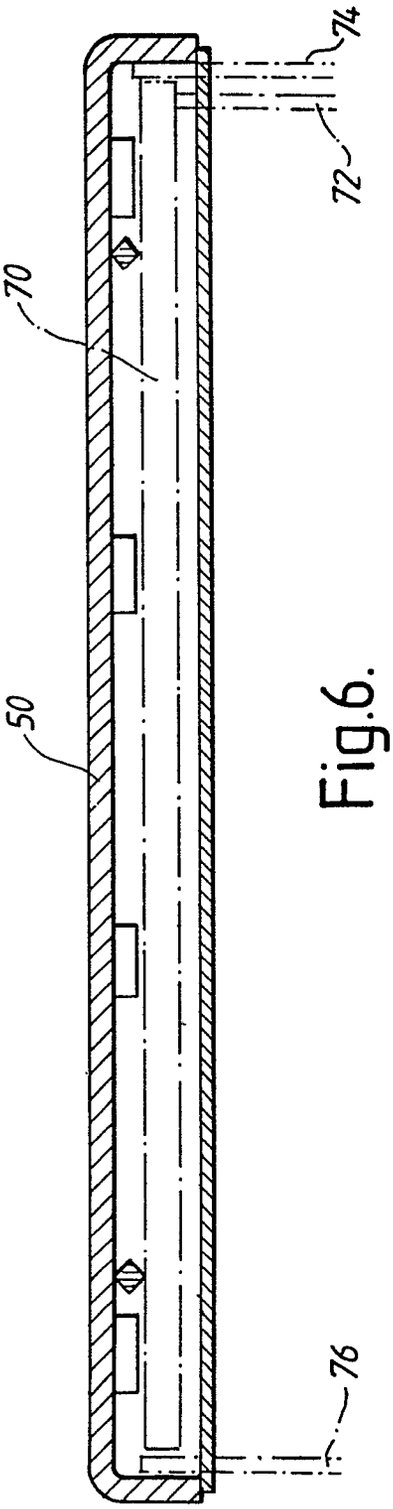


Fig.6.