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(54) IMPROVEMENTS IN OR RELATING TO PLANSIFTERS

(71) We, GEBRUEDER BUEHLER AG, a Swiss Body Corporate, of CH 9240 Uzwil, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:–

The invention relates to plansifters, more particularly to plansifters mounted or intended to be mounted for free oscillation and having two neighbouring sieve stacks.

The plansifter is one of the few machines which for nearly a hundred years has withstood all attempts made hitherto by inventive ingenuity to replace it, and, still based on the same basic technique, remains unsurpassed for the same uses in mills, namely producing and grading individual products of grinding operations such for examples as baking-flour and semolina.

The plansifter in its entirety is given a horizontal circulating movement which not only allows the actual sifting work to be carried out but also conveys the product from sieve to sieve and to predetermined channels and outlets. The mounting and drive of the plansifter can be constructed in such a way tht it operates as a freely oscillating apparatus or as a positive drive plansifter constrained in its movements.

One of the disadvantages of positive drive, more particularly in large plansifters, however, is the provision of guides required for the positive drive, i.e. the entire mechanism which is necessary including a crank drive with attendant lubrication and maintenance problems. In the case of positive drive sifters more oscillation forces are transmitted towards the outside then by a freely oscillating plansifter. Plansifters should be designed constructionally so that they do not suffer damage when operational disturbances occur, even if they remain in operation partly or completely filled with products.

If the market situation at the moment is considered, it will be noted that there has been a certain standardisation of plansifters. The large plansifter which is constructed in almost all cases as a freely oscillating sifter is numerically clearly the dominant machine. The second most frequently used is presumably the small plansifter constructed as a positive drive sifter and having only a single open stack of sieves.

The medium-size sifter with usually two sieve compartments or stacks, which would naturally be assumed to be in the majority, is to be found relatively infrequently. Reasons which are given for this include high price, inadequate economic advantages, and constructional defects, but hitherto a really basic reason could not be pinned down.

It is a fact recognised in the technical world that the running-up and running-down of a freely oscillating plansifter without an outside drive shaft do not take place without resonance. With the approximation formula $w_2 = g/\ell$ (wherein ℓ is the length of pendulum suspension) the angular velocity or resonance range can be estimated, and practical values are obtained for example in the range of 10 to 30 r.p.m. for the rotational speed of an eccentrically mounted weight. The operational speed of the eccentric weight in most cases is far above these values, so that the freely oscillating plansifter has to pass through the critical resonance range when running-up and running-down.

In large plansifters the resonance problems are greatly reduced since they have a large number of inlets and outlets or corresponding connection points to non-moving parts of a structure or building, which has an inhibiting effect on any excessive outward throw of the plansifter.

Circumstances are rather different with a single-stack sifter. All influencing factors regarding resonance problems are more disadvantageous than for large plansifters. In addition the mass of material being sifted for example in control sifting may amount to a much larger proportion of the total weight of the plansifter. The mechanical problems are also increased by fluctuating weights and centre of gravity positions. In a single-stack sifter a compromise has to be accepted between (among the other things) the constructional design and easy replacement of sieves on the one hand and the arrangement of the eccentric weight on the other hand. It is generally found by engineers that in connection with natural forces such as those caused by resonance, compromise is very dangerous and often leads to serious damage. A way out of this dilemma in practice has been to use the positive drive sifter for small or single-stack sifters, the appropriate construction allowing the dangerous resonance ranges to be avoided or cut out in all working conditions. However, with a single-stack sifter the number of sieves situated one above the other has to be limited to 6 to 9 at the most, since otherwise wobble or run out forces prejudice operational safety and reliability. The number of possible separations in a single-stack sifter is usually between 2 and 6, and stacks of sieves with a smaller overall surface are used.

Positive operational experience for many decades now has shown the correctness of the ideas described for large and small plansifters. But since the freely oscillating apparatus is not suitable for small sifters and conversely positive drive has been found not very suitable for large plansifters, the engineer hitherto has had the difficult task of deciding which design is best for the medium size, more particularly the category of the two-stack sifter.

It is with these problems that the invention is concerned. The object is to provide an improved plansifter and one which at least in its preferred form allows the two-stack sifter to be constructed in a constructionally simple manner and to operate satisfactorily and safely coupled with a long working life. There has been no lack of attempts to solve this difficulty in the past. But hitherto the solutions proposed have always fallen down on basic points. Thus for example in the case of a two-stack positive drive sifter it is not possible to use more sieved or a larger screening surface than with two-single-stack sifters. The large plansifter reduced to a two-stack sifter is no longer acceptable on cost grounds because of the necessary frame and housing construction. Two stacks of sieves situated one above the other result for example in cumbersome handling of the sifter during operation.

The invention provides a free-oscillating plansifter comprising a housing, two neighbouring sieve stacks each comprising not less than 6 and not more than 18 individual sieves, an oscillating generator having a drive motor and a weight which is eccentric with respect to a vertical axis of rotation, the oscillation generator being mounted between the sieve stacks to oscillate with the housing, the disposition and arrangement of the parts being such that the effective plane of action of the centrifugal forces arising upon rotation of the eccentric weight intersects a vertical axis of the plansifter at about the region of the centre of gravity of the plansifter, and the drive motor is constructed and arranged in such a way that the oscillation generator can be run up substantially to its normal operating speed within 5 seconds and decelerated from this speed substantially to rest within 10 seconds. Preferably the sieve stacks comprise not more than 15 and preferably not more than 12 individual sieves. Preferably the construction and arrangement of the drive motor is such as to permit run up within about 1 to 2 seconds and run down within 2 to 5 seconds. Preferably it is such as to permit both to be performed within 4 seconds.

In a preferred constructional form the plansifter housing is constructed symmetrically and in the region of the sieve stacks as an upwardly open trough (Carrier, tray or frame) into which the sieve stacks can be placed. This allows easy handling of the plansifter for example when changing sieves or inspecting. The centre of gravity lies lower down, and it is found that the plansifter has a particularly quiet behaviour in all operating states likely to occur in actual practice.

In order to allow for all kinds of sifting tasks, larger sieves than hitherto may be used or, instead of large sieves, the appropriate larger number of small sieves in each stack.

The plansifter housing may comprise a continuous trough floor or bottom on which the drive motor for the eccentric weight is preferably secured. Functionally, constructionally and also as regards the manipulation of the sifter, there are great advantages when using the following features.

- The lateral walls of the trough surround only the lower half of the highest possible stack of sieves.

- The eccentric weight and the drive motor are enclosed by the plansifter housing, the roof and bottom giving a drive casing about 2/3 the maximum height of the sieve stack. This means that if the smallest practical number of sieves is used, the stack and the drive casing are about the same height.

- The lateral walls of the trough are constructed with vertical stack rails which extend over a height of 1/3 - 1/2 of the full stack height, and arranged at the outer four corners of the plansifter. The trough shape is made sufficiently full to allow access to the stacks at the end of the trough.

The plansifter can be suspended, as has been usual hitherto for large plansifters, as a freely oscillating body. This may be effected by suspension from elastic bars, preferably four groups of bars which in each case are attached to the plansifter housing tn the region of the lateral stack centre. The groups of bars can be secured, depending on given space conditions or the height of the upper fastening of the elastic bars, either in the region of the trough bottom or for example in the region of the stack central plane viewed over the vertical.

A first prototype constructed appropriately was generally regarded as interesting but the structure wobbling on four supports was considered to have only a short working life. It was thought that momentary overloading intensified by lack of equilibrium in the material being sieved, which might occur naturally with two stacks arranged side by side, must result in fracture of the supports after a short time more particularly in the running-up phase. The plansifter, was constructed entirely without a constrained guide arrangement, safety cables and the like. Surprisingly, after nearly a year of continuous testing simulating practical work, and with overload, the supports still held and the structure continued intact.

It is not yet possible to determine with certainty which are the essentials of this optional feature of the invention which results in this surprising success. It is regarded as important that each support is composed of a plurality of individual bars. But it is supposed that one of the important contributions to the so far continuous success resides in the overall combination on the one hand and also the use of plastics material bars, preferably plastics material bars reinforced with glass fibre, or glass fibre bars, on the other hand. A plurality of plastics material bars are preferably combined to form a support and the entire plansifter is mounted on preferably four elastic supports as a freely oscillating body.

The best solution so far has been found if the upper fixing point of the supports is situated approximately in the horizontal centre of gravity plane, and in the centre of the side of the stack.

It was possible to meet all doubts regarding plastics material on the score of possible long-term behaviour, more particularly flow properties, by securing the plastics material bars above and below with clamps, and constructing the clamps without pointed portions, with a shape of the clamping surfaces the same as the round shape of the plastics material bars. Preferably the plastics material bars are constructed as round solid bars.

Two constructional embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a front elevation of a plansifter with two stacks of sieves mounted as a freely oscillating body on four supports;

Figure 2 shows the plansifter of Figure 1 in side view;

Figure 3 is a diagrammatic plan view corresponding to Figure 1;

Figure 4 shows the trough-shaped construction of the plansifter housing;

Figure 5 shows a fixing detail of the elastic supports;

Figures 6, 7 and 8 show three ways of mounting the plansifter for thee oscillation, with supporting props in Figure 6 as in Figure 1, or suspended from roof beams in Figure 7 or from a frame structure in Figure 8; and

Figures 9 to 11 show in greater detail the plansifter of Figures 7 and 8 with its suspension mountings.

The plansifter 1 in Figures 1 to 3 includes a left-hand stack of sieves 2 with individual sieves 4 numbered 1 to 10, and also a right-hand sieve stack 3 with sieves 4 numbered from 1 to 8. Both sieve stacks comprise an upper end element 5 with inlet union 6 these being connected by flexible sleeves 7 with appropriate product feed conduits 8. The individual products fractionated according to size issue from the lower end of the sieve stacks by way of outlets 9 which are also connected by flexible sleeves 10 to stationary outlet conduits 11.

The left-hand sieve stack 2 has for example two inlet unions 6 operating for the ten sieves 4, secured to the two sleeves 7 which are illustrated and the product feed conduits 8. The right-hand sieve stack on the other hand is supplied only with one product feed conduit 8. As a result there are different load conditions between the left-hand stack 2 and the right-hand stack 3.

The illustrated plansifter housing 12 does not actually represent a housing in the conventional sense - it is rather simply a half housing which is shaped as a trough 13 open topped in the region of the sieve stack (Figure 4). This makes it possible for the two stacks of sieves 2 and 3 to be fitted and removed as complete stacks into and from the trough 13 in the direction of the arrows 14. The sieves may also be changed individually by hand in the same direction as hitherto.

Reference will now be made to Figure 4 where there is shown in a simplified manner and in perspective the plansifter housing 12 constructed as a trough. The plansifter housing 12 comprises over the two longitudinal sides in each case a side wall 15 and a continuous trough bottom 16. The two troughs formed for receiving the stacks of sieves are connected in the middle by a drive casing 17 which is formed above with the roof 18 and below with the bottom 16 to form a housing and thus gives the trough shape the necessary stability for oscillation. At the outer four corners there is also arranged in each case a stack holding rail 19, this being secured by a fixing screw 19′. The stack holding rail is used for guiding so that the sieves, more particularly the lowest sieve, can be placed precisely at the correct location on the trough bottom 16, but at the same time the rail serves as a safety means in case the operators forget before starting the machine to tighten the clamping apparatus for the sieves. The plansifter housing 12 is mounted on four upright supports 20 which are held by means of an upper fixing element 21 directly on the side walls 15 of the housing 12 and also by lower fixing elements 22 placed directly on the floor.

Figures 1 to Figure 4 and also Figure 5 show details of the bearing arrangement. The upper fixing element 21 is secured by a large round flange 23 by means of four screws 24 to the side wall 15 in the region of the vertical central plane of a stack side. This arrangement allows the upper fixing element to be attached directly to the plansifter housing 12, or the thin-walled side wall 15.

Fatigue phenomena in the support material coming from the bearing arrangement have not been found to occur if the following construction is used. The upper fixing system is shown in Figure 5 on a larger scale illustrating the construction with plastics material bars 25. Each four plastics material bars 25 are brought together and fixed as a bar group 26 by a fixing element 21 above and 22 below respectively. Thus far it has been found advantageous to connect the fixing point rigidly to the plansifter housing 12, or the floor. For extreme cases such as for example for relatively large travel circles it may be advantageous to make the fixing point yieldable or give it elements which additionally are elastic. The fixing element 21 is a three-part clamp, a clamping plate 27, a central part 28 and a counter-plate 29 which are all adapted to be clamped together by a screw 30. All the clamping parts have round recesses 31 shaped in accordance with the shape of the plastics material bars 25, that is to say the radius of the recesses 31 is the same as the radius of the plastics material bars. Experience thus far has shown, after many unsuccessful experiments, that in fact the fixing of the plastics material bars has to be given as much care as the dimensions, the quality and the internal structure of the plastics material bars themselves. The plastics material bar comprises internally a very high percentage of glass fibres which extend in the longitudinal direction of the plastics material bar and are embedded in special synthetic resin.

The plastics material bar has in general an elastic behaviour similar to steel. Contrary to the idea which might be obvious, of arranging pointed elements on the internal surface of the clamps such as is the case with hitherto known bamboo or other similar tubular bars and which penetrate into the material, with these plastics material bars only the non-pointed clamping system has been found satisfactory, i.e. the internal clamping surfaces are to conform to the shape of the bars and are to be substantially smooth. Hitherto this arrangement has not shown any flow problems or harmful shrinkage or expansion problems.

The lower fixing element 22 is constructed similarly to the element 21 since substantially the same forces occur. Here again there is a three-part clamp with a central supporting part and two outer elements, and it is fixed to the floor by means of a foot 34 with sufficient stability. The four feet need not be connected to one another as has hitherto been the case with the corresponding single-stack or two-stack sifter constructed as a positive drive sifter. It has been found that with the constructional form described only a fraction of the oscillation forces are transmitted through the floor to the environment or to the building as compared with comparable positive drive sifters.

As Figure 1 shows, the sieve stacks 2 and 3 project above the plansifter housing. The exact number of sieves is not basically limited by the fundamental idea but more because of the constructional arrangement, *viz.* to stacks each comprising not less than 6 and not more than 18 sieves.

An economical number with regard to all influencing factors is about 10-15 sieves placed one above the other, and the surface of the individual sieves can be substantially larger as compared with conventional positive drive sifters. The number of sieves in the stack may differ depending on specific sifting tasks which have to be carried out. After inserting the desired number of sieves the stacks are clamped by clamping rods 35 securely on to the trough in a downward direction. Clamping screws 36 and a lock screw 37 are tightened securely. For changing the sieves the clamping bars 35 can be swung slightly to the side. The height of the drive casing 17 amounts to about 2/3 of the height of the largest sieve stack. This advantageous feature, for one thing allows the overall centre of gravity of the sifter to be kept low down, this being less than 1/3 of the maximum sieve stack height for the plansifter housing without a stack.

For the like reason, the drive motor 40 is fixed to the continuous trough bottom 16 in the drive casing. Drive is transmitted from the motor 40 to the eccentric weight 41 by way of direct belt pulleys 42 with belt drive below the continuous trough bottom 16. The drive motor could also be secured from below on the trough bottom. The drive motor with full voltage starting (usually Δ connection) in this way comes immediately to its nominal rotational speed. So far this feature has been found advantageous for passing through the dangerous resonance range sufficiently quickly.

It is desirable that the drive motor and the transmission should be brought with the given masses in about 1-2 sec to full rotational speed (in any case within 5 seconds), and in at the most rather more than twice that time should run through the region of the critical speed or be braked within at most 10 seconds by means of for example a stop motor.

The eccentric weight 41 is mounted in bearings 43 and 44 on the roof and bottom of the drive casing. The eccentric weight consists of an iron body 45 in which lead can be cast or screwed, into compartmented hollows, in order to determine precisely the eccentric weight mass, and also its distribution within the body 45 and hence the precise position of the plane of action of the centrifugal forces arising upon rotation of the eccentric weight. In this way the position of the plane of action can be varied in a very simple manner within a range equivalent to 1/4 - almost 1/2 of the height of the sieve stack. The entire constructional arrangement gives sufficient scope to allow of positioning the plane of action of the centrifugal forces for all cases likely to occur in practice, so that it is positioned in a horizontal plane SE containing the centre of gravity of the plansifter. Since the entire design is so to speak "inherently" trouble-free, it is quite possible to tolerate small deviations of the position of the centre of gravity or of the corresponding plane of action of the centrifugal forces. This is in fact one of the basic requirements expected of the plansifter. Practical requirements are satisfied by the plansifter in that mills now have less supervision, more automation and generally have fewer product changes, that is to say it is worthwhile having very precise adaptation of the plane of action of the centrifugal forces, so that the plansifter is adjusted precisely in the empty state, i.e. with the largest number of sieves but without the product. Then in operation this sifter tolerates small deviations in the centre of gravity caused by the mass of product. For effecting changes when required, provision is made to displace the eccentric weight 41 axially by means of clamping rings 60 on the shaft 61.

Constructionally and also in operation the trough shape of the plansifter housing affords very many advantages. The lateral trough walls in the preferred constructional form extend only over about half the height of the sieve stack. Accessibility and visual control are improved in that the side walls are constructed to fall away outwards from the drive casing. The external stack holding rails 19 can easily project somewhat above the side walls. This does not prejudice to any considerable extent either visual control or ease of attending to the machine. On the other hand this measure makes it possible for the centre of gravity of the stack of sieves to be situated at the most only slightly above the safety rails 19 and the stack itself, if the tensioning arrangement has not been tightened or has been insufficiently tightened, is not thrown out of the plansifter when the latter is started up.

The plansifter can alternatively be suspended by elastic bars 70 as shown in Figures 9, 10 and 11.

In the suspended constructional form the optimum solution for most purposes is to arrange the lower fixing means of the suspension on the continuous trough bottom. But the fact that the trough shape almost has the characteristic of a bridge girder means that it is also possible to select the position of the fixing means in the vertical sense, as may be required to suit the available space, or the required free length of the suspension member.

Versatility is regarded as one of the chief and most surprising advantages. It has been possible for the first time to allow the choice of alternatives with regard to mounting by a suspended arrangement or with supporting props, or to offer the customer a free choice to take his particular constructional requirements into account. Without having to accept any disadvantage, but particularly whilst retaining many practical advantages, the same sifter can be mounted either, as Figures 1 - 6 show, on elastic supports or, as Figures 7 and 8 show, suspended on a freely oscillating body from a frame as in Figure 8 or on roof members as in Figure 7, as has been usual hitherto with large plansifters.

Without important price concessions the sifter can also be used where hitherto only large plansifters were appropriate. Thus more particularly the plansifter also makes it possible to set up plansifters in buildings constructed in so-called hanger fashion, for example in regions where there is a danger of earthquakes or in zones with regulations to this effect. With the suspended constructional form it is possible at will to use plastics material bars or the previously mentioned bamboo or other similar tubular bars. But the plastics material bars are suitable for both forms of mounting that is to say this construction makes it possible even in the case of plastics material bars to supply these as part of the kit, allowing the choice of the final fixing method, either supported from below or suspended, to be made on the spot in accordance with actual constructional requirements. As a freely oscillating body, such a small amount of oscillation forces are transmitted to the exterior that it has been possible for example in the test apparatus to hold it when operating directly on a thick board floor. In the case of support from below new and hitherto unknown phenomena have in fact been noted. For example with the same power consumption of the motor and the same oscillation masse, a more attractive and slightly larger oscillation pattern is obtained with the supported variant.

However it has not yet been possible to clarify all relevant facts, and possibly in addition to the cleaner design one of the reasons may be that with the supported variant the sifter is brought from a higher position of rest into a relatively low operating position. In the case of a suspended freely oscillating body the situation is exactly the reverse.

The plansifters described above in fact now make it possible to end the state of affairs which has been unsatisfactory for a long time. The solution which they provide makes it possible to construct the category of medium-size sifters with the constructional simplicity of small sifters but with all the operational advantages of large sifters. Special cases aside, the customer can for the first time buy, for twice the price of a single-stack sifter, almost three times the sifting surface with the two stack sifters. He can choose an economically more advantageous next-larger sifter besides the single-stack sifter which is still required for production purposes, and thus improve the economy of the entire mill installation.

Surprisingly it has been found that the plansifters not only obviate the disadvantages mentioned earlier but also make it possible to open up new and very advantageous methods of operating and constructional methods.

It has already been shown by experiment that it is possible with the above sifters to keep a single sieve stack in operation without causing any danger. The resulting slight deviation of the oscillation pattern from the ideal circular form has no influence on the sifting performance. There are no disadvantages on the mechanical side.

WHAT WE CLAIM IS:

1. Free-oscillating plansifter comprising a housing, two neighbouring sieve stacks each comprising not less than 6 and not more than 18 individual sieves, an oscillation generator having a drive motor and a weight which is eccentric with respect to a vertical axis of rotation, the oscillation generator being mounted between the sieve stacks to oscillate with the housing, the disposition and arrangement of the parts being such that the effective plane of action of the centrifugal forces arising upon rotation of the eccentric weight intersects a vertical axis of the plansifter at about the region of the centre of gravity of the plansifter, and the drive motor is constructed and arranged in such a way that the oscillation generator can be run up substantially to its normal operating speed within 5 seconds and decelerated from this speed substantially to rest within 10 seconds.

2. Plansifter according to Claim 1, wherein the sieve stacks each comprise not more than 15 individual sieves.

3. Plansifter according to Claim 1, wherein the sieve stacks each comprise not more than 12 individual sieves.

4. Plansifter according to any preceding Claim, wherein the drive motor is constructed and arranged in such a way that the oscillation generator can be run up as aforesaid within 4 seconds and run down as aforesaid within 4 seconds.

5. Plansifter according to any preceding Claim, wherein the drive motor is constructed and arranged in such a way that the oscillation generator can be run up as aforesaid within about 1 to 2 seconds and run down as aforesaid within about 2 to 5 seconds.

6. Plansifter according to any preceding Claim, wherein the housing is symmetrical about a vertical plane between the sieve stacks, and trough shaped, and open at the top in the region of the sieve tacks.

7. Plansifter according to Claim 6, wherein the housing has a continuous trough bottom to which the drive motor is fixed.

8. Plansifter according to Claim 6 or Claim 7, wherein the lateral walls of the trough extend about only the lower half or thereabouts of the sieve stacks.

9. Plansifter according to any of Claims 6 to 8, wherein the eccentric weight and the drive motor are enclosed by the housing, a roof portion and trough bottom portion forming a drive casing of about 2/3 the full height of the sieve stacks.

10. Plansifter according to any of Claims 6 to 9, wherein lateral walls of the trough carry vertical stack holding rails which extend over a height of about 1/3 - 1/2 of the full stack height at the outer four corners of the plansifter.

11. Plansifter according to Claim 10, wherein the stack holding rails are detachable from and re-attachable to the trough.

12. Plansifter according to any preceding Claim wherein the plansifter is suspended by elastic bars for free oscillation.

13. Plansifter according to Claim 12, wherein the elastic bars comprise four bar groups, each of which is attached to the plansifter housing in the region of the vertical central plane of a stack side.

14. Plansifter according to Claim 13, wherein the bar groups are attached to the plansifter housing in the region of the trough bottom.

15. Plansifter according to any of Claims 1 to 11, wherein the plansifter is mounted on upright supports (e.g. to be secured directly to a floor) for free oscillation.

16. Plansifter according to Claim 15, wherein each support is composed of a plurality of individual elastic bars.

17. Plansifter according to any of Claims 1 to 11 or 15 or 16, wherein the plansifter is supported on plastics material bars.

18. Plansifter according to Claim 17, wherein each support comprises a plurality of bars of plastics material assembled together, and the plansifter is mounted on four supports for free oscillation.

19. Plansifter according to Claim 17 or Claim 18, wherein the plastics material bars are fastened above and below with clamps, and the clamps are non-pointed and have clamping surfaces conforming to the round shape of the plastics material bars.

20. Plansifter according to any of Claims 17 to 19, wherein the individual plastics material bars are round solid bars.

21. Plansifter according to any of Claims 15 to 20, wherein the upper fastening of the supports is at about the region of the horizontal centre of gravity plane of the plansifter.

22. Plansifter according to Claim 21, wherein the upper fastening of the supports in each case is situated in the region of the vertical central plane of a stack side.

23. Plansifter according to any preceding Claim wherein each sieve stack is clamped by clamping devices to the bottom of the plansifter housing.

24. Plansifter according to Claim 23, including four clamping devices namely one at each corner of each sieve stack.

25. Free-oscillating plansifter substantially as shown in and hereinbefore described with reference to Figures 1 to 6 or Figures 7 and 9 to 11 of the accompanying drawings.

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1602756 COMPLETE SPECIFICATION

6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

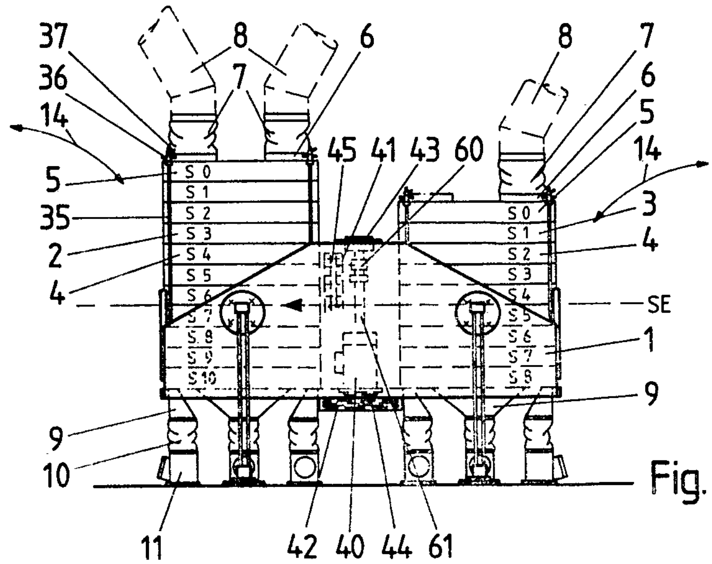

Fig. 1

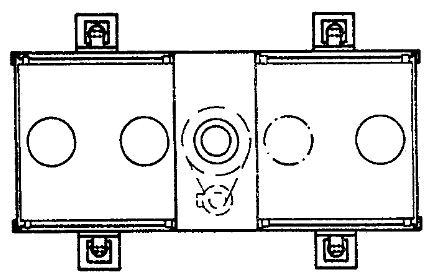

Fig. 3

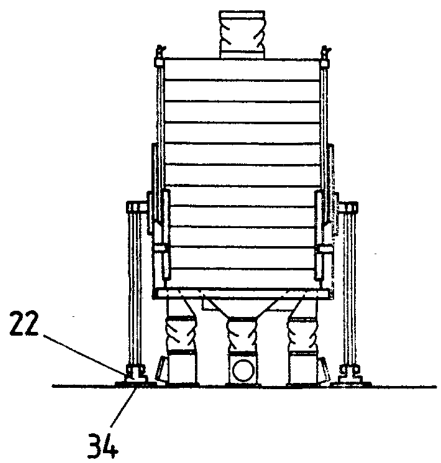

Fig. 2

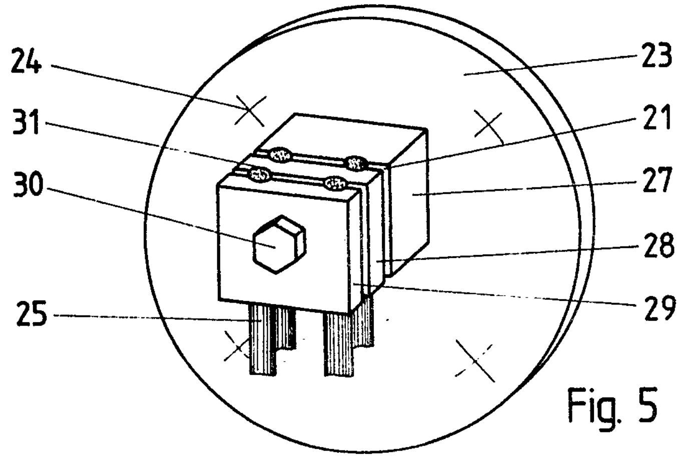
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Fig. 5

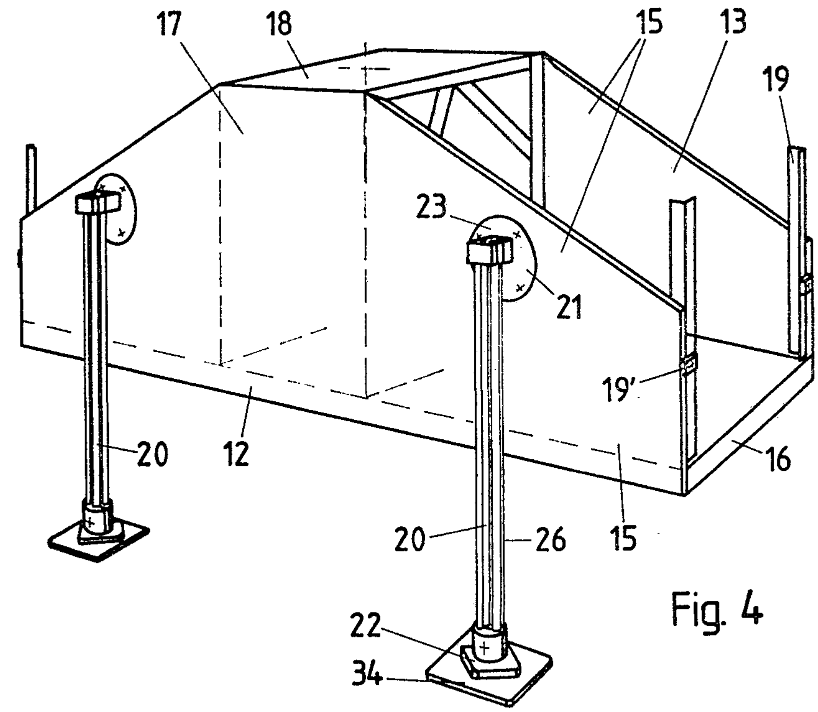
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Fig. 4

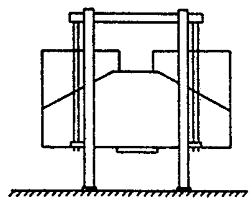

Fig. 8

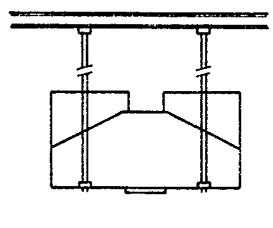

Fig. 7

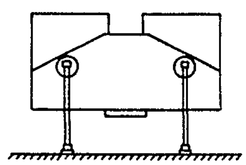

Fig. 6

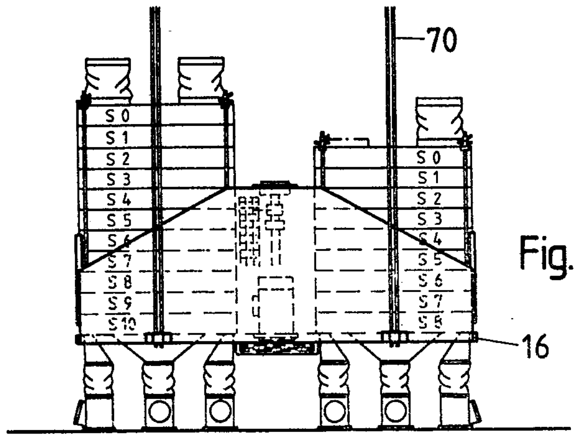

Fig. 9

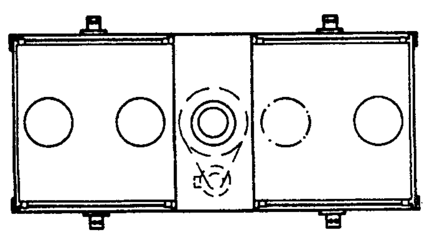

Fig. 11

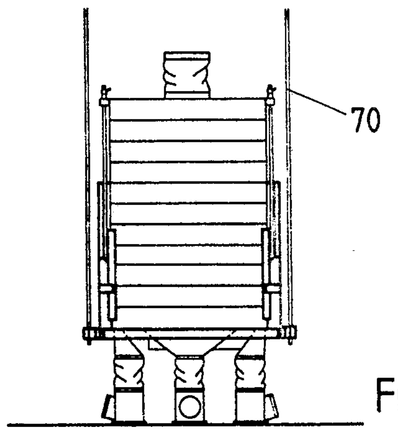

Fig. 10