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AUTOMATIC WEIGHING OF FERTILISERS -

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A surplus weight of 100 gr. per 50 kg. bag can seriously affect the bagging operation when dealing with 50,000 metric tons of product per year, and can cause a loss of 100 metric tons of fertiliser; this example shows what economies could be expected from a precise and accurate weigher.

The weigher which we have made is designed to be part of a light, modern production plant, easily accommodated in a plant, and capable of packing either powdered or granulated fertilisers; this precision apparatus can weigh either before the material enters the bags, or when it is in the bags.

We describe the model which weighs the product in the bag.

Description.

A diagram of this arrangement is attached.

The flow from the feed hopper is controlled by a flexible rubber sleeve (28) which can be gripped by two rollers (29a and 29b) worked by a system of levers (30a, 30b) which are moved by a piston (6) which is operated by compressed air. A second piston (34), operated by compressed air, limits the closing of the flexible sleeve to allow the bag to be filled in two stages: the first stage is rapid and the second slower as the final weight is approached.

The bag is held on to the sleeve of the bag-holder (18) by means of two jaws worked by a piston (21) which is operated by compressed air; because the bag-holder is hung from the beam of the balance, the parts of the apparatus operated by compressed air were particularly designed in order to eliminate any reaction on the weighbeam arm, or any check on its oscillations, which would reduce the sensitivity of the apparatus.

The weight box is hung at the extreme end of the balance and, when the bag is empty, it shuts a valve (13) which is connected to the compressed air circuit. By the action of a compressed-air relay (9), the sleeve under the hopper opens wide and the fertiliser flows rapidly into the bag until the weight is such that the pressure of the weight box on the valve (13) is no longer sufficient to hold the latter closed.

The compressed air then escapes and by means of the relay (9) operates the piston (6), and partly closes the sleeve from the hoppe

In the meantime, by means of compressed air, the piston (40), whose cylinder is fixed to the frame of the weigher, rises, putting the electric contact (37) into contact with the solid abutment of the weight box; the electric contact (37) which is then open, causes the piston (34) to rise by means of an electro-pneumatic relay, thus limiting the movement of the piston (6), and hence the degree of closure of the flexible sleeve from the feed hopper.

This ends the first stage in filling the bags.

The second stage of bagging, which is less rapid, now begin The further filling of the bag raises little by little the weight bo up to the abutment (38), until the latter is separated from the contact (37). The electric circuit then closes, and actuates the electro-pneumatic relay (35-36). This action allows the piston (34) to come down, which causes the piston (6) to drop sharply and ensures the complete closing of the flow of fertiliser into the bag.

Once the bag is filled and weighed, an automatic system (nc shown on the diagram) causes the piston (40) to drop and thereby rel the load from the weighbeam arm, which avoids any damage to the knif edges of the latter when, by the opening of the jaws of the bag holder, the bag is released.

The arrangement shown in the figure is completed by safety systems which stop the automatic release of a bag, when, following a weighing error, a bag is too heavy or too light.

Results.

Operation.

The bagging operator places the opening of the bag over the bag-holder, then holds it there with one hand, and with the other hand, works the valve (39); all subsequent operations of weighing, checking and release of the bag are done automatically. Thus one man, without special training, can look after two bagging units.

The double machine, fed by powdered or granulated fertilise of a good commercial grade, has an hourly output which exceeds 350 kg. bags or 400 50 kg. bags.

A specially designed arrangement causes the bags from the two weighers to be fed to a single sewing line; thus the bagging team consists of only two men: one at the weighers and the other at the sewing machine.

The consumption of compressed air for the double weigher is about 50 Nm^3 per hour at a pressure of 5 kg. (30 c.f.m. at 75 p.

Precision and Accuracy.

The weights of bags were checked systematically on about 100 different bags.

The statistical summary of the weights taken, plotted on a Gauss curve, gave the same mean error for bags of 50 kg. and for bags of 100 kg. which was equal to ± 35 gr.

The analysis of these same results has been done by the Fischer method, and the average error was calculated at:

± 34 gr. for bags of 100 kg.
± 36 gr. for bags of 50 kg.

In order to illustrate these results, the calculation shows that when one metric ton of fertiliser is delivered, the actual weight should be between:-

999.740 kg. and 1,000.420 kg. with a probability of 95%
between 999.620 kg. and 1,000.540 kg. " " " " 99%
for 50 kg. bags.
and between 999.870 and 1,000.370 kg. with a probability of 95%
between 999.780 kg. and 1,000.460 kg. with " " " 99%
for 100 kg. bags.

It appears from the above figures that the weigher was regulated to a weight slightly higher than 50 or 100 kg. (+ 4 gr. for 50 kg. bags, + 12 gr. for 100 kg. bags).

Sensitivity.

The use of compressed air as power gives great flexibility, has a gentle action on the mechanism, and keeps dust out; there is therefore no corrosion. It follows that the sensitivity of the apparatus is maintained even if it is working in a dusty atmosphere, which is often the case when bagging fertilisers.

Maintenance.

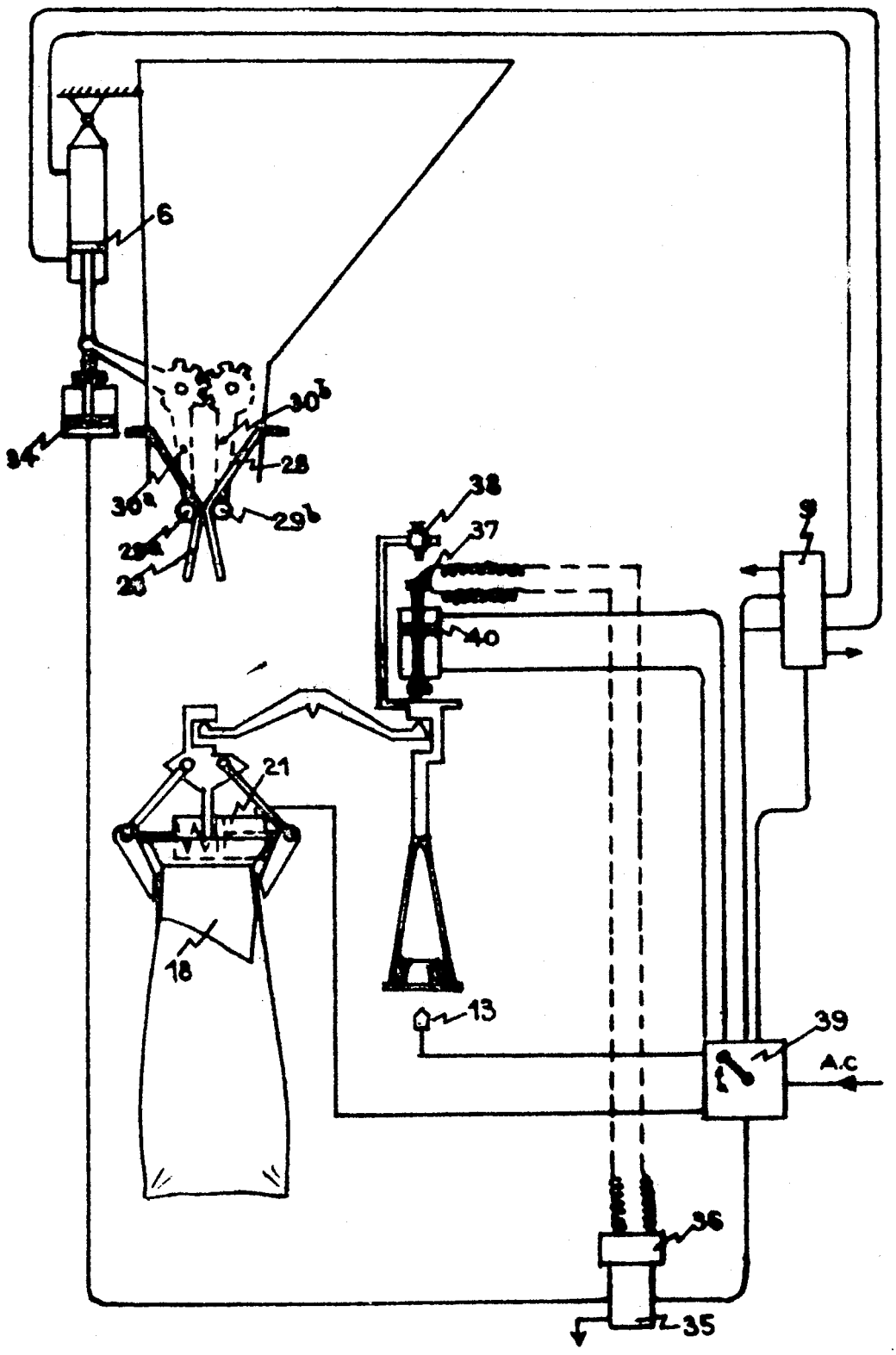
After weighing and bagging thousands of metric tons, we have experienced neither irregularities nor wear in the weigher.

The greasing of the machine is done automatically by passing compressed air through the oil, and daily maintenance consists solely of de-dusting the apparatus after work, which takes a few seconds with a jet of compressed air.

Summary

The weighing machine which we have designed possesses the following characteristics:

- The motive force is compressed air which ensures that the bag is held in the bag-holder, that the opening of the reserve hopper sleeve remains open, that this opening is partially closed when the bag is on the point of being filled and that it is completely closed when the weighing is finished, and, finally, that the bag is liberated.
- One operator can look after the two bagging units, with an hourly output of 350 100 kg. bags or 400 50 kg. bags.
- The machine's precision is such that an average variation in weight is equal to ± 35 gr. for bags of 100 kg. or of 50 kg.
- Thanks to the use of compressed air as the motive force, working in a dusty atmosphere does not have any effect on the operation and precision of weighing; no irregularities or wear result after weighing and bagging thousands of tons of fertilisers. The maintenance required is negligible.



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