

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) SILO

(71) We, JOHN LYSAGHT (AUSTRALIA) LIMITED, a Company incorporated under the laws of the State of New South Wales, Commonwealth of Australia, of 50 Young Street, Sydney, New South Wales, Commonwealth of Australia, 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:—

This invention relates to sheet-metal vessels, commonly known as silos, for the storage of wheat and similar crop materials, or other flowable granular solid materials generally.

Existing sheet metal silos of the kind for the purposes indicated comprise:—

(a) A storage body which is usually but not necessarily cylindrical in plan view but may be square or other non circular form and which may be made out of flat corrugated or other sheet metal;

(b) A central downwardly convergent hopper floor for the said body whereof the slope angle exceeds the angle of repose of the material to be stored so to permit gravitational discharge of the material through a discharge opening at the bottom of the floor; said floor corresponding in shape to the plan profile of the storage body and joined to the body along the upper periphery of the floor;

(c) A take-off boot having a top intake opening in registration with the floor discharge opening for receiving material therefrom.

The boot has a side normally closed discharge opening which may constitute the intake end of a discharge elevator. This may be a bucket elevator or a lifting auger; alternatively, the access opening may be simply a normally closed opening into which the intake end of an elevator may be dipped.

Silos of the kind indicated which are hereinafter referred to as silos of the kind referred to, for economic and other reasons are necessarily made of relatively light gauge sheet metal (about 18 gauge steel, for example) and [Price 5s. 0d. (25p)]

although the hopper floor is provided with external supports in the form of columns, struts, truss-like frames, or the like, it is found in use that the floor is seriously over-stressed as the silo content varies from zero to maximum storage capacity.

Hitherto it has been customary for the top of the take-off boot to be fixedly adjoined to the hopper floor so that the boot will act as a column providing some support for the centre region of the silo floor. This fixed connection of the boot and the hopper floor is satisfactory in some respects but as the hopper floor tends to descend under load, the floor is over-stressed, mainly in that annular region of it adjacent its circumferential attachment to the body side walls and or in that portion of it which borders the discharge opening. Consequently there is a likelihood of failure of the sheet metal in one or both of these vicinities or elsewhere in the floor, by fatigue or otherwise, which causes breakdown of the floor early in what would otherwise be the useful life of the whole silo structure.

Our experiments have shown that in the absence of boot support, the discharge opening will descend by as much as or even more than one inch from unloaded to fully-loaded condition of the hopper floor.

Clearly, such failure could be avoided by so designing the hopper floor and the column or other supports therefor so that they will not yield or tend to yield under load as just discussed, but that is objectionable because it adds to the metal weight and hence the production expense of the structure as a whole. For these reasons, it has been common to make no attempt to increase the structural strength of the floor or its supports and simply allow the mentioned floor failure to take place and then repair the situation either by providing the silo with a new floor or replacing the silo in its entirety.

Our experiments have shown further that the mentioned circumferential failure about the

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upper end of the hopper floor is largely due to the fact that a high proportion of the load due to the stored material transfers its loading effect to the body walls which therefor transmit this load to the floor rim; strain due to this load is opposed due to the column-like nature of the take-off boot and the relative rigidity of the inner regions of the floor and because of this virtually unyielding support for the inner regions of the floor the sheet metal in the vulnerable upper or rim zone is stressed beyond the elastic limit of the metal in that zone; it is this stressing which is responsible or mainly responsible for the mentioned floor failure.

By the present invention the indicated disability is remedied not by strengthening the floor or its supports or increasing the boot support for the floor, but by eliminating boot support altogether so that the floor as a whole is free to descend under load. This, we have found, does not, of course, eliminate floor stress, and consequent strain, but it keeps or helps to keep that strain within the elastic limit of the floor metal sufficiently for the useful life of the floor to be substantially equal to that of the silo structure as a whole.

According to the invention a sheet metal silo of the kind referred to is characterised by a male neck-ring secured to the silo floor and disposed coaxially about the discharge opening and extending downwardly through the intake opening into the boot, said male neck-ring passing freely through the intake opening in spill-proof relationship therewith, and without imposition of any of the hopper floor loading on the boot so as to permit descent of the hopper floor under load of material in the hopper.

A preferred embodiment of the invention is illustrated in the drawings herewith.

Figure 1 is a sectional elevation of the bottom portion of a grain storage silo.

Figure 2 is a plan (on a larger scale) of the take-off boot, shown, in sectional end elevation, in Figure 1.

Figure 3 is a sectional side elevation taken on line 3—3 in Figure 2 and additionally repeating part of the silo floor shown in Figure 1.

The silo body 4 its floor 5, and the support structure 6 therefor are of substantially conventional design. The floor has in it a discharge opening 7. The male neck-ring 8 is fixed to the hopper floor and, as shown, extends downwardly from opening 7.

Neck-ring 8 is circular (as viewed in plan). The neck-ring 8 extends into an intake opening in the top of the boot 11 which is simply a boot roof plate 9 having a circular hole 10 in it. Neck-ring 8 is free to descend telescopically within the hole 10. The circular form of the neck-ring 8 and intake opening has an added advantage in that it permits the boot to be rotated about the vertical axis of

the neck-ring so that it may easily be positioned for take-off of grain at any point about that axis.

The boot 11 rests on a base indicated at 12a and is substantially in the form of a box having a sideward extension 12 furnished with a top opening which is itself the inlet end of a grain removal elevator or which is simply a normally closed access opening 13 into which the intake end of such an elevator may be dipped. In the latter case the boot outlet is preferably provided with a lid 14 which is either hinged to or wholly removable from the boot so as to permit the boot to be kept closed during ordinary periods of grain storage. It will be understood that in any event the boot is designed more-or-less conventionally so that the angle of repose of the grain is exceeded at all parts of the boot from which grain might otherwise escape.

To some extent this applies equally to the telescoped neck-rings. Obviously, the neck-ring may be very loosely fitting within the intake opening of the boot provided the depth by which the neck-ring 8 normally passes through the intake opening is such that grain will not spill either by flowing upwardly between the neck-ring and the intake opening or by simple overflow of grain by reason of the floor neck-ring (under any conditions of silo loading or partial loading) not extending deeply enough through the intake opening into the boot.

Notwithstanding the fact that the male neck-ring 8 may be loose-fitting relative to the intake opening of the boot it is preferable that they be separated by no more than is necessary for ordinary mechanical working clearance so as to minimise access of foreign matter insects, mice and so on. To this end the continuity of the spill-proof feature of the associated telescoping neck-ring 8 and roof plate 9 may be augmented by furnishing them with weather or moisture proofing means. For example, the space between the neck ring and the roof plate may be closed by a sealing ring in the form of an O-ring or the like provided it be of a nature which will not substantially impair the freedom with which the neck-ring 8 may rise or fall within the roof plate 9. Alternatively, or additionally, the annular space between the neck-ring and the roof plate may be protected by an overlying eave-plate 15 which is fixed about the upper end of the male or furnished with a downwardly but outwardly neck-ring 8. If provided, this eave-plate 15 preferably extends outwardly well beyond the space to be covered and is inversely saucered, or furnished with a downwardly but outwardly flaring rim skirt, so that any moisture which may be deposited on the eave-ring will shed well clear of the space to be protected.

WHAT WE CLAIM IS:—

1. A sheet metal silo of the kind referred to characterised by a male neck-ring secured

upper end of the hopper floor is largely due to the fact that a high proportion of the load due to the stored material transfers its loading effect to the body walls which therefor transmit this load to the floor rim; strain due to this load is opposed due to the column-like nature of the take-off boot and the relative rigidity of the inner regions of the floor and because of this virtually unyielding support for the inner regions of the floor the sheet metal in the vulnerable upper or rim zone is stressed beyond the elastic limit of the metal in that zone; it is this stressing which is responsible or mainly responsible for the mentioned floor failure.

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the neck-ring so that it may easily be positioned for take-off of grain at any point about that axis.

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- to the silo floor and disposed coaxially about the discharge opening and extending downwardly through the intake opening into the boot, said male neck-ring passing freely through the intake opening in spillproof relationship therewith, and without imposition of any of the hopper floor loading on the boot so as to permit descent of the hopper floor under load of material in the hopper.
- 5 2. A silo according to Claim 1 wherein said neck-ring is circular (when viewed in plan) and wherein said intake opening is a circular hole in a roof-plate forming the top of said boot.
- 10 3. A silo according to Claim 1 or Claim 2 which includes an eave-plate which is secured to said neck-ring to overlie the space between the neck-ring and the boot intake opening.
4. A sheet metal silo of the kind referred to constructed and adapted to operate substantially as herein described with reference to the accompanying drawings.
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