Jan. 17, 1967 E. E. KÜHNER ET AL 3,298,552

MATERIAL HOIST FOR MATERIAL

Filed Nov. 18, 1963 3 Sheets-Sheet 1

Fig. 1

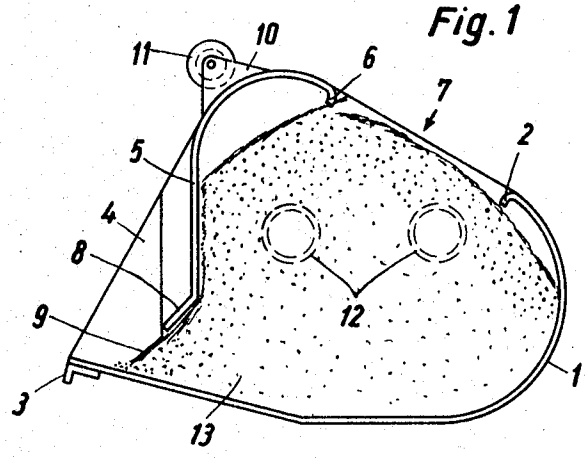


Fig. 3

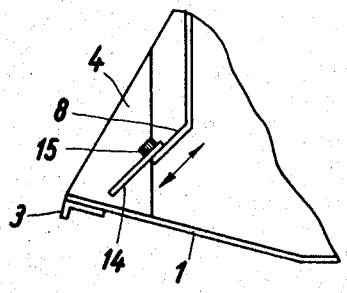
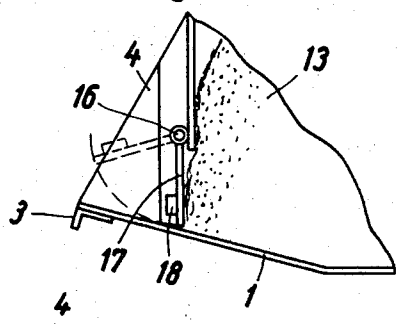


Fig. 4



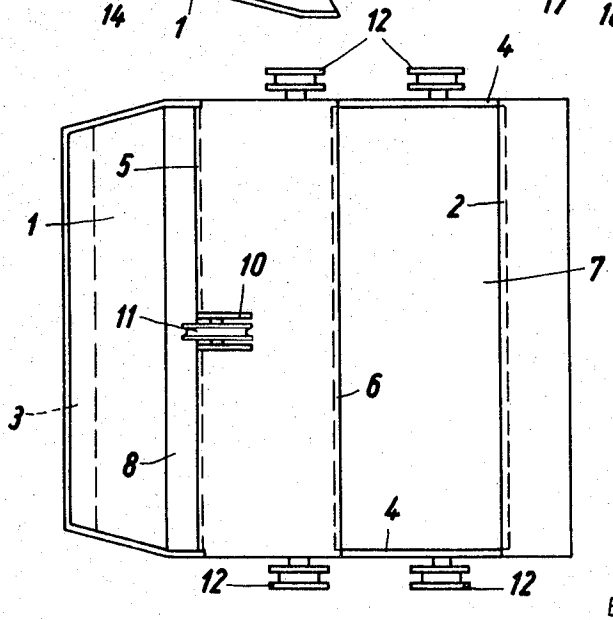


Fig. 2

INVENTORS
ERNST EWALD KÜHNER
ERNST WILHELM SUTTER
BY Hamilton & Cook
ATTORNEYS

Jan. 17, 1967 E. E. KÜHNER ET AL 3,298,552

MATERIAL HOIST FOR MATERIAL

Filed Nov. 18, 1963 3 Sheets-Sheet 2

Fig. 5

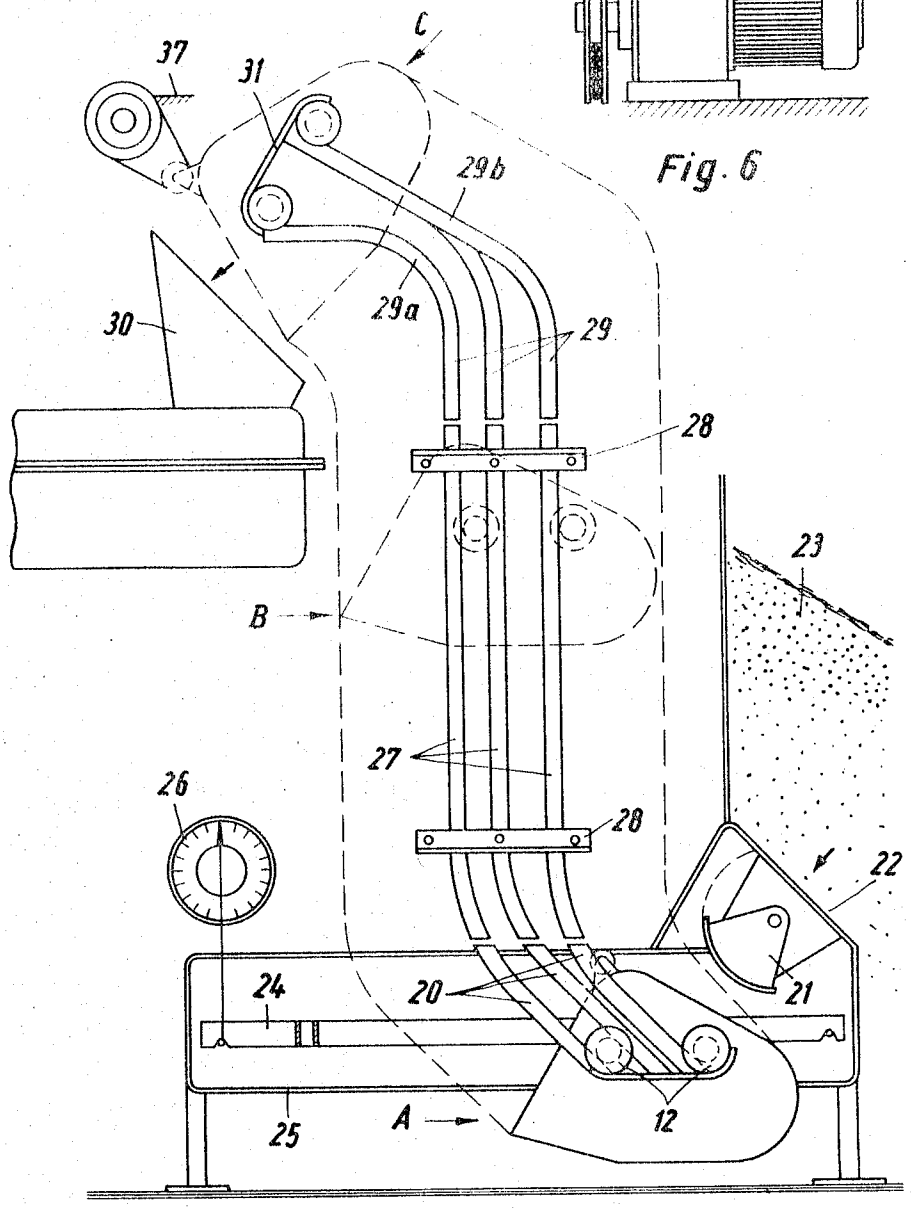
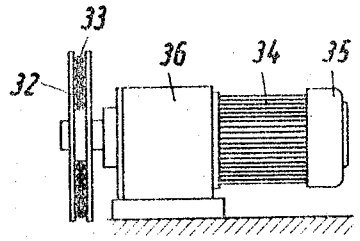


Fig. 6



INVENTORS
ERNST EWALD KÜHNER
ERNST WILHELM SUTTER
BY Hamilton & Cook

ATTORNEYS

Jan. 17, 1967 E. E. KÜHNER ET AL 3,298,552

MATERIAL HOIST FOR MATERIAL

Filed Nov. 18, 1963 3 Sheets-Sheet 3

Fig. 7

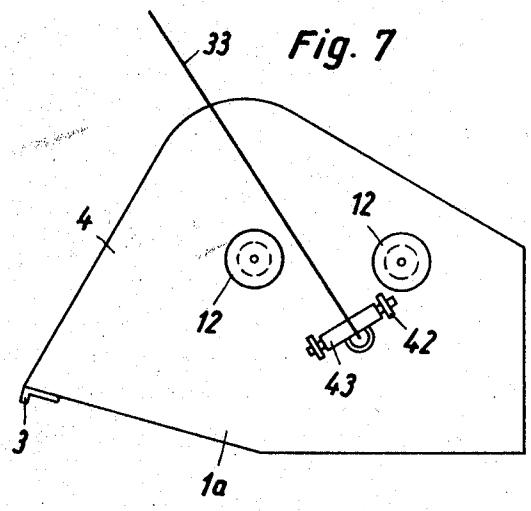


Fig. 10

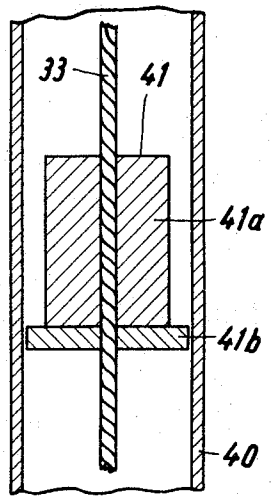


Fig. 8

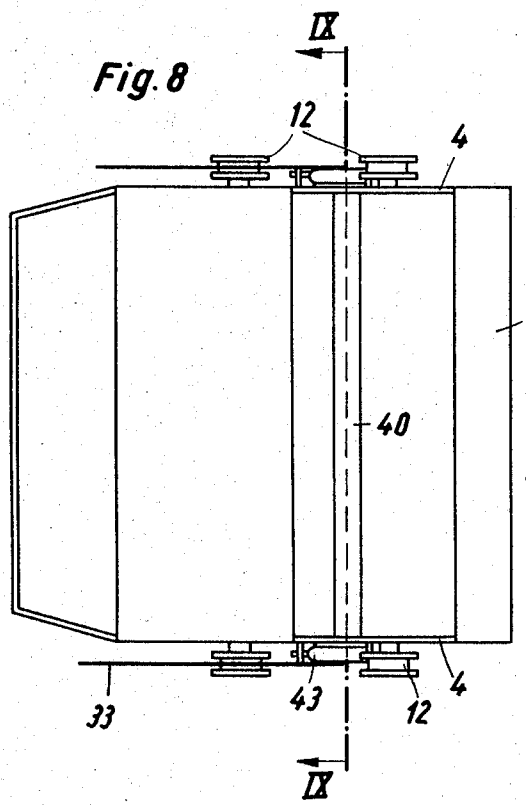
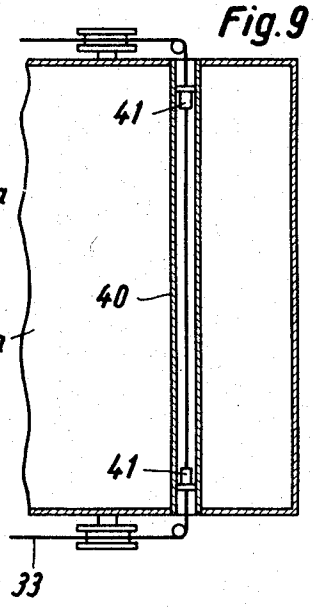


Fig. 9



INVENTORS
ERNST EWALD KÜHNER
ERNST WILHELM SUTTER
BY Hamilton & Cook
ATTORNEYS

United States Patent Office 3,298,552 Patented Jan. 17, 1967

3,298,552

MATERIAL HOIST FOR BULK MATERIAL

Ernst Ewald Kühner, Kreuzstrasse 1, Bruchhausen, near Karlsruhe, Germany, and Ernst Wilhelm Sutter, Gartenstrasse 80, Sulzbach, near Ettlingen, Germany

Filed Nov. 18, 1963, Ser. No. 324,494
Claims priority, application Germany, Nov. 17, 1962, K 48,251
12 Claims. (Cl. 214—707)

The invention concerns a material hoist for conveying bulk material, in particular in the building industry, e.g. for mixing machines, weighing devices and complete concrete preparation plants, with a hoistway, a container for the bulk material and a hoist winch with a pull cable.

Skip type hoists for bulk materials have been known for a long time in the building trade and have stood the test especially because of their robustness. They tend to have considerably fewer breakdowns than other means of conveyance, such as elevators, screw conveyors and the like. When such breakdowns do actually occur, they are confined mostly to defects in the hoist cable, which can be regarded as having an operating life of relatively short duration because of internal friction and which may be considered the only working part in hoists of the type mentioned.

For this reason, it has to be renewed from time to time, whereas all the other structural parts have an extraordinarily long service life under normal circumstances.

At most, the walls of the skip may need an occasional renewing.

Therefore, the expenditure for maintenance is relatively low, compared with the performance of such hoists, so that the disadvantages associated with their operation, such as no-load time, moving dead masses, unequal conveying and some more, are put up with. On the other hand, a material hoist of this type offers advantages, which none of the constant-flow conveying devices can offer. Thus, it is readily possible to run the skip into a weigher when it is being loaded or at another point of the hoistway.

In the case of all these material hoists, the skip is discharged at the end of the run either by swinging into the tipping position, or by means of a bottom flap which is to be opened by hand or by a releasing device.

The material hoists which have been put into use in recent times, and which have a container equipped with a bottom flap, permit of a run to directly over the unloading point, where the bottom flap is opened and the conveyed material can flow out. Since the height of the material containers must be greater than their width in order to ensure that the material will be discharged, difficulties occur when travelling under the loading point. For example, if a material container provided with a bottom flap is employed in a concrete preparation plant, a pit will have to be provided for it below the aggregate batter stockpile. This measure not only entails additional costs, but from a rational point of view it can not be carried out under certain circumstances, e.g. where there is ground water, rocky ground or installations. In addition, the overall height of the concrete preparation plant will be disproportionately large because of the hoistway which has to be led up rather high. Furthermore, the necessary mechanical devices for the bottom flap of the container are naturally liable to break down.

The invention, therefore, is based on the proposition of producing a material hoist which has a hoist skip for bulk material, a hoistway and a cable winch, which does not possess the disadvantages mentioned, and which above all requires neither a pit for travelling under a loading point nor, for the material container, neither a tipping device nor a mechanical device for operating a bottom flap.

This problem is solved by means of a hoist skip which is equipped with means of being guided in a hoistway and which is provided with a top feed opening and a discharge slot, said discharge slot located in a front wall which is essentially vertically arranged, and which is situated directly above the bottom which extends beyond the front wall to form a discharge plate, said discharge slot arranged in such a manner that the material, flowing out and collecting on the discharge plate and forming the natural angle of slope in the filling and transport positions, closes the discharge slot, whereas by inclining the hoist skip into a position which prevents the material collecting on the discharge plate (the discharge position), the discharge slot releases the contents and they can flow out, and by means of a hoistway arranged essentially vertically which is designed for the forced guide of the hoist skip in such a manner that the skip positions for loading, transporting and discharging are fixed.

According to a preferred example of embodiment, the hoist skip assumes the shape of a tank manufactured of sheet steel, the bottom plate of which is rounded off or bent up at one end, and limits with its end edge the feed opening at this point, and which is slightly raised at the other end. Perpendicular side plates are welded to the bottom plate around its edges and enclose a front wall arranged at right angles to said bottom plate. The top part of the front wall is bent inwards and, with its end edge, limits the other side of the feed opening, whilst its bottom part possesses an inclined surface which is bent outwards and downwards and terminates at an empirically found distance from the bottom plate. The clear space between the inclined surface of the front wall and the bottom plate serves as discharge slot.

On the outside of each of the two sideplates there are two rollers arranged symmetrically on a common horizontal plane for guiding the hoist skip in the hoistway. The rollers may be provided with a groove running around the periphery and enclosing the guide rails of the hoistway. The pertinent hoistway consists of three guide rails on each side of the hoist skip, the central portion of said guide rails running essentially vertically, the bottom portion bent away to one side in the direction of the loading point, the top portion bent to the other side in the direction of a point of discharge.

In a preferred example of embodiment, the hoistway consists of individual sections corresponding to the hoistway sections. The top section of the hoistway is bent over to the point of discharge and is preferably designed in such a manner that the guide rail which is here the lowest has a short horizontal stretch and then terminates in a stop for the pertinent roller, whereas the top rail runs upwards at an angle. The forced guide which results makes the hoist skip tilt into the discharge position.

The central vertical section of the hoistway, on which the hoist skip moves in the transport position when travelling upwards and downwards, is designed for practical purposes to be variable in the length. In one form of embodiment comprising sections, the variation in the length may be effected for example by mounting further sections having vertically arranged, parallel rails.

The bottom hoistway section is appropriately designed as a section disconnected from the rest of the hoistway and, if necessary, rigidly connected to a weigher, for example to an aggregate weigher, into which weigher the hoist skip, which also serves as a weigh bin, travels for the purpose of loading and weighing. This hoistway section is bent over towards the loading point, e.g. towards the through passages for the aggregates lying in a batter stockpile.

The hoist winch for the material hoist is preferably equipped with a sheave for winding up the hoist cable

spirally. By virtue of the uniformly increasing load lifting arm, the hoist skip is given additional acceleration when traveling upwards, and by a reverse process when traveling downwards into the bottom end position, e.g. into the weighing device, the skip is subject to a corresponding progressively increasing retardation.

Because of the simple construction of the discharge opening, without any special door members subject to wear and tear, the material hoist according to the invention is particularly suitable for most bulk materials, especially for those used in the building trade, and permits of a fast, trouble-free transport. However, the discharge slot should be designed somewhat narrower for transporting particularly fine-grained bulk materials of a mealy nature. Yet, in order to still have a rather large opening available for discharging, a further development of the invention provides for additional throttle or closing devices. For example, a screen which is movably arranged on and attachable to the inclined surface of the wall is suitable for adjusting the discharge slot to the changing conditions. A swiveling door flap, which is provided in front of the discharge slot, and which opens automatically when the hoist skip is swung over into the discharge position, is also advantageous.

The hoist cable can be led on the hoist through a cable sheave arranged on the upper side of the hoist. An embodiment, in which the hoist cable is loosely passed through a pipe which goes right through the hoist skip from sidewall to sidewall at about the height of the axis through the center of gravity, seems to be practical. This embodiment makes it possible to arrange breaking safeguards for the pull cable, for example by fitting clamping members to that part of the cable which passes through the pipe, which would then engage when necessary in the stops provided on the sidewalls.

Further details, features and advantages of the object of the invention are explained in the following description of the attached drawings, which render the preferred embodiment of a material hoist designed according to the invention. The drawings show:

FIGURE 1 a hoist skip in vertical section;

FIGURE 2 the same in horizontal projection;

FIGURE 3 an embodiment provided with an adjustable screen, a section through the discharge opening, in vertical section;

FIGURE 4 an embodiment of the hoist skip with a swiveling flap, a section through the discharge opening, in vertical section;

FIGURE 5 a complete hoist with hoist skip, aggregate weigher and hoist winch arranged in a concrete mixing plant with a batter stockpile, side elevation;

FIGURE 6 a hoist winch with a cable sheave, side elevation;

FIGURE 7 a skip hoist with a cable fairleads centrally arranged, side elevation;

FIGURE 8 the same in horizontal projection;

FIGURE 9 the same to illustrate cable, guidance along the sectional line IX—IX in FIGURE 8, sectional drawing;

FIGURE 10 a safety clamp, enlarged view, sectional drawing.

The bottom plate **1** (FIG. 1) of the hoist skip is bent up at one end, and for reinforcing purposes it is supplied with a flange **2**. The bottom plate **1** is slightly raised towards the other end, it is trimmed off at the corners at an angle, and it has an angle iron **3** underneath the edge in order to stiffen said edge. The two congruent sideplates **4** are welded perpendicularly to the side edges of the bottom plate **1**, the edges of said sideplates following the curvature of the bottom plate **1**, beginning first at the flange **2** of the bottom plate and running up at a slant, finally rounded off and running down at a slant to the other edge of the bottom plate **1**, said latter edge stiffened by means of the angle iron **3**. The sideplates **4** are bent inwards corresponding to the trimmed-off corners of the bottom plate **1**. A front wall **5** of sheet metal is welded in between the sideplates **4** and butting them at right angles, the top part of said front wall following the curvature of the sideplates **4** and covering the hoist skip; at the end of the curvature there is provided a flange **6**, the purpose of which is to stiffen this edge. The space which is limited at the sides by the sideplates **4**, by the flange **2** on the end of the curvature of the bottom plate, and by the flange **6** of the curvature of the front wall **5**, forms the inlet opening **7** of the skip hoist. That part of the wall **5** which follows directly after the curved section and which is vertical is provided at its bottom end with an inclined surface **8** running downwards and outwards and terminating at a certain distance, based on values found by experience, above the bottom plate **1** and forming with said plate the discharge slot **9**. On the curve and in the center of the front walls **5** there is mounted a bracket **10** with a cable sheave **11**, the horizontal rotation axis of which cuts the planes of the sideplates **4**. Two rollers **12** are arranged on the outside of each sideplate **4**, their axes are located on a horizontal plane and each two are arranged opposite one another on one axis.

When the hoist skip is filled in an approximately horizontal position (filling position A, transport position B), the sloping material **13** closes the discharge slot **9** and, assisted further by the rise in the bottom plate **1**, prevents the material from coming out farther under the filling pressure. For bulk materials with a small angle of repose (FIG. 3) there is provided an adjustable screen **14** which is attached in the required position on the inclined surface **8** of the wall **5** by means of a screw connection **15**.

FIGURE 4 illustrates another method of adaptation to the angles of repose of the different materials. Discarding the inclined surface **8**, the bottom end of the wall **5** is provided with a through hinge **16**, on which is swung a flap **17** which closes the discharge slot **9**. The efficiency of the flap **17** is increased by loading it with a weight **18**.

FIGURE 5 depicts the material hoist arranged in a concrete mixing plant. In the loading position A of the hoist skip **1**, this latter has been traveled into the lower hoistway section **20** and is positioned in such a manner that its inlet opening **7** is underneath the through passages **22** situated on the rear of the concrete mixing plant and each provided with a quadrant door **21** for the aggregates **23**. The bottom section **20** of the hoistway is connected structurally with an aggregate weigher **24** which is located in the frame **25** of a concrete mixing plant and the net load of which can be read off an indicating device **26**.

Adjoining the bottom hoistway section **20** is the central hoistway section **27** with fixing devices **28**. Above this section follows the top hoistway section **29**, the rails **29*a*** and **29*b*** of which are designed as forced guides which cause the inclining of the hoist skip. During this movement, it is of decisive importance that the hoist skip, when traveling from the transport position B into the discharge position C, reaches the angle of inclination necessary for the safe discharge of the transported material **13** only when it is directly above the point of discharge, which is the feed funnel **30** of a rotary mixer in the illustrated example. For this reason, the guide rails **29*a*** and **29*b*** which serve as curve guides are led towards one another in such a manner that the hoist skip is brought farther in the transport position which is essentially horizontal until the roller **12** running in the lower guide rail **29*a*** hits against the stop **31**. Then the roller running in the upper rail **29*b*** continues under cable pull along the diverging part of said rail to its upper end, whereby the hoist skip is brought into the tipped position (discharge position C) and empties.

To overcome the inertia forces occuring in the top section **29** of the hoistway, it is intended that, according to the invention, the hoist skip is to be accelerated when

travelling upwards. For this purpose, the hoist winch used (FIG. 6) is fitted with a cable sheave, onto which the hoist cable 33 is coiled spirally in one plane layer for layer. The actual drive unit for the hoist winch consists of the electric motor 34 with brake 35 and built-on gear 36.

When hauling in the hoist cable 33, which runs from the cable sheave 32 through the cable sheave 11 on the hoist skip and back to a fixed point 37 in the immediate vicinity of the hoist winch, the diameter of the drive sheave, that is to say the lifting arm of the load torque, increases by one cable thickness with every turn of the cable sheave 32. This means that the hoist skip is given an additional acceleration, with the result that the skip travels lively to the upper guide rail 29*b* and is brought into the discharge position C without additional energy requirements.

The skip, by virtue of laws analogous to those applied when it is travelling upwards, is lowered down with a progressively increasing retardation, which particularly in the case of the aggregate weigher 24 results in a preserving effect.

In the following FIGURES 7 through 9, a hoist skip 1*a* is depicted with central cable guidance. A pipe 40, into which the hoist cable 33 is pulled, is inserted through the sideplates 4 and through the loading chamber below the rollers 12. Two safety clamps 41, attached to the hoist cable 33 and freely movable in the pipe 40 in accordance with FIGURE 10, serve as safety device for the hanging hoist skip if the cable should part. The safety clamps 41 consist of a cylindrical clamp body 41*a* and a head disc 41*b*. The head disc 41*b* has an external diameter which is approximately the same as the internal diameter of the guide pipe 40. As well as this, the head discs 41*b* are turned towards the openings of the pipe 40. These latter are covered about halfway by the cylindrical rollers 43 fitted in brackets 42 on the sideplates 4, so that the safety clamps 41 cannot be withdrawn when the rollers 43 are mounted.

A hoist winch with two cable sheaves 32 is intended for the last described embodiment of the hoist skip, to which sheaves are connected the ends of the hoist cable 33 running through correspondingly arranged fairlead rollers.

What is claimed is:

1. In a material hoist for conveying bulk materials having a hoist skip adapted to carry bulk material, a hoistway selectively positioning said hoist skip, a hoist winch, a pull cable engaging said hoist winch, said hoist skip comprising, an upper feed opening, a substantially vertical front wall having an outwardly inclined surface, a bottom plate extending outwardly of said front wall, discharge means in said front wall and said bottom plate located to retain said bulk material when said hoist skip is in loading and transport positions and to release said bulk material when said hoist skip is inclined in a discharge position, means guiding said hoist skip on said hoistway, and attachment means on said hoist skip receiving said pull cable.

2. A material hoist according to claim 1, wherein said hoist skip comprises, an inclined surface formed at the lower extremity of said front wall and directed downwardly and outwardly of said hoist skip.

3. A material hoist according to claim 2, wherein said discharge means comprises, a slot in said front wall and a portion of said bottom plate extending outwardly of said front wall being raised to restrict discharge of said bulk material.

4. A material hoist according to claim 3, wherein said hoistway comprises, a plurality of sectional travel rails, each of said travel rails having a substantially vertical center section, a top discharge section directed to one side of said center section, and a bottom loading section directed to the other side of said vertical section, said bottom loading section being attached to a weighing device.

5. A material hoist according to claim 3, wherein said hoistway comprises, a plurality of sectional travel rails each of said travel rails having a substantially vertical center section, a top discharge section directed to one side of said center section, and a bottom loading section directed to the other side of said vertical section and said hoist winch has a cable sheave winding said pull cable spirally in a vertical plane, whereby the velocity of said hoist skip is accelerated upon approaching said discharge section and retarded upon approaching said loading section.

6. A material hoist according to claim 2, wherein said discharge means comprises, a slot in said front wall and throttle means attached to said front wall and selectively projecting over said slot.

7. Apparatus according to claim 6, wherein said throttle means is a screen member.

8. Apparatus according to claim 6, wherein said throttle means is a pivoted flap provided with weighting.

9. Apparatus according to claim 2, wherein said attachment means comprises, aperture means located substantially at the center of gravity of said hoist skip and housing said pull cable in a freely movable manner.

10. Apparatus according to claim 9, wherein said aperture means is a length of pipe extending substantially through said skip hoist.

11. Apparatus according to claim 10, wherein cylindrical rollers are mounted across the extremities of said pipe, said rollers having their longitudinal axes approximately at right angles to the direction of pull of said cable.

12. Apparatus according to claim 11, wherein said pull cable has a plurality of safety catches, each said catch comprising, a clamping member attached to said cable within said pipe and a head disc which engages behind said cylindrical roller and prevents said hoist skip from falling if said pull cable parts.

References Cited by the Examiner

UNITED STATES PATENTS

913,319	2/1909	Stuebner	294—69
1,009,037	11/1911	Bathrick	214—715
1,775,970	9/1930	Ross	214—709
2,141,702	12/1938	Walsh	294—73
3,136,434	6/1964	Mauderer	214—626 X

FOREIGN PATENTS

817,999	8/1959	Great Britain.
411,382	1/1910	France.

GERALD M. FORLENZA, *Primary Examiner.*

R. B. JOHNSON, *Assistant Examiner.*