March 13, 1951 W. A. HILGEMAN 2,544,682

LATCH

Filed Dec. 3, 1945 2 Sheets-Sheet 1

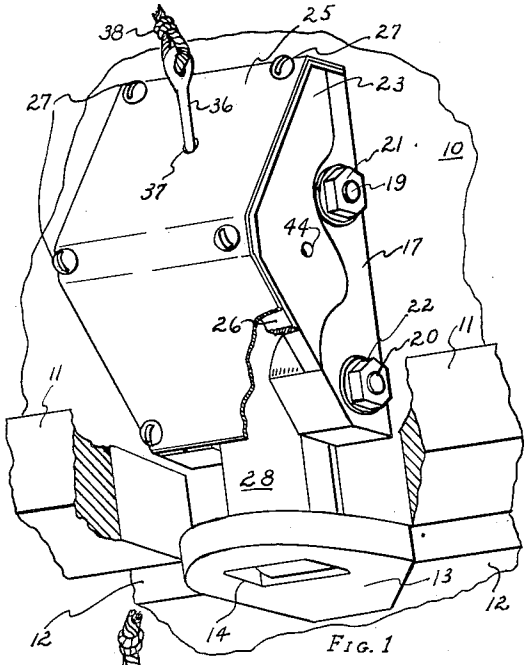


FIG. 1

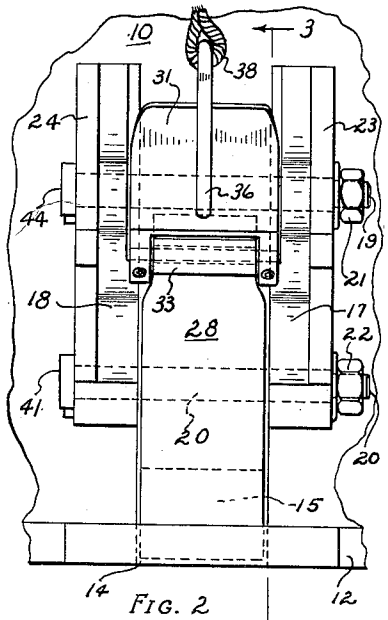


FIG. 2

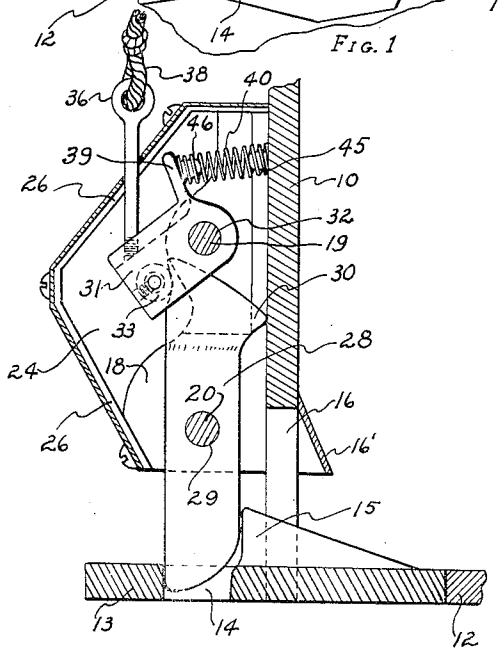


FIG. 3

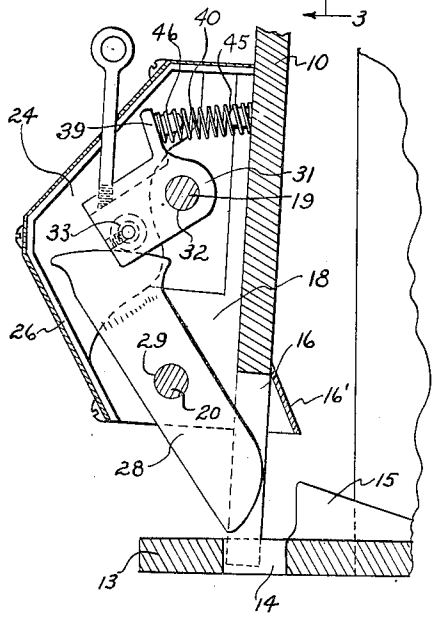


FIG. 4

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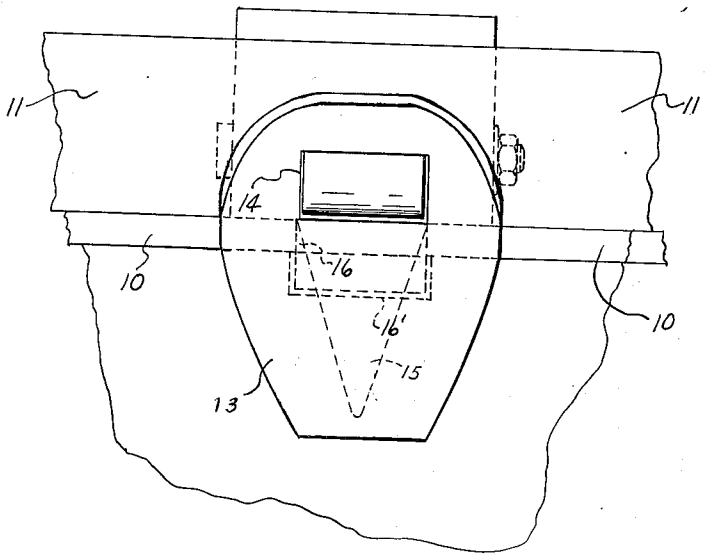


FIG. 5

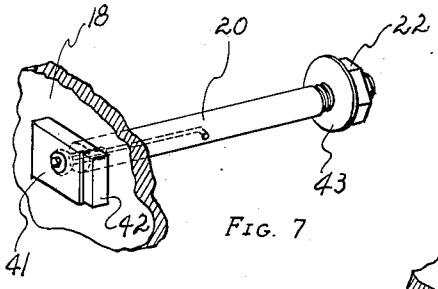


FIG. 7

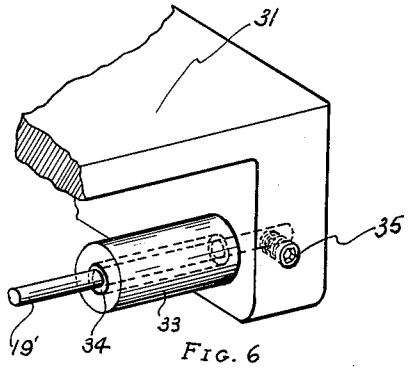


FIG. 6

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Patented Mar. 13, 1951

2,544,682

UNITED STATES PATENT OFFICE

2,544,682

LATCH

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Application December 3, 1945, Serial No. 632,433

8 Claims. (Cl. 292—198)

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This invention relates to a latch for use in connection with doors in which a load presses against the door putting weight on the latch so that it must be released against the pressure of the load. More specifically, it relates to a latch for use on the dipper of a power driven shovel of the type which dumps through the back.

The conventional type of power driven shovel has a dipper with a door in the back for dumping, the door being held shut by a latch. The conventional latch in use on all such dippers comprises a latch-bar which moves in a vertical direction more or less parallel to the back of the dipper door and one end of which is inserted into a slot in the dipper floor. The dipper is dumped by drawing the latch toward the top of the door and out of the slot by means of a motor-powered winch. Since the dipper is dumped through the back, it is apparent that the entire weight of the load rests on the latch when it is in dumping position. Therefore, in order to withdraw the bar, it must be pulled upward against the frictional pressure imposed by the load pressing it against the latch-bar slot.

In one broad embodiment, my invention comprises a latch comprising a slotted sill, a latch bolt or bar, means for pivotally mounting the latch-bar on a door so as to engage said slotted sill, the pivot point being intermediate the length of said bar, trip means pivotally mounted on the door adjacent to but spaced from the bar, means urging said trip means into engagement with one end of said bar to prevent it from pivoting when in latching position, and means for pivoting the trip means to permit said latch-bar to pivot.

In another embodiment, the invention comprises a latch-bar pivoted intermediate its length and mounted for partial pivotal motion on the back of a dipper door, tripping means including a spring engageable with one end of said bar to prevent pivoting thereof when in latching position, and means associated with said tripping means to release it whereby said bar may pivot.

In a specific embodiment, the invention comprises a latch useful for example on a power driven dipper, said latch comprising a latch-bar engageable with a latch-bar slot associated with a sill of dipper, said bar being pivotal intermediate its length and pivotally mounted on a dipper door, the lower and upper ends of said latch-bar being curved arcuately inwardly toward the dipper door to form bearing surfaces to aid in the opening and closing of the latch, a trip pivotally mounted on the dipper door adjacent said latch-

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bar, said trip comprising a spring retaining member, a spring urging one end of the trip against the latch-bar to prevent pivotal motion of the latch-bar when in latching position, and to resist return of the latch-bar to latching position after the latch is released, means to pivot said trip to release the latch-bar and permit it to be pivoted and thereby disengaged from the slot due to the weight of the load within the dipper.

The device has the advantage that the latch is as firmly held in latched position as with the conventional sliding bolt type latch, but that it can be tripped by the application of a relatively slight pull, since the release or trip mechanism does not have to overcome the sliding frictional pressure of the loaded latch, but merely the pressure necessary to hold the latch bar in position so it cannot pivot. Because of the lever principle used in my invention, the power necessary to trip the latch is less than the weight thereof. The conventional latch-bar may weigh several hundred pounds in the large machines, and requires a substantial motor to operate it. My latch can be operated with a fractional horsepower motor.

With conventional latches the time lost in repairs and the like may amount to several hours a week. This time is largely saved with my latch.

One difficulty experienced with conventional latches is in plugging of the latch-bar slot with rocks or dirt. Often this must be cleared manually, resulting in lost time. Due to the construction of my latch, the latch bar exerts a prying action as it enters the slot, thereby clearing it of impediments and saving time. My latch automatically closes and engages when the door slams shut the first time which is not always the case with the conventional latch. This also is time consuming. Since the larger machines, e. g. earth stripping shovels of 20–35 cubic yards capacity, are rated at several hundred dollars per hour, every improvement in efficiency represents a material financial saving.

Other advantages will become apparent from the following description.

The invention is illustrated in the accompanying drawings.

Figure 1 illustrates one embodiment of the invention shown in perspective and partly in section from the back, i. e. facing the door. Figure 2 is a plan view of the latch with the protecting cap removed. Figure 3 is a side view partly in section taken through line 3—3 showing the trip in latching position. Figure 4 is a side view sim-

ilar to Figure 3 but showing the latch released. Figure 5 is a view from the top with the cap in place. Figure 6 is a perspective view partly in section of a detail of the trip mechanism. Figure 7 is a detail showing one type of shaft assembly for supporting the latch-bar.

Referring to the drawings, a section of a dipper door of a power driven shovel is generally indicated at 10. In the conventional type of dipper, a stiffener 11 may extend around the edge of the door to prevent its buckling under the enormous weights which it must sustain. The bottom of the dipper is indicated at 12. Associated with the bottom of the dipper (the sill) and extending parallel thereto but projecting beyond the general contour of the bottom is a sill member 13 containing a latch-bar slot 14. The edge of the slot is approximately flush with the dipper door when it is closed. This is so that when the latch-bar is in position and the door is latched, it will be held firmly in place without substantial vibration. The construction of the sill and slot may vary depending on the device. For example, the slot may be in the sill itself. Attached to the bottom 12 of the dipper is a stop 15 which is approximately the width of the latch-bar and extends above the bottom of the dipper or the sill. The face of the stop is slightly curved to conform to the curved lower face of the latch bar 28 so as to guide it into the latching position as the door swings shut. It will be noted that this action exerts a prying effect on any material that may stick in the slot, thereby clearing it and assuring the latching of the door. The weight of the door aids in this, while in conventional latches the only effect is obtained by the weight of the latch-bar. This stop may be built up approximately the width of the latch-bar and then tapered toward the front of the dipper away from the sill to form a beaver tail which strengthens the stop. An opening 16 is cut in the door to permit it to pass over the stop 15 and also to permit the latch-bar to pivot properly when it is tripped.

Attached to the dipper door 10 is a pair of support members 17 and 18 which contain holes through which shafts 19 and 20 extend. These may be held in place by means of nuts 21 and 22, and may have square heads 41 and 44 on the opposite ends. Attached by welding or otherwise to the supports 17 and 18 are plates 23 and 24 which serve to support a protective cover 25 added to prevent dirt from entering the latch. As may be seen in Figure 1, the plates have a flange 26 extending inwardly. These are drilled and tapped to take cap screws 27 which hold the cover plate 25 in position. A latch-bar 28 is pivotally mounted on shaft 20 by means of a hole 29 extending therethrough. This hole may be located intermediate the length of the latch-bar 28 and is preferably near the center. The position of the hole will determine to a large extent the amount of force required to hold the latch-bar in position and to release it. The lower end of the latch-bar may have a curved or arcuate end being relieved inwardly adjacent the dipper so as to engage the curved face of stop 15 and thus guide the latch-bar into the latch-bar slot 14 when the door is slammed shut and the latch-bar is moved into the latched position as shown in Figure 3.

The upper end of the latch-bar is likewise curved inwardly but the face is preferably extended beyond the width of the bar by a projection 30. This projection may serve as a stop by resting against the dipper door 10 and prevent substantial vibrational movement when the bar is in latched position. Moreover the face is extended so that the tripping mechanism 31 will have a place to rest when the latch is in tripped position shown in Figure 4.

When the latch-bar is in latched position as shown in Figure 3, it is held there by means of a trip 31 which is pivotally mounted on shaft 19 by a journal 32. Journalled in the leading or lower edge of trip 31 is a roller 33, which rests against the back face of latch-bar 28 when it is in latching position (Figure 3) but which rides along the upper curved face of the latch-bar when it is in tripped position as is shown in Figure 4. This roller preferably has a bearing 34. The shaft 19 is prevented from turning by means of set screws 35 or other conventional means. The journal 32 for shaft 19 is located above the upper end of latch-bar 28 so that when the trip is released the roller 33 describes an arc beginning outwardly and upwardly over the end of the latch-bar.

There is preferably a slight depression or groove extending laterally across the latch-bar 28 near the upper end to aid the roller and trip mechanism to hold latch-bar 28 in latching position.

Attached to the trip 31 near the forward face is a link 36 which extends approximately parallel to the door and out through a hole 37 in the cover 25. A flexible bellows, not shown, may seal this hole. A link or loop is placed in the end of link 36 for attaching cable 38 which runs to a trip mechanism which is mechanically powered in the case of power driven shovels. By pulling upward on cable 38 the leading or forward edge of the trip mechanism 31 is caused to pivot upwardly and outwardly disengaging itself from the vertical face of latch-bar 28 and thus permitting the weight of the load on the dipper door to thrust the door outwardly into the position shown in Figure 4.

A spring retaining member such as arm 39 extends from the trip mechanism at a point remote from roller 33. That is, the pivot point lies between the arm 39 and the roller 33 so that movement of either exerts an opposite effect on the other member. A spring 40 urges the arm away from the dipper door. Thus, referring to Figure 3, when the latch is in latched position, the spring urges roller 33 against the back face of latch-bar 28 and prevents it from pivoting around point 29. The trip mechanism is operated by momentarily raising the leading edge of the trip including roller 33, thereby permitting latch-bar 28 to pivot due to the weight pressing against the door. As it pivots, roller 33 rides up and over the end of bar 28 and the lower end of bar 28 rides free of latch-bar slot 14 and the dipper door is free to open. The action in disengaging the latch-bar from the slot is, in effect, a rolling motion rather than a sliding motion as in the conventional latches. The slot 16 in the door prevents more than limited pivoting of the latch-bar, the lower end of which must clear the sill.

The roller 33 now is pressed against the curved face of the upper end of bar 28 so that the bar is prevented from dropping back into latching position and so that the lower end will be held in a position to clear the sill when the door subsequently swings shut. This is essential to the successful operation of the latch.

Spring 40 is held in place by conventional means shown as projections 45 and 46 on the

door and arm 39 respectively. The spring is comparatively weak since it need only be strong enough to overcome the tendency of arm 28 to pivot.

Referring to Figure 7, this is a detail of one means of associating shaft 20 with the mechanism. A square head 41 is attached to the shaft which is driven through a hole in support 18. The shaft is prevented from turning by means of a lug 42. The opposite end of shaft 20 is threaded to receive washer 43 and nut 22. The latch-bar 28 forms a journal for this shaft and the latch-bar pivots around the shaft. Preferably the latch bar is of hard steel so that most of the wear occurs on shaft 20. When the shaft becomes worn, a new bearing surface can be presented by merely withdrawing the shaft and turning it a quarter turn. Thus the bearing surface can be renewed three times before a new shaft must be supplied. Shafts 19 and 20 are preferably identical. An alternative structure of the latch-bar provides that the shaft 20 may be made integral with latch-bar and bearing provided, e. g. pillow bearings, to provide pivot means for the bar. As illustrated, provision is made for lubricating the pivotable bearing by means of a counter sunk grease fitting and a hole drilled through the shaft and openings within the bearing.

A shield or cover 16' over opening 16, may be provided to protect the latch-bar 28 from damage and dirt. There is an opening below the cover 25 to allow any dirt that gets into the mechanism to work free. When associated with the dipper of a power driven shovel, the mechanism operates in the following manner.

As shown in Figure 3 the latch-bar 28 is approximately parallel to the dipper door. The lower end of the latch-bar is associated with the latch-bar slot 14 and thus prevents the dipper door from opening. The spring 40 thrusts against arm 39 thus urging the roller 33 against the latch-bar 28. No tension is applied to link 36 or cable 38.

When the dipper is raised into position to be dumped, tension is applied to cable 38 usually by means of a motor which drives a suitable cable drum. Only a momentary pull is required and this may be usually done with a fractional horsepower motor since it is only necessary to overcome the action of spring 40 in order to release the trip. Once the trip mechanism begins its outward and upward movement, the weight of the load pressing against the door causes latch-bar 28 to pivot around point 29 and move into the position shown in Figure 4. The motion is a rolling motion, not sliding, and the force necessary is provided by the weight of the load, not the tripping mechanism. The roller 33 rides along the curved surface of the upper end of the latch-bar 28. The latch-bar is prevented from moving more than a limited distance since it strikes the upper part of slot 16 in the door. The trip motor operates only momentarily and immediately releases tension on cable 38 so that the spring 40 again exerts its pressure. It thrusts roller 33 against the inwardly curved surface of bar 28 and prevents it from moving of its own weight, back into latch position. Thus bar 28 is held so that the lower end will clear the sill as the door subsequently swings shut which it would not do if the latch-bar could assume a position parallel to the door before the lower end cleared the sill. Any suitable retaining member may be employed to limit the pivot of the latch-

bar and the door may be reenforced at the point where the bar strikes.

When the dipper is lowered, the door swings shut because of its own weight, bringing the lower curved surface of latch-bar 28 into contact with the curved surface of the stop 15. As the weight continues to press against the latch-bar, it is guided downwardly causing it to pivot at point 29. Since the strength of the spring is too small to resist the weight of the door, the roller 33 rides along the upper curved face of the latch-bar, and over the projecting point until it assumes the position shown in Figure 3 where it prevents further pivotal action of the latch-bar until it is released by a pull on cable 38.

Conventional types of oilers may be applied. A hole 44 is provided in plate 23 to reach an oiling mechanism in the end of shaft 19.

It should be understood that this invention is not limited to the exact forms shown or described.

I claim as my invention:

1. A latch useful on power driven dippers which comprises spaced supporting members attachable to a door, a shaft through two of said supporting members, a latch-bar pivotally mounted on said shaft intermediate the length of the bar, said bar being relieved arcuately at each end inwardly toward the door, the lower end of said bar being engageable with a slotted sill member, a shaft mounted on two of said supporting members, a trip member mounted pivotally on the shaft, a roller associated with one end of said trip member and engageable with the back of said latch-bar when it is in latching position, an arm extending beyond the pivot point of said trip member, a spring normally urging said arm away from the door so as to engage said roller with the end of said bar, and means for urging said arm toward the door thereby overcoming the effect of said spring and moving the roller away from said bar thereby permitting the bar to pivot.

2. A latch for doors carrying weight against the latch when the door is to be opened, comprising a latching device attachable to the door, said device comprising a pair of spaced shaft supports, shafts extending therethrough, a latch-bar pivotally mounted on one of said shafts intermediate the length of said bar, said bar being adapted to engage a sill member of the door, a trip member pivotally mounted on the other shaft, said trip member comprising a roller engageable with said latch-bar to prevent pivoting thereof when in latching position, and tending to urge the latch-bar out of latching position when in non-latching position.

3. A latch comprising, a latch-bar support, a latch-bar pivotally mounted on the support at a point intermediate the length of the bar, a trip support, a trip pivotally mounted thereon adjacent but spaced from one end of said bar and engageable therewith to prevent pivoting of the bar when it is in latching position, the opposite end of the bar adapted to engage a cooperating latch keeper, means normally urging said trip against said bar and means to which force may be applied to oppose the action of the last named means, thereby removing the retaining effect of the trip on said bar and permitting pivoting of said bar.

4. A latch comprising, a latch-bar support, a latch-bar pivotally mounted on the support at a point intermediate the length of the bar, a trip support, a trip pivotally mounted thereon

adjacent but spaced from one end of said bar and engageable therewith to prevent pivoting of the bar when it is in latching position, the opposite end of the bar adapted to engage a cooperating latch keeper, means normally urging said trip against said bar and means to which force may be applied to oppose the action of the last named means thereby removing the retaining effect of the trip on said bar and permitting pivoting of said bar, and a cover mountable over said latch-bar and said trip, said cover having an opening for said force applying means and an opening for the latch-bar.

5. A door latch for doors subjected to heavy door opening pressure, said latch tending to unlatch under the influence of said pressure when released, said latch comprising a support adapted to be mounted on a door; a latch bar pivotally mounted on said support intermediate the length of the bar, the forward end of said bar being adapted to selectively engage or disengage a cooperating latch keeper when the bar is pivotally rotated in one direction or the other; a trip member adapted to engage a surface on the rear end of the bar when in latching position thereby preventing rotation of the bar, said trip member also adapted to engage another surface of the rear end of the bar to urge the bar out of latching position when the bar is in non-latching position; means for impelling the trip member into engaging position with the bar, control means to actuate the trip member out of engaging position

at will against the influence of the impelling means thereby permitting the bar to rotate under the influence of a pressure against the door.

6. The latch of claim 5 characterized by the fact that the rear end of the bar comprises a cam surface and the trip member comprises a roller adapted to be engaged therewith.

7. The latch of claim 5 wherein the latch bar is substantially straight and centrally pivoted.

8. The latch according to claim 5 wherein the impelling means is a spring.

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