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JIB HOIST AND AUTOMATIC INTERLOCKING DEVICE FOR LOCOMOTIVE CRANES AND THE LIKE.

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1,428,539. Patented Sept. 12, 1922.

Fig. 1

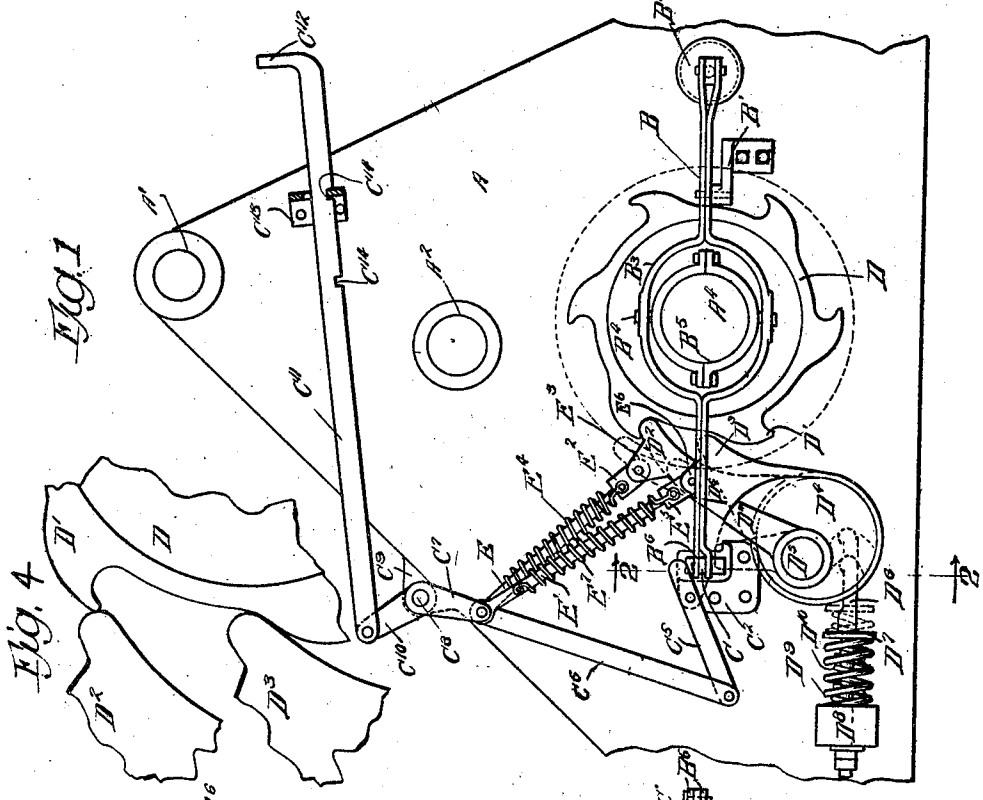


Fig. 4

Fig. 3

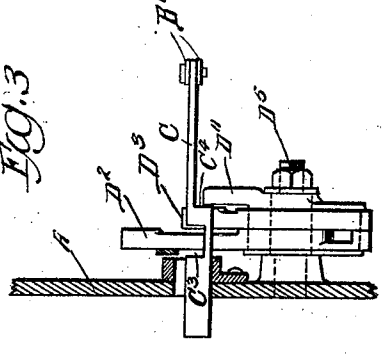
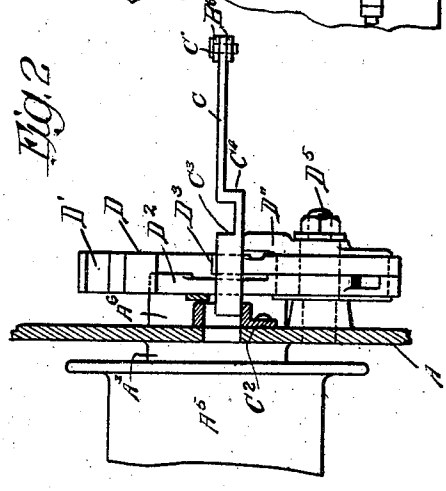


Fig. 2



Witnesses

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UNITED STATES PATENT OFFICE.

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JIB HOIST AND AUTOMATIC INTERLOCKING DEVICE FOR LOCOMOTIVE CRANES AND THE LIKE.

Application filed March 1, 1917. Serial No. 151,859.

To all whom it may concern:

Be it known that I, WALTER FERRIS, a citizen of the United States, residing at South Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Jib Hoists and Automatic Interlocking Devices for Locomotive Cranes and the like, of which the following is a specification.

My invention relates to improvements in jib hoists and automatic interlocking devices for locomotive cranes. It will be understood that it refers generally to that part of the crane controlling and operating mechanism which concerns itself with raising and lowering the jib or boom. It will be understood that unlike a locomotive steam shovel the boom or jib of the locomotive crane is adapted to be raised and lowered. Ordinarily this raising and lowering taken place before the work starts, but under some circumstances it must be raised and lowered carrying a full load. Ordinarily the arrangement of the machinery is such that when the engineer wishes to raise the jib he connects the hoisting engine with the operating drum to raise it and then when the raising has been done releases the connection between the engine and the drum and allows the drum which is held against rotation by ratchet and pawl to hold the jib in position.

In operating a wrecking crane it happens occasionally that the operator will forget to take the weight of the jib on the pawl and ratchet provided for that purpose before he throws out the clutch by means of which the jib hoist drum is driven. Whenever this occurs the boom of course falls. On my crane a positive interlocking arrangement has been provided, whereby it is impossible to open the clutch while the pawls are disengaged, so that at all times the load must be carried either by the engine or by the pawls.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation;

Figure 2 is a section along the line 2—2 of Figure 1 and shows the clutch out;

Figure 3 is a similar section with parts omitted showing the working parts in a different position with the clutch in.

Figure 4 is a digrammatic showing of the relation between the dogs and ratchet wheel.

Like parts are indicated by like characters in all the figures.

A is a side frame provided with journals A^1, A^2, A^3 wherein may be rotatably mounted shafts carrying any suitable operating drums. A^4 is a shaft rotatably mounted in the journals A^3. This shaft carries keyed thereon the jib hoisting drum A^5. A^6 is a housing containing a clutch not specifically illustrated. The clutch may be any suitable form such as a jaw clutch or the like.

B is a clutch lever pivoted on a bracket B^1 on the side frame A. B^2 is an air cylinder adapted to operate the clutch lever to engage and disengage the clutch. The clutch lever is forked as at B^3 to engage trunnions B^4 on the clutch controlling collar B^5. The forks are bent together beyond the clutch controlling collar and terminate in a fork B^6.

C is a latch bar pivoted by a pin C^1 in the fork B^6. It is adapted to slide on the bearing bracket C^2. It is slotted as at C^3 and provided with a shoulder C^4 and arranged to slide back and forth as the clutch lever is oscillated. C^5 is a latch lever pivoted on the bracket C^2. C^6 is a link pivoted at one end on the lever C^5 and at the other end on a lever C^7 which lever is rigidly mounted on a shaft C^8 and a bracket C^9 on the frame A. C^{10} is a lever rigidly mounted on the other end of the shaft C^8 and in pivotal connection with an operating bar C^{11} which bar is provided with a handle C^{12} and is slidably mounted in a bracket C^{13} and is notched as at C^{14} to engage said bracket.

D is a ratchet wheel mounted on that side of the clutch which carries the drum and having about is periphery a series of teeth D^1 adapted to be engaged by dogs D^2, D^3. These dogs are each of them rotatably mounted upon an eccentric bearing D^4 which eccentric bearing itself is rotatably mounted upon the pin D^5 projecting from the side frame A. The eccentric D^4 is socketed at one side of its engagement on the pin or stud D^5 to engage the thrust bar D^6. This thrust bar carries a collar D^7 rigidly mounted thereon and is slidable in the lug D^8. Springs D^9 and D^{10} surround the bar D^6 and are adapted to be compressed between the lug D^8 and the collar D^7, the arrangement being such that the lighter spring D^{10} is longer than the heavier spring D^9 and is

compressed partially before the heavier spring comes into operation. These two springs form a yielding abutment which through the eccentric and dogs hold the drum against rotation. D^{11} is a cam shaped locking lug formed on the eccentric D^4 adapted at certain times to come into engagement with the shoulder C^4 on the bar C.

The dogs D^2 and D^3 are controlled by the reach rods E, E^1 which are both pivoted on the lever C^7. The reach rod E extends into the pivoted socket E^2 which socket is pivoted on a lug E^3 on the dog D^2. The rod is slidable in said socket and is surrounded by a spring E^4 which is anchored at one end on the socket E^2 and at the other end on the rod adjacent it pivot point. The rod E^1 engages the socket E^5 pivoted on the lug E^6 on the dog D^3 being slidable therein. It is surrounded by a spring E^7 anchored at one end on the rod adjacent its pivot point and at the other end on the socket E^5.

It will be evident that while I have shown in my drawings an operative device, still many changes might be made both in size, shape and arrangement of parts without departing materially from the spirit of my invention and I wish, therefore, that my drawings be taken as in a sense diagrammatic.

The use and operation of my invention are as follows:—

The holding dogs are loosely mounted on a large eccentric which in turn is mounted on the stud rigidly set in the side frame. When either of these dogs carries a load the reaction will pass through the center of the eccentric. This tends to turn the eccentric on the stud and this turning tendency is resisted by a buffer spring which is preferably provided with a lighter auxiliary spring having a greater free length than the main spring. The primary purpose of mounting the dogs on the eccentric reacting against the buffer spring is to form a yielding abutment to absorb shocks received through the ratchet wheel.

In applying the interlocking device to this part of the mechanism the cam shaped projecting lug upon the eccentric, it will be noted, is located in such a position that where there is no reaction or no unusual load carried by either pawl, the buffer spring will push the eccentric around to this no load position so that the cam shaped locking lug crosses the path of the lower shoulder on the sliding bar and this prevents any outer movement of the bar, and therefore prevents disengagement of the clutch. The purpose of the light spring with the long travel is to get such positive and ample movement of the interlocking lug when the load carried by the pawls is at a minimum or merely due to the weight of the jib sufficient to insure a proper interlocking because the heavier stiffer spring might very easily not travel a sufficient distance to provide a positive and definite interlock.

The dogs may be withdrawn from engagement with the ratchet by the reach rods and levers as indicated, the peculiar features of these dogs being that the reach rods while pivoted to the lever are slidable in the pivotal heads so that they may thrust the dogs inwardly by a positive connection but slide outwardly away from the dogs when moved in the opposite direction. The rods E, E′, are loosely socketed at E^2, E^5. The shoulders shown on these rods partially concealed by the springs provide a positive connection with the sockets E^2, E^5, and the rods exert their pressure on the sockets E^2, E^5, so that these shoulders limit the inward movement of the rods toward the sockets to get a positive downward pressure, but since the necked down end of the rod is slidable in the sockets, the rods may withdraw slightly, thus putting the spring under tension, which, when the load on the pawl is released, will pull the pawl up and bring the socket back against the shoulder on the rods. However when so moved they cause the exertion of a tension in the coil springs tending yieldingly to draw the dogs outwardly. When it is desired to withdraw the dogs from engagement with the ratchet the operating lever or connecting arm is moved to the right rotating the short lever, drawing up on the reach rod and exerting a tension in the spring. One dog will, of course, not being held by the load applied to the ratchet wheel, immediately draw away from the ratchet, the other one being held by the load on the drum will not be free to move, but when power is applied and the drum is rotated in a clockwise direction, the dog will be released and the spring will instantly draw it away from the ratchet teeth. It will be noted, of course, when the parts are in the position shown in Figure 2, the lever cannot be moved because when it is moved the short interlocking or latch lever must engage the notch in the sliding bar and in the position shown in Figure 2 is cannot engage it. It is only when the clutch is thrown in that the notch is in such position that it can be engaged by the interlocking lever and it is only at such time when the parts are in the position shown in Figure 3 that the controlling rod can be drawn to the right to exert the tension which tends to move the dogs out of the locking position.

Assuming now that the jib or boom was being supported upon the pawl and the hoisting engine is being used for other purposes the clutch will have been disengaged by the power cylinder and it is desirable that the mechanism be so arranged that no

steps towards disengaging the pawls be taken unless the sliding jaw clutch is fully engaged, as experience has shown that this clutch is sometimes carelessly engaged on the corners only and when these corners become rounded from continuous use the clutch may slip or be wedged out after the load has been raised and after the dogs have been disengaged. Such a situation is obviously guarded against by the notch in the sliding bar which as indicated is so narrow that only when the clutch is fully in can the latch lever connected to the dog controlling apparatus swing down to permit the dogs to be disengaged because at other times the latch lever will strike the top of the bar and the dogs could not be free.

As soon as the clutch, however, is fully engaged the operating lever may be moved and caught in the inner notch C^{14} so that it will be set to stretch the spring and of course, as scoon as the engine is started and the load lifted off the dog the spring will contract and lift the dog out. This release of the load even of the jib only from the dog will permit the buffer spring to expand and throw the cam in front of the shoulder on the sliding bar and this will prevent any withdrawl of the clutch because the cam-like member is now in front of the shoulder and the sliding bar cannot be withdrawn until the load is again carried by the dog and until that load has caused the pressure on the dog to rotate the eccentric against the abutment spring until the cam is rotated into the position shown in full lines in Figure 1 and this absolutely prevents disengagement of the hoisting clutch by inadvertence or carelessness of the operator until one of the pawls has taken the load as indicated by the compression spring resulting in the rotation of the eccentric and a removal of the locking cam from its position in front of the sliding bar. A third possibility of accident lies in the possible engagement of one of the dogs with the overhanging end of a corresponding ratchet tooth in such a position that it may slip off and thereby drop the load. This possibility and the provision against such an accident is made clear in Figure 4. It will be seen that the profile of the ratchet wheel is such that the arc between two teeth is divided into halves, the periphery through one half of the arc being circular, and the remaining half gradually rising to the height of the ratchet tooth. This circular periphery is at the minimum radius of the root of the tooth and it is obvious from inspection that when either one of the dogs is either engaged fully or partially with a ratchet tooth, the other is lying against the surface of minimum radius and in position of engagement, although removed by one half of a tooth pitch from the tooth with which it would next engage. Therefore if one dog should slip out the other would immediately engage with the same tooth of the ratchet wheel from which the first had slipped as soon as the ratchet wheel had revolved through one half of the tooth pitch. This happens no matter which dog slips. If it is the upper dog the lower one will catch on the same tooth as the ratchet wheel comes around. If it is the lower dog that first engages, the upper will catch on the next tooth as it comes around so there is no possibility of a slip getting away from both these dogs under any circumstances.

Assuming now that the clutch has been released and the load is carried by one of the pawls, if the operator now try to withdraw it it would be necessary for him to withdraw the operating bar to the right which acting through the bell crank and lever connections would rotate the locking end of the interlocking lever downwardly against the surfaces of the sliding rod and this cannot be done until the clutch is thrust into engagement thus sliding the rod to the left until the notch in its upper surface is penetrated by the inner locking end of the lever.

I claim:—

1. In a hoisting mechanism, a winding drum and driving gear therefor, a ratchet wheel connected to the driving gear and provided with a pawl, a source of power, a disengaging clutch interposed between the source of power and the gear, operating means for engaging and disengaging the supporting pawl, other operating means for engaging and disengaging the clutch and an interlocking apparatus comprising a member attached to the clutch operating means and carrying a member engageable with the pawl operating mechanism and another member engageable with the pawl supporting mechanism whereby the clutch cannot be withdrawn until the pawl is supporting the load and the pawl cannot be withdrawn until the clutch is fully engaged.

2. A safety detent gear to prevent the fall of a load supported by a winding drum comprising a ratchet wheel member connected with the winding gear of said drum, a pawl engaging said ratchet wheel and mounted on a yielding support, a source of power, a clutch for engaging said source of power with the winding gear and an operating means for the pawl comprising a yielding member attached directly to the pawl and a non-yielding member interlocking with the clutch operating means.

3. A safety detent gear to prevent the fall of a load supported by a winding drum comprising a ratchet wheel member connected with the winding gear of said drum, a pawl engaging said ratchet wheel and mounted on a yielding support, a source of power, a

clutch and operating means therefor for engaging said source of power with the winding gear and operating means for the pawl comprising a yielding member attached directly to the pawl, a non-yielding member interlocking with the clutch operating means to prevent the clutch from being withdrawn and a member operated by the movement of the pawl and also interlocking with the clutch operating means.

4. A safety detent gear to prevent the fall of a load supported by a winding drum comprising a ratchet wheel member connected with the winding gear of said drum, a pawl engaging said ratchet wheel and mounted on a yielding support, a source of power, a clutch and operating means therefor for engaging said source of power with the winding gear and operating means for the pawl comprising a yielding member attached directly to the pawl, a non-yielding member interlocking with the clutch operating means to prevent the clutch from being withdrawn and a member operated by the yielding movement of the pawl when co-acting against the ratchet wheel, which member also interlocks with the clutch operating means.

5. In a detent motion a ratchet wheel, a pawl permissibly engaging said ratchet wheel and mounted upon a yielding abutment, a clutch which drives the ratchet wheel, means for disengaging the clutch and means operated by the yielding abutment for preventing disengagement of the clutch.

6. In a detent motion a ratchet wheel, a pawl permissibly engaging said ratchet wheel by gravity or otherwise, a yielding operating member which may be set to cause withdrawal of the pawl when the load is relieved therefrom, and non-yielding interlocking means which functions to prevent the movement of the yielding member during period of interlock.

7. In a hoisting mechanism a winding drum and driving gear therefor comprising a detent mechanism, a source of power, a clutch interposed between the source of power and the gear, operating means for engaging and disengaging the detent mechanism, operating means for engaging and disengaging the clutch comprising a member attached to a clutch lever carrying a member engaging with the detent mechanism operating mechanism and a member engaging with the detent mechanism supporting mechanism whereby the clutch cannot be withdrawn until the detent mechanism is supporting the load and the detent mechanism cannot be withdrawn until the clutch is fully engaged.

8. A safety detent gear to prevent the fall of a load supported by a rotating member comprising a detent device connected to the rotating member a part of said detent being mounted on a yielding support another part being mounted on the rotating member, a source of power, a clutch between the rotating member and the power source, an operating means for the detent comprising a yielding member attached directly to a part thereof and a non-yielding cam interlocking with the clutch operating means.

9. A safety detent gear to prevent the fall of a load supported by a rotating member comprising a detent device connected to the rotating member a part of said detent being mounted on a yielding support another part being mounted on the rotating member, a source of power, a clutch between the rotating member and the power source, an operating means for the detent comprising a yielding member attached directly to a part thereof and a non-yielding cam interlocking with the clutch operating means and a member operated by the movement of the detent and also interlocking with the clutch operating means.

In testimony whereof, I affix my signature in the presence of two witnesses this 28th day of February, 1917.

WALTER FERRIS.

Witnesses:

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