July 17, 1962 R. J. HARRY 3,044,639

LOCK ROD MECHANISM

Filed Oct. 30, 1958

Fig. 1.

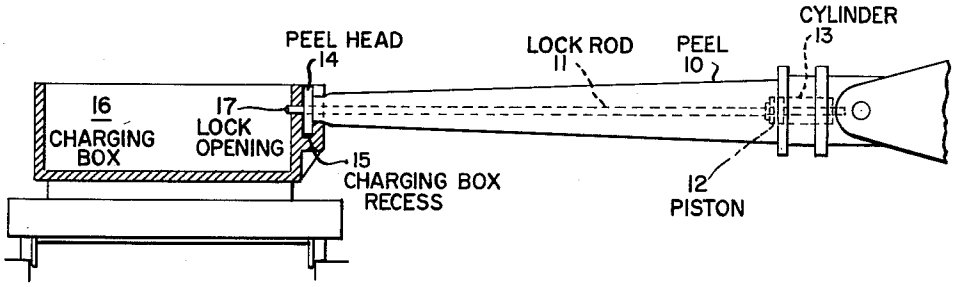


Fig. 2.

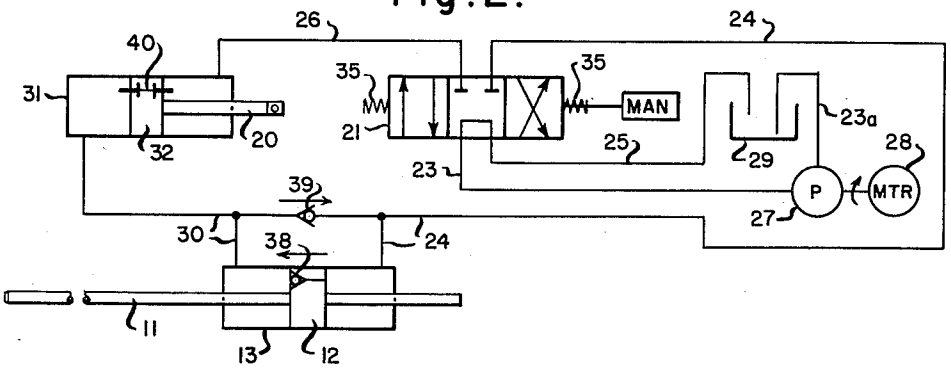


Fig. 3.

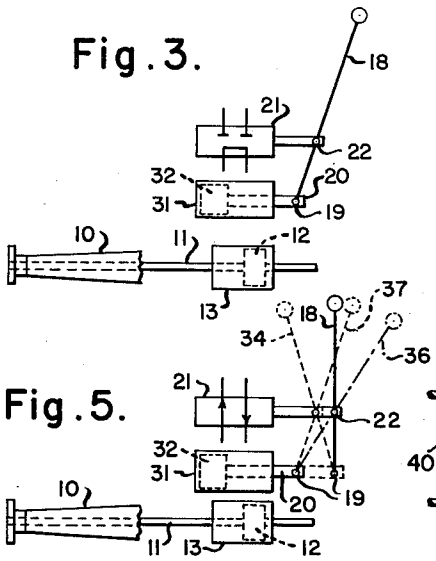


Fig. 4.

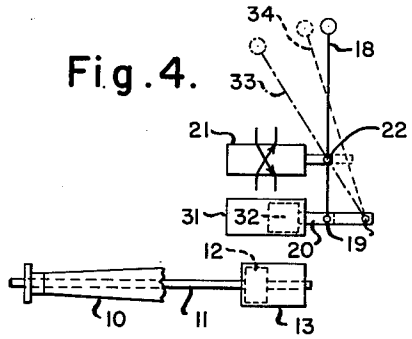
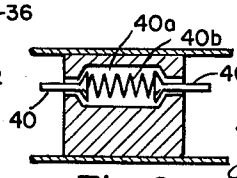


Fig. 5.

Fig. 6



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United States Patent Office 3,044,639 Patented July 17, 1962

3,044,639

LOCK ROD MECHANISM

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Filed Oct. 30, 1958, Ser. No. 770,746
9 Claims. (Cl. 214—31)

This invention relates to lock rod mechanism and particularly to the locking of an open hearth charging machine to a charging box and comprises new features and improvements assuring said locking to a positive certainty. In an open hearth charging machine and the like, the lock rod extends from the head of the peel of the charging machine and engages a hole in the charging box provided for its reception. When in locked position, the lock rod prevents the box from falling off the peel head when the box is lifted by the machine and rotated in the open hearth furnace. Prior to my invention, it was possible and not altogether uncommon for the lock rod to partially or completely fail to enter and engage the hole in the box. However, the head of the peel could, nevertheless, bind in the recess provided for its reception at the end of the box and thereby still permit the box to be picked up by the machine. If the box is sufficiently jarred during manipulation, it would fall off the peel end onto whatever or whomever was beneath it; but the more likely result was that when the charging machine operator positioned the box inside the open hearth and rotated it, the box, as well as its contents, was discharged into the furnace, thereby losing an expensive piece of equipment. With my invention, this problem is completely eliminated.

I provide a control arm member, a reversible valve means connected to said control arm and responsive thereto, a fluid motor means delivering fluid to said valve means, at least two fluid pressure cylinder means, a reciprocating member in each such cylinder means, receiving fluid from said valve means, fluid transmission means between said fluid pressure cylinder means whereby said reciprocating members are responsive to each other, a lock rod member engaged by one reciprocating member and responsive thereto, a control rod member engaged by another of said reciprocating members and responsive thereto, said control rod member being in engagement with the control arm member and responsive thereto, whereby movement of said control arm member indicates the position of the lock rod member, and fluid transmission means returning the fluid from the cylinder means to the fluid reservoir.

Preferably, I also further provide other safety features including a check valve located in the piston with the lock rod attached whereby under certain conditions fluid may pass through the check valve and thus permit the piston and lock rod to retract without fluid pressure being delivered by the pump.

In a preferred embodiment, I further provide a fluid transmission line, with a check valve in it, that bypasses the lock rod cylinder, whereby when the lock rod piston is out of synchronization with the rest of the system, the fluid may bypass through this check valve and thereby resynchronize the system.

Poppet valves are preferably provided in the control rod piston through which the fluid may pass when the control rod piston is out of synchronization and thereby resynchronize the system.

Other details, objects and advantages of my invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings, I have shown a present preferred embodiment of the invention in which:

FIGURE 1 is a side view, partly in section of the peel of a charging machine in engaging relation with a charging box;

FIGURE 2 is a somewhat diagrammatic elevational view of the system;

FIGURE 3 is a schematic fragmentary view of one position of the rods and arm in synchronous relationship, with the valve in neutral position;

FIGURE 4 is a schematic fragmentary view of another position of the rods and arm in synchronous relationship, with the valve in a forward operating position; and

FIGURE 5 is a schematic fragmentary view of still another position of the rods and arm in synchronous relationship, with the valve in a retracting operating position.

FIGURE 6 is a fragmentary section through the poppet valves in the positioning cylinder.

Referring now more particularly to the drawings, and initially to FIGURE 1, the charging machine peel **10**, has within it a lock rod **11** substantially rigidly attached at one end of the peel to a piston **12** within a cylinder **13** supported at the other end by a peel head **14** through which the lock rod advances and retracts. The peel head is lowered into a recess **15** provided for its reception in the end of the charging box **16**. The peel head and charging box recess are of conventional form. The lock rod is then advanced to engage an opening **17** provided for its reception in the end of charging box **16**. As shown in FIGURE 1, the lock rod is in its advanced or locked position and the charging box **16** is ready to be lifted by raising the charging machine peel **10**, and may be safely moved and rotated without any danger of its falling off the peel.

The operator, desiring to advance the lock rod, pushes the control arm **18** from a neutral position, as in FIGURE 3, into its forward position. Pivoting at point **19** where it is pivotally connected to control rod **20** the control arm **18** advances a manually controlled 4-way three position spring centered valve **21**, pivotally connected thereto at **22**, into its forward position as in FIGURE 4.

This connects the fluid transmission lines **23**, **24**, **30**, **26** and **25** in forward operating relationship. Referring now to FIGURE 2, pump **27** powered by motor **28** will then pump fluid from the reservoir **29**, through line **23***a* and the pump, then through line **23**, thence through line **24** into lock rod cylinder **13**, thereby advancing lock rod piston **12** which advances lock rod **11** into its engaging or locked position. As piston **12** advances, it displaces the fluid on the other side of piston **12**. Said displaced fluid is transmitted through line **30** into cylinder **31** containing a piston **32** to which is substantially rigidly connected control rod **20**. Piston **32** and control rod **20** are thereby advanced. The fluid on the other side of piston **32** is thereby displaced and said fluid is transmitted through line **26**, through valve **21** and line **25** into reservoir **29**. As control rod **20** advances to its forward position, control arm **18**, pivotally connected thereto at **19**, is thereby shifted into its forwardmost position **33**. This immediately informs the operator that the lock rod is positively locked in the opening of the charging box.

If the lock rod is not aligned with opening **17**, it cannot advance, thus piston **12** cannot advance to displace the fluid on the other side of it which in turn means that piston **32** and control rod **20** do not advance and thus control arm **18** is not shifted to its forwardmost position **33**, which informs the operator that the lock rod is not in locking engagement with opening **17** of the charging box and that he must further adjust the position of the peel until it is properly aligned. Ultimate proper engagement will be indicated to him when the control arm **18** finally shifts to its forwardmost position **33**.

When the control arm 18 shifts to its forwardmost position under pressure from the operator, the operator releases the control arm which is then shifted to forward position 34, as indicated in FIGURE 4, by the spring centering action of the springs 35 of valve 21. This positions valve 21 in a neutral or locking position whereby only lines 23 and 25 are in operative relationship with each other and thus substantially "freezes" or locks the remainder of the system with the pistons 12 and 32 and rods 11 and 20 substantially locked in whatever position they happen to be when the control arm is released. In this position pump 27 powered by motor 28 transmits the fluid from reservoir 29 through line 23*a*, the pump and line 23, through valve 21 into line 25 and back into reservoir 29, bypassing the rest of the system.

When the operator completes his charge he will then wish to release charging box 16. To do this the control arm 18 is moved to the rear as shown in FIGURE 5. As control arm 18, pivoting at 19, moves to the rear, valve 21, pivotally connected thereto at 22, is moved from its neutral or locking position to its retracting position. This connects lines 23, 26, 30, 24 and 25 in a retractive operating position. In this relationship the pump transmits fluid from reservoir 29 through line 23*a*, the pump and line 23, through valve 21 and then through line 26 into cylinder 31. This moves piston 32 and control rod 20 to their retracted position. The fluid displaced on the other side of the piston 32 is transmitted through line 30 into cylinder 13 and moves piston 12 and lock rod 11 into a retracted position. Fluid is prevented from passing through the check valve 39 (more fully described later) by reason of the fact that the valve 39, like check valve 38, is set to operate at a pressure higher than the normal operating pressure of the system. The fluid displaced on the other side of piston 12 is transmitted through line 24, through valve 21 into line 25 and thence into the reservoir. As lock rod 11 is moved to a retracted position, it withdraws from opening 17 and the peel is then free to be disengaged by raising the peel head out of recess 15. As control rod 20 is retracted, control arm 18 is shifted to its rearmost position 36, as shown in FIGURE 5. This indicates to the operator that the lock rod 11 should be retracted and he may now proceed to raise and disengage the peel from the charging box. The operator then releases control arm 18, which thereupon shifts to position 37 by virtue of the action of the self-centering springs 35. Valve 21, thereby returned to its neutral position by springs 35 thereupon substantially locks the system in the retracted position.

Located in piston 12 is a check valve 38, set to operate only at pressures somewhat above the maximum pressure deliverable by pump 27. For example, if the maximum pressure deliverable by the pump is 300 p.s.i. then the check valve 38 may be set at 350 p.s.i. Further, check valve 38 is operable in one direction only, so that fluid will flow only in the direction that permits piston 12 and lock rod 11 to retract. Thus, if lock rod 11 is somehow bumped, while in its advanced position, creating a pressure of 350 p.s.i. or above, check valve 38 will open to permit the passage of fluid and piston 12 with lock rod 11 may thereby retract. In this event, however, the system will be out of synchronizatoin, the control rod 20 with piston 32 being in an advanced position and the lock rod 11 with piston 12 being in a retracted position. So that the system may resynchronize itself, I provide a check valve 39 located between lines 24 and 30 and poppet valves 40 located in a chamber 40*a* in piston 32. Poppet valves 40 are opposed to each other and are urged apart by spring 40*b* so that when the protruding valve stems are not in engagement with the end of the cylinder, no fluid will pass through the piston. However, when the system is out of synchronism, piston 32 will advance or retract in the cylinder beyond the normal travel. In such case the protruding stem of the poppet valve would come into contact with the end of the cylinder and open the poppet valve, permitting the fluid to pass through the port opening unrestricted. This occurs at both extreme ends of the travel. Since these valves are opposed to each other oil can pass through piston 32 only when the protruding stem opens the poppet valve. Thus, assuming the system is out of synchronization as described above, if the operator attempts to retract lock rod 11, it having already been bumped into its retracted position, piston 32 and control rod 20 will retract, the displaced fluid on the other side of piston 32 being unable to flow into the already retracted cylinder 13 will instead flow from line 30 through check valve 39, which like check valve 38 is set to operate at a pressure somewhat above the maximum pressure deliverable by pump 27, into line 24 and thus resynchronize the system.

On the other hand, if the operator attempts to advance the lock rod, the fluid will move piston 12 and the lock rod to the advanced position. The displaced fluid on the other side of piston 12 will be transmitted by line 30 into cylinder 31 and since piston 32 and control rod 20 are already advanced, the fluid will pass through poppet valves 40 into line 26, thus resynchronizing the system.

Similarly, if the system goes out of synchronization in the other direction, i.e., the lock rod 11 and piston 12 in advanced position and piston 32 with control rod 20 in retracted position, the poppet valves 40 will permit the system to resynchronize itself. In this case, the operator will first proceed to retract the lock rod 11. Since piston 32 and control rod 20 are already retracted, the fluid will flow through poppet valves 40 into line 30 and cylinder 13, thus retracting lock rod 11 and piston 12 and resynchronizing the system.

While I have shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. In a charging machine having a peel, a head adapted to engage a charging box and a lock rod movable lengthwise of the peel and movable from a position in the peel head to a locked position in an opening in the body of the charging box, a lock rod control mechanism comprising a control arm member, a reversible valve means pivotally connected to said control arm and responsive thereto, a source of fluid pressure delivering fluid to said valve means, at least two fluid pressure cylinder means, a reciprocating member in each such cylinder means receiving fluid from said valve means, fluid transmission means between said fluid pressure cylinder means whereby said reciprocating members are responsive to each other, said lock rod member engaged by one reciprocating member and responsive thereto, a control rod member engaged by another of said reciprocating members and responsive thereto, said control rod member being in engagement with the control arm member and acting thereon to move it about its pivot on the reversible valve means whereby movement of said control arm member indicates the position of the lock rod member with respect to the peel head and the opening in the charging box, and fluid transmission means returning the fluid from the cylinder means to the source of fluid pressure.

2. In a charging machine having a peel, a head adapted to engage a charging box and a lock rod movable lengthwise of the peel and movable from a position in the peel head to a locked position in an opening in the body of the charging box, a lock rod control mechanism for open hearth charging machines comprising a manually operable control arm member, a spring centered reversible valve means pivotally connected to said control arm and responsive thereto, a source of fluid pressure delivering fluid to said valve means, a fluid pressure cylinder means, a reciprocating member in said cylinder receiving fluid

from said valve, a lock rod member engaged by said reciprocating member and responsive thereto, another fluid pressure cylinder means, a reciprocating member in said another cylinder means receiving fluid from the fluid pressure means, a control rod member engaged by said reciprocating member and responsive thereto, fluid transmission means from each cylinder means to the valve means, second fluid transmission means between each cylinder means whereby each reciprocating member is responsive to the other reciprocating member, the control arm member being pivotally engaged by the control rod member and responsive thereto to be moved about its pivot on the reversible valve means whereby movement of said control arm member indicates the position of the lock rod member with respect to the peel head and the opening in the charging box, and fluid transmission means returning the fluid from the cylinder means to the source of fluid pressure.

3. In a charging machine having a peel, a head adapted to engage a charging box and a lock rod movable lengthwise of the peel and movable from a position in the peel head to a locked position in an opening in the body of the charging box, a lock rod control mechanism for open hearth charging machines comprising a manually operable control arm member, a four-way three position spring centered valve means pivotally engaged by said control arm member and responsive thereto, a source of fluid pressure delivering fluid to said valve means, a fluid pressure cylinder means, a reciprocating member in said cylinder receiving fluid from said valve and actuated thereby, a lock rod member substantially rigidly engaged by and responsive to said reciprocating member, fluid transmission means connecting the valve and said cylinder means on one side of the reciprocating member, a second fluid pressure cylinder means, a reciprocating member in said second cylinder means, a control rod member substantially rigidly engaged by and responsive to said second mentioned reciprocating member, fluid transmission means connecting the valve and said second cylinder means on one side of said second mentioned reciprocating member, second fluid transmission means connecting the two cylinder means on the other sides of said reciprocating members, whereby the reciprocating members are responsive to each other, the control arm member being pivotally engaged by the control rod member and responsive thereto whereby the movement of the control arm member indicates the position of the lock rod member, and fluid transmission means returning the fluid from the several cylinder means to the source of fluid pressure.

4. A lock rod control mechanism in accordance with claim 1 including a check valve means in the reciprocating member engaging the lock rod member whereby fluid may pass through said check valve from one side of said reciprocating member to the other thereby allowing the lock rod member and said reciprocating member to retract in the event excessive pressure is applied to the end of the lock rod at any time.

5. A lock rod control mechanism as claimed in claim 1 including a fluid transmission means bypassing the cylinder means with the lock rod member, check valve means in said fluid transmission means whereby the fluid may bypass the said cylinder means with the lock rod member when the reciprocating member of said cylinder means with the lock rod member is out of synchronization with respect to the reciprocating member carrying the control rod member and thereby resynchronize the system.

6. A lock rod control mechanism as claimed in claim 1 including a poppet valve means in the reciprocating member engaging the control rod means whereby the fluid may pass through said poppet valve means whenever the reciprocating member of said cylinder means with the lock rod member is out of synchronization with respect to the reciprocating member carrying the control rod member and thereby resynchronize the system.

7. A lock rod control mechanism in accordance with claim 1 including a check valve means in the reciprocating member engaging the lock rod member whereby fluid may pass through said check valve from one side of said reciprocating member to the other thereby allowing the lock rod member and said reciprocating member to retract in the event excessive pressure is applied to the end of the lock rod member, a fluid transmission means bypassing the cylinder means with the lock rod member, check valve means in said fluid transmission means whereby the fluid may bypass the said cylinder means with the lock rod member when the reciprocating member of said cylinder means with the lock rod member is out of synchronization with respect to the reciprocating member carrying the control rod member and thereby resynchronize the system.

8. A lock rod control mechanism in accordance with claim 1 including a check valve means in the reciprocating member engaging the lock rod member whereby fluid may pass through said check valve from one side of said reciprocating member to the other side thereby allowing the lock rod member and said reciprocating member to retract in the event excessive pressure is applied to the end of the lock rod member, and a poppet valve means in the reciprocating member engaging the control rod means whereby the fluid may pass through said poppet valve means whenever the reciprocating member of said cylinder means with the lock rod member is out of synchronization with respect to the reciprocating member carrying the control rod member, and thereby resynchronize the system.

9. A lock rod control mechanism in accordance with claim 1 including a check valve means in the reciprocating member engaging the lock rod member whereby fluid may pass through said check valve and thereby allow the lock rod member and said reciprocating member to retract in the event excessive pressure is applied to the lock rod member, a fluid transmission means containing a check valve means bypassing the cylinder means with the lock rod member whereby the fluid may bypass the said cylinder means when the reciprocating member of said cylinder means is out of synchronization and thereby resynchronize the system, and a poppet valve means in the reciprocating member engaging the control rod means whereby the fluid may pass through said poppet valve means whenever the reciprocating member of said cylinder means with the lock rod member is out of synchronization with the reciprocating member carrying the control rod member and thereby resynchronize the system.

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