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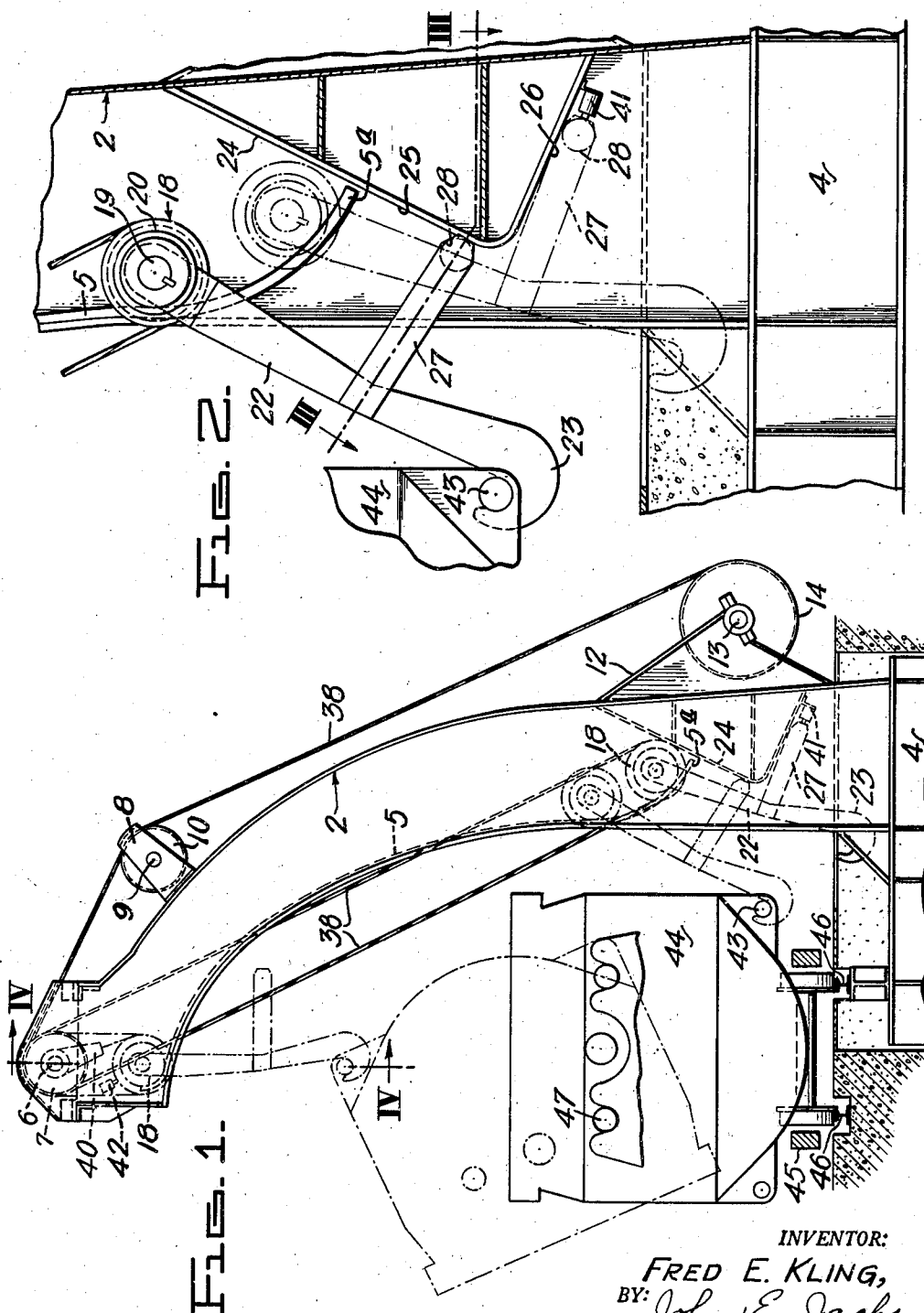
F. E. KLING

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LADLE TILTING APPARATUS

Filed Nov. 2, 1944

2 Sheets-Sheet 1



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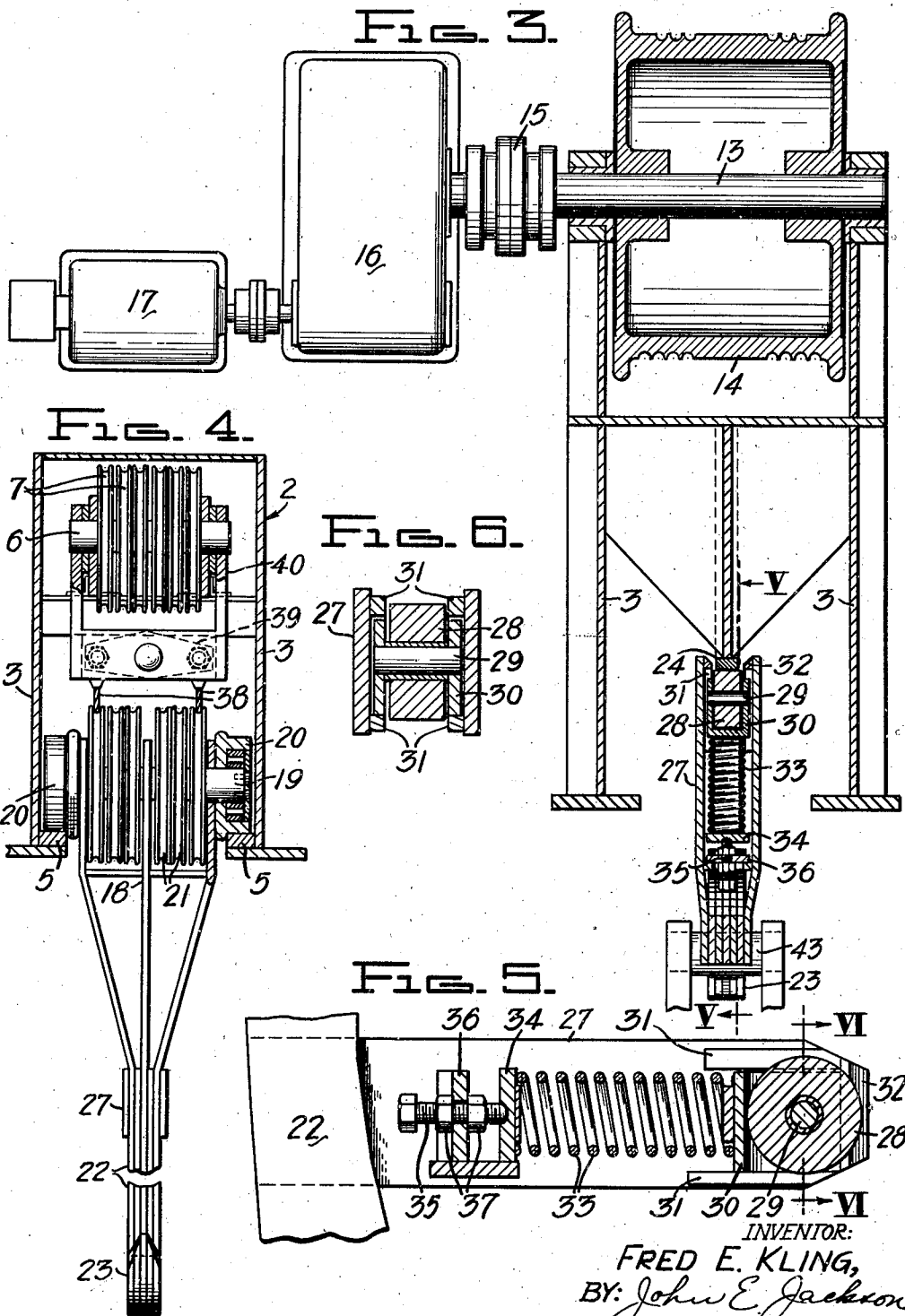
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UNITED STATES PATENT OFFICE

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LADLE TILTING APPARATUS

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6 Claims. (Cl. 214-64)

This invention relates to a ladle tilting apparatus, and particularly to an improved automatic hook connecting mechanism therefor.

In the casting of hot metal, it is disposed usually in a large ladle which is supported on a car or truck for transporting the same to a point where it is poured into the molds of a pig-casting machine or into smaller transfer ladles. The car or truck is properly positioned with regard to a pouring stand and the ladle is tilted on the truck to effect a pour. This tilting is usually performed by means of a hook which is suspended from an overhead lifting device. It is to an improved means or hook mechanism for automatically tilting the ladle for pouring the metal that the present invention relates.

Accordingly, it is the general object of the present invention to provide an improved hook mechanism for apparatus of this class which will automatically engage with and disengage from the ladles to be tilted.

It is another object of the invention to provide an improved hook mechanism for ladle tilting apparatus which will be moved automatically to a retracted position out of the way of the operator and workmen when not in use so as to eliminate any obstruction or hazard to the workmen in the vicinity of the pouring operation.

It is a further object of the invention to provide an improved automatic hook mechanism for ladle tilting apparatus which is simple and inexpensive in its construction, and, at the same time, efficient and effective in its use.

Various other objects and advantages of this invention will be more apparent in the course of the following specification and will be particularly pointed out in the appended claims.

In the accompanying drawings there is shown, for the purpose of illustration, an embodiment which my invention may assume in practice.

In these drawings:

Figure 1 is a side elevational view of a ladle tilting apparatus showing the improved automatic hook mechanism of my invention incorporated therewith;

Figure 2 is an enlarged side view of my improved hook mechanism;

Figure 3 is a sectional view taken on line III—III of Figure 2;

Figure 4 is a sectional view taken on line IV—IV of Figure 1;

Figure 5 is a sectional view taken on line V—V of Figure 3; and

Figure 6 is a sectional view taken on line VI—VI of Figure 5.

Referring more particularly to the drawings, there is shown an upwardly and forwardly arcuated mast 2 consisting preferably of a pair of spaced apart structural members 3 which are suitably arranged on a base 4 preferably positioned below the floor level, as shown in Figure 1. On the inner side of each of the structural members 3, there is arranged an inwardly extending flange portion 5 which is adapted to act as a track. At the upper end of the mast 2, there is arranged between the structural members 3, a transversely extending shaft 6 on which there is mounted a plurality of sheaves 7. Intermediate the height of the mast 2, on the outer side thereof, there is arranged a bracket member 8 which carries a shaft 9 and upon which, in turn, there is mounted a pair of sheaves 10. Adjacent the bottom of the mast 2, on the outer side thereof, there is positioned preferably another bracket member 12, on which there is mounted a shaft 13 carrying preferably a grooved drum 14. The shaft 13 is connected preferably by means of a coupling 15 to a gear reduction unit 16, and the gear reduction unit, in turn, is connected to preferably a reversible electric motor 17.

According to the present invention, there is arranged within the mast 2 between the structural members 3, a trolley 18 consisting preferably of a transversely extending shaft 19 having a wheel or roller 20 arranged on each end thereof which are adapted to cooperate with and ride along the flange or track portions 5 of the structural members 3. Between the rollers 20, there is mounted on the shaft 19, a plurality of rotatable sheaves 21 and a downwardly extending hook 22 having a hook portion 23 arranged on the extreme lower end thereof which is adapted to cooperate with the ladle to be tilted in a manner hereinafter to be described. Within the mast 2 adjacent the bottom thereof and at a point directly opposite the drum 14, there is arranged a cam member 24 which is positioned centrally between the structural members 3 with the upper and lower cam surfaces 25 and 26, respectively, of the cam member disposed substantially at right angles to each other. The lower end of each of the flanges or tracks 5 preferably is curved inwardly toward the center of the mast as at 5^a and terminate at a point directly opposite the upper cam surface 25 of the cam member 24.

Intermediate the length of the hook 22, there is integrally arranged therewith, a rearwardly extending hollow arm portion 27 having a roller 28 rotatably arranged in the outer end thereof which

is adapted to act as a cam follower and cooperates with the cam surfaces 25 and 26 of the cam 24, in a manner to be described. As more clearly shown in Figures 3, 5, and 6 of the drawings, the roller 28 is preferably mounted on a stud shaft 29 preferably carried by a U-shaped member 30 movably mounted within the arm-like portion 27. The member 30 is guided in its movement within the arm portion preferably by means of horizontally disposed top and bottom guide portions 31 carried by the arm portion, and is prevented from movement out through the end of the arm portion preferably by means of vertically extending side stop portions 32. Within the arm portion 27, there is arranged also preferably a compression coil spring 33 with one end thereof bearing against the bottom of the U-shaped member 30 and at the opposite end of the coil spring 33, there is arranged a movable plate-like seating member 34. There is arranged also within the arm portion 27, an adjusting screw 35 which is carried by a plate member 36 suitably attached to the arm portion. There is positioned on the screw 35, a pair of lock nuts 37, and the inner end of the screw is positioned against the plate or seating member 34, and it is the purpose of the screw to adjust the compressive force of the spring 33 in a well known manner. It is the purpose of the coil springs 33 to maintain the roller 28 in its outermost position in the arm portion 27 for a purpose which will hereinafter become apparent.

There is arranged around the sheaves 7 of the trolley 18, the sheaves 7 arranged at the top of the mast, over the sheaves 10 and the drum 14, preferably a pair of cables or ropes 38 for manipulating the trolley. One end of each of the cables 38 is attached preferably to an equalizer 39 carried by a U-shaped member 40 which is pivotally connected to the shaft 6 at the upper end of the mast 2. The opposite end of each of the cables 38 is connected to the drum 14 and are adapted to be wound therearound.

Directly below the lower cam surface 26 of the cam member 24, there is arranged preferably a limit switch 41 with which the hook 22 cooperates for deenergizing the motor 17 when the hook is moved to its lowermost position, and there is arranged at the top of the mast 2 preferably another limit switch 42 with which the hook cooperates to deenergize the motor 17 when the hook has been moved to its uppermost position on the mast.

In operation, the motor 17 is energized, and the drum 14 to which the cables 38 are attached is then rotated through the action of the gear reduction unit 16 and the coupling 15. Upon rotation of the drum 14, the cables 38 will be wound therearound, and the trolley 18 will be moved upwardly along the track 5 due to the action thereof. As the trolley 18 is moved upwardly over the inwardly curved lower ends 5^a of the track 5, it will be seen that the hook 22 arranged therewith will also be moved and that the roller 28 carried by the arm portion 27 will move along the lower cam surface 26 of the cam 24, and the hook will be moved outwardly from within the mast. After the roller 28 has passed along the cam surface 26 to the outer side of the cam, it will be seen that the hook portion 23 will be forced outwardly and upwardly into engagement with a horizontally disposed pin 43 carried by a ladle 44 adapted to be tilted, as shown in the broken lines of Figure 1 and the full lines of Figure 2. It will be understood that the ladle 44 is mounted on a truck or car 45 which is positioned on rails 46 directly opposite the mast 2.

Upon further movement of the trolley 18 upwardly along the inclined track 5 to the top of the mast, it will be seen that the ladle 44 is tilted about the fulcrum or pivot 47 so that the contents thereof are poured therefrom, as shown in the broken lines of Figure 1 of the drawings. When the trolley 18, together with the hook 22 carried thereby, reaches its uppermost position on the mast, it will be seen that the trolley strikes the limit switch 42 thereby deenergizing the motor 17. After the pouring of the hot metal from the ladle 44 has been completed, the motor 17 is energized so as to travel in a reverse direction and the cables 38 are unwound from the drum 14 thereby permitting the trolley 18 to pass downwardly along the track 5. As the trolley 18 approaches the curved portion of the track, it will be seen that the roller 28 carried by the arm portion 27 of the hook 22 will again contact the upper cam surface 25 of the cam member 24. As the trolley 18 continues to move downwardly, it will be seen that it moves inwardly of the mast over the curved lower ends 5^a of the track 5 and that the roller 28 passes from the cam surface 25 and down over the lower cam surface 26 thereby disengaging the hook portion 23 from the pin 43 of the ladle 44 and returning the ladle to its normal position on the truck 45. When the hook 22 reaches its lowermost position, as shown in the full lines of Figure 1 of the drawings, it will be seen that the hook is disposed wholly within the mast 2 with the hook portion 23 disposed below the floor level. When the hook 22 reaches this lowermost position, it will be seen that the roller 28 strikes the limit switch 41 thereby deenergizing the motor 17.

It will be understood that the pin 43 of the ladle with which the hook 22 cooperates to tilt the same is not always disposed in the same position on various ladles. This condition is primarily due to the fact that the ladle is not always placed in the same position on the car or truck. To correct this condition so as to insure that the hook portion 23 of the hook will always properly engage the pin 43 of the particular ladle to be tilted positioned opposite the mast 2, the roller 28 in the end of the arm portion 27 of the hook is mounted yieldably therein due to the action of the coil spring 33. The roller 28 is always maintained in its outermost position in the end of the arm portion 27 due to the compressive action of the coil spring 33. If the pin 43 of the ladle is positioned too far to the right, as shown in Figures 1 and 2 of the drawings, it will be seen that the outer side of the hook 22 at a point immediately above the hook portion 23 thereof, will strike the pin 43 of the ladle when the roller 28 passes onto the upper cam surface 25 of the cam member 24, thereby forcing the hook backwardly. It will be seen that when the hook 22 is forced backwardly, that the roller 28 which is in contact with the cam surface 25, will be moved inwardly into the arm portion 27 against the action of the coil spring 33 thereby permitting the hook portion 23 to properly and securely engage the pin 43 of the ladle. After the trolley 18 has moved upwardly a short distance along the track 5, it will be seen that the roller 28 moves out of contact with the upper cam surface 25 and that the roller 28 again will be moved to its outermost position in the end of the arm portion 27 due to the action of the coil spring 33. By providing such a construction, it will be seen that the hook 22 is assured of properly engaging the pin 43 of the ladle, even though the pin is not in the same position in all cases.

As a result of my invention, it will be seen that there is provided a hook mechanism for a ladle tilting apparatus which automatically engages with the pin of the ladle so as to tilt the same when the trolley is moved upwardly along the mast, and automatically disengages from the pin of the ladle when the trolley is moved downwardly along the mast, and the ladle is returned to its normal position on the truck. It will also be seen that the hook in its normal position, is maintained in a retracted position within the mast with the hook portion thereof disposed below the floor level so as to eliminate any obstruction in front of the mast between the same and the car or rails.

While I have shown and described one specific embodiment of my invention, it will be understood that this embodiment is merely for the purpose of illustration and description and that various other forms may be devised within the scope of my invention, as defined in the appended claims.

I claim:

1. In a ladle tilting apparatus, the combination with an upwardly and forwardly inclined track, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a rearwardly extending adjustable cam follower on said hook, and camming means arranged adjacent the lower end of said track for automatically causing said hook to move into engagement with the ladle to be tilted when said trolley is moved upwardly, and for automatically disengaging said hook from the ladle after said trolley has been lowered to return the ladle to its normal position.

2. In a ladle tilting apparatus, the combination with an upwardly and forwardly inclined track, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a cam member arranged adjacent the lower end of said track, a rearwardly extending arm portion carried by said hook, and a roller arranged on the outer end of said arm portion which cooperates with said cam, said cam adapted to automatically move said hook into engagement with the ladle to be tilted when said trolley is moved upwardly, and to automatically disengage said hook from the ladle after said trolley has been lowered to return the ladle to its normal position.

3. In a ladle tilting apparatus, the combination with an upwardly and forwardly arcuated mast having an inclined track carried thereby, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a rearwardly extending cam follower on said hook and a cam member arranged within said mast adjacent the lower end of said track, said cam being constructed and arranged so as to cause said hook to move automatically outwardly from said mast into engagement with the ladle to be tilted when said trolley is moved upwardly, and to automatically disengage said hook from the ladle when said trolley is lowered to return the ladle to its normal position and to

move said hook inwardly to a retracted position within said mast.

4. In a ladle tilting apparatus, the combination with an upwardly and forwardly arcuated mast having an inclined track carried thereby, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a cam member arranged within said mast adjacent the lower end of said track, the lower end of said track being curved inwardly toward the center of said mast and terminating adjacent said cam member, a rearwardly extending arm portion carried by said hook, and a roller arranged on the outer end of said arm portion which cooperates with said cam, said cam member being constructed and arranged so as to cause said hook to move automatically into engagement with the ladle to be tilted when said trolley is moved upwardly and to automatically disengage said hook from the ladle after said trolley has been lowered to return the ladle to its normal position so that said hook is moved inwardly to a retracted position within said mast.

5. In a ladle tilting apparatus, the combination with an upwardly and forwardly inclined track, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a cam member arranged adjacent the lower end of said track, a rearwardly extending arm portion carried by said hook, a roller arranged in the outer end of said arm portion which cooperates with said cam member, said roller mounted for limited movement longitudinally of said arm portion, and a compression coil spring carried by said arm portion for maintaining said roller normally in its outermost position on said arm portion, said cam member adapted to automatically move said hook into engagement with the ladle to be tilted when said trolley is moved upwardly, and to automatically disengage said hook from the ladle after said trolley has been lowered to return the ladle to its normal position.

6. In a ladle tilting apparatus, the combination with an upwardly and forwardly inclined track, a trolley arranged on said track, and means for moving said trolley along said track, of a downwardly extending hook carried by said trolley, a cam member arranged adjacent the lower end of said track, a rearwardly extending arm portion carried by said hook, a roller arranged in the outer end of said arm portion which cooperates with said cam member, said roller mounted for limited movement longitudinally of said arm portion a compression coil spring carried by said arm portion for maintaining said roller normally in its outermost position on said arm, and means for adjusting the compressive force of said spring, said cam member adapted to automatically move said hook into engagement with the ladle to be tilted when said trolley is moved upwardly, and to automatically disengage said hook from the ladle after said trolley has been lowered to return the ladle to its normal position.

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