Sept. 2, 1924. 1,506,906

A. E. HOLCOMB ET AL

CONVERTIBLE CRANE

Original Filed Sept. 12, 1922 3 Sheets-Sheet 1

Fig. 1.

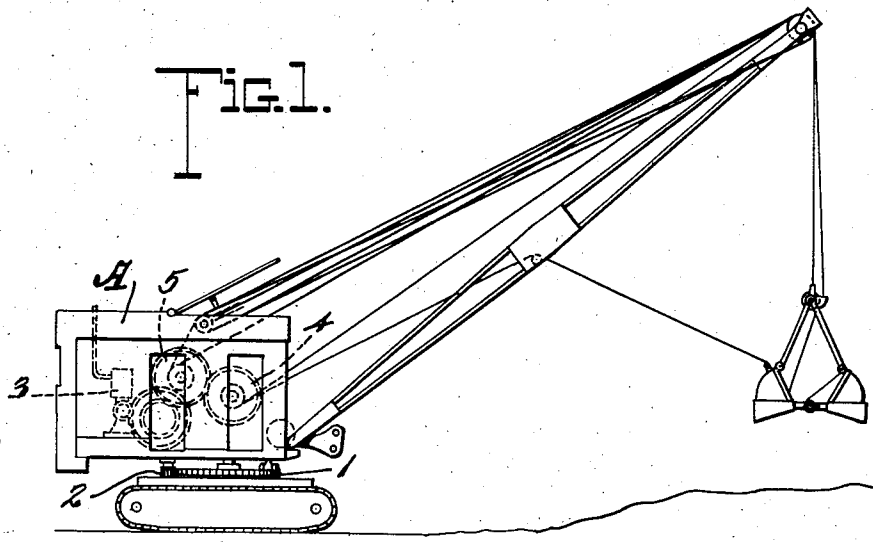
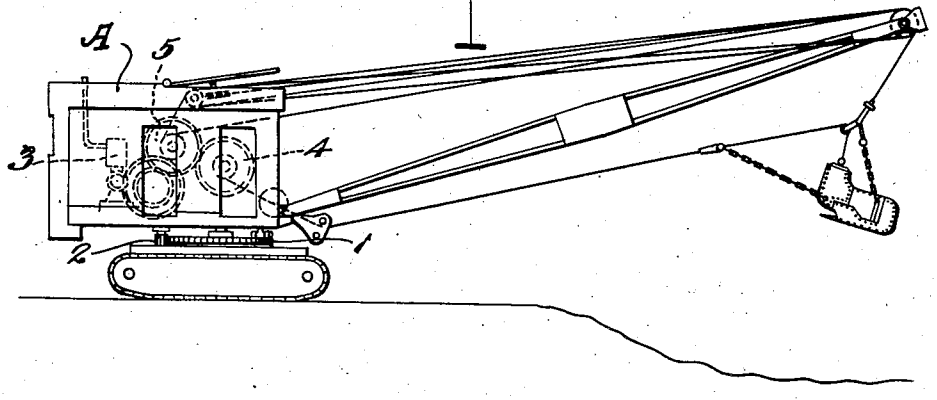


Fig. 2.



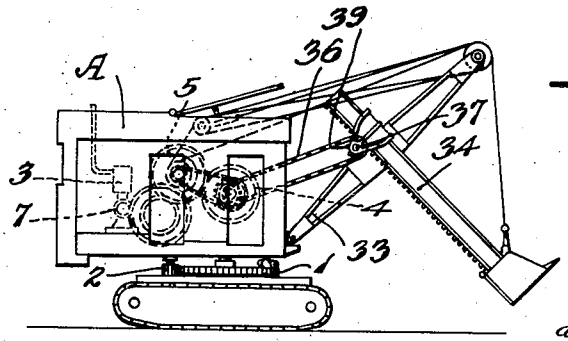


Fig. 3.

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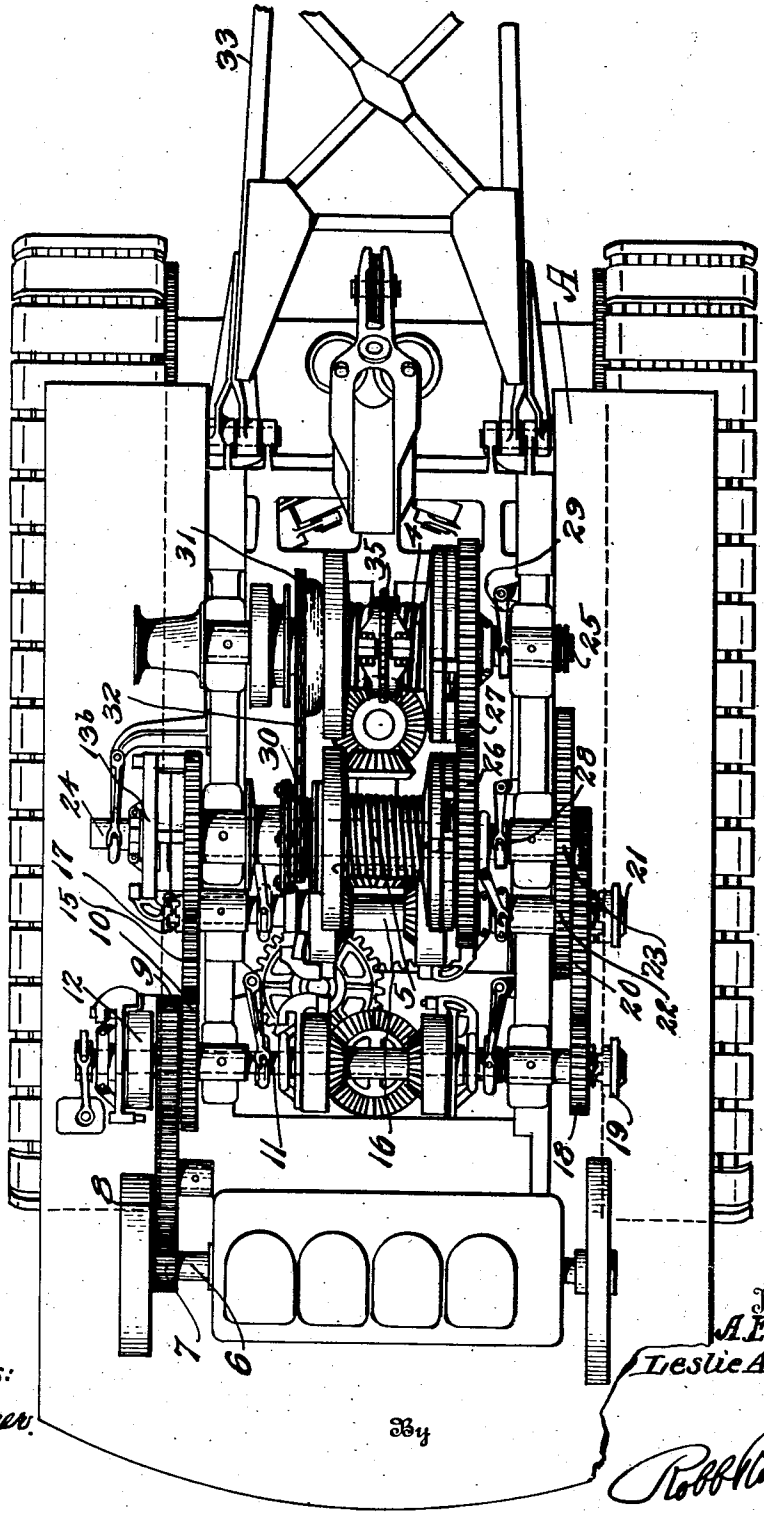
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Fig. 4.



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A. E. HOLCOMB ET AL

CONVERTIBLE CRANE

Original Filed Sept. 12, 1922 3 Sheets-Sheet 3

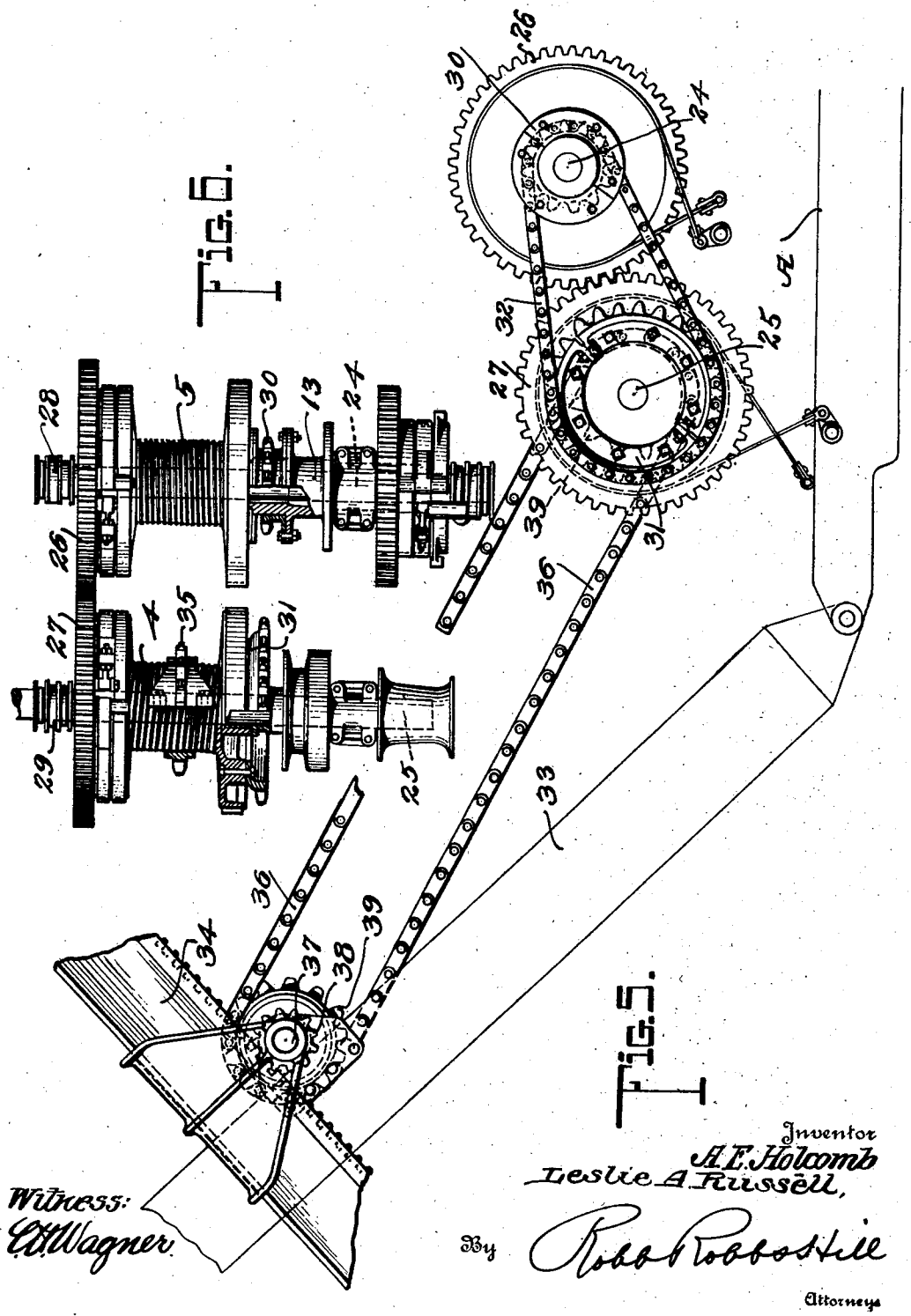


Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

ALPHEUS E. HOLCOMB AND LESLIE A. RUSSELL, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO KOEHRING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

CONVERTIBLE CRANE.

Continuation of application Serial No. 587,676, filed September 12, 1922. This application filed December 8, 1922. Serial No. 605,750.

To all whom it may concern:

Be it known that we, ALPHEUS E. HOLCOMB and LESLIE A. RUSSELL, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Convertible Cranes, of which the following is a specification, this application being a continuation of the application for patent of Alpheus E. Holcomb, filed Sept. 12, 1922, Ser. No. 587,676, for convertible crane.

This invention has to do with excavating machinery, and especially machines of the locomotive crane type. The invention deals with the problem of adapting a locomotive crane to do different kinds of work. That is to say in the economical development of a crane of the above mentioned class, it is desirable that the machine be so constructed that by mere interchange of boom and bucket equipment, it may be converted from a shovel type crane, usually known as a steam or power shovel, into a clamshell or dragline bucket type of crane.

By the present invention the convertibility of the crane machinery to do the different kinds of work of a steam shovel, a clamshell bucket crane, and a dragline bucket crane, is achieved without the necessity for the interchanging of any parts of the main machinery, involving removal of a main drum or drums, and the replacement of a substitute differently constructed part.

Assuming the crane of this invention to be adapted for its clamshell class of work, if it is desired to convert the crane into a power shovel type machine, it is only necessary to add a part to the main operating mechanism, and connect up existing parts, which may be readily done, and substitute for the clamshell bucket and boom equipment, the shovel boom and dipper equipment.

When it is desired to convert the machine from a dragline bucket crane into a power shovel, the same operation is necessary in general principle.

When it is desired to convert the crane from a clamshell type to a dragline bucket type, it is only necessary to substitute the dragline bucket and cables for the clamshell bucket and cables, and shift a clutch to operate the main operating drums at the proper reduction of speed. Exactly opposite substitutions would be made in the conversion from a dragline bucket into a clamshell bucket type with a shifting of change speed gearing to give the necessary increase in speed of the operating drums.

With the foregoing in view a full understanding of the invention may be had on reference to the accompanying drawings, in which;

Figures 1, 2 and 3 are side elevation views of clamshell, dragline, and power shovel types of cranes, the views being largely diagrammatic, and the operating machinery being illustrated as when connected up for the actuation of boom and bucket equipments.

Figure 4 is a plan view of the main operating gearing.

Figure 5 is a side view showing more clearly the dipper stick and shovel boom arrangement with the sprocket driving mechanism therefor.

Figure 6 is a plan view partially in section showing more clearly the main operating drum, the hoisting drum, and the permanent and detachable sprocket arrangements provided therefor, whereby the convertibility functions of the machine are achieved.

To those versed in the art, it will be apparent that the main operating machinery of the crane illustrated in the drawings is substantially that of the type known today as the Koehring crane. The said main operating machinery includes primarily the car or body A adapted to be rotated as usual by the turntable gear 1 actuated from the turning pinion 2 in the customary manner.

The main operating machinery of the crane includes the front main operating drum 4 and the rear main hoisting drum 5 connected by suitable gearing with the engine or motor 3 on the car or body A. The said gearing is preferably of a change speed type forming a novel feature of the construction of the type of crane in connection with which this invention is used, enabling ready conversion of the crane from its use in conjunction with a clamshell bucket, to that involving the use of a dragline bucket.

Figure 4 will be referred to as showing best the gearing arrangements that will now be set forth in a general way to enable an understanding of the improvements of this

invention. The drive for the drums 4 and 5 is taken from the motor by a drive pinion 7 on the engine shaft 6, meshing with a transmitting gear 8 that engages a drive gear 9 cooperative with a high speed gear 10, the gears 9 and 10 being coaxially mounted on the jackshaft 11. A clutch 12 of any suitable type, preferably friction, is used to connect the gear 9 with the shaft 11, and motion may be transmitted from the shaft 11 to the pinion 2 for turning the body A, and to the shaft 24 on which the drum 5 is mounted for driving said shaft and turning the boom hoist drum 13 mounted thereon, said drum being adapted to operate a boom hoist cable 13^a by which the boom 14 used from the clamshell and dragline bucket equipments may be peaked in and out. (See Figures 1 and 2.)

The gear 10 meshes with the high speed driven gear 15 on the countershaft 16, and there is provided the clutch 17 to enable connection of the gear 15 with the countershaft 16. The shaft 11 is equipped with a slow speed driving gear 18 mounted on the end thereof opposite the gear 10, and adapted to be connected with the shaft for rotation by means of a clutch 19. The gear 18 meshes with a slow speed driven gear 20, and the gear 20 is carried on the shaft 16 and is adapted to be connected with the said shaft by the clutch 21. At its right hand end the shaft 16 has a high and low speed gear 22 and a gear 23 on the shaft 24 meshes with the gear 22 and enables a low speed driving connection to be established from the shaft 11 and the drum 5.

The shaft 24 is connected with the main operating shaft 25 by means of gears 26 and 27 mounted on the shafts 24 and 25 respectively, and keyed thereto.

A high speed drive for the drums 4 and 5 is obtained when the clutch 12 is active, motion being transmitted thru gear 9, shaft 11, gear 10, gear 15, shaft 16, which is under these conditions connected with the gear 15 by throwing in the clutch 17, motion thence being transmitted to the drums thru the gears 22, 23, and shaft 24 connected with shaft 25 by gears 26 and 27.

When it is desired to drive the drums 4 and 5 at low speed, motion is transmitted thru the gear 9, shaft 11, gear 18, rendered operative by throwing in the clutch 19, gears 20, 22, 23 and shaft 24, the clutch 21 also being rendered operative. When the slow speed is used the clutch 17 for the high speed gear 15 is of course thrown out. Normally the drums 4 and 5 are loose upon their respective shafts 25 and 24, a friction clutch being availed of in case of each drum to operatively connect it to each shaft. The friction clutch for the drum 5 is designated 28, and that for the drum 4, 29. The boom hoist drum 13 is adapted to be operated when the clutch 13^b, a friction clutch preferably, is rendered active thereby connecting the drum so that it will be turned by the shaft 24.

Thus far there has been described the general construction of the Koehring crane machinery adapted to be used in conjunction with either the bucket and cable equipment of a clamshell bucket, or the bucket and cable equipment of a dragline bucket, or other cable and tackle equipments such as might be used for doing various and other work such as pile driving and general hoisting operations. The conversion from the clamshell type crane to the dragline, and vice versa, involves only two main things, the application of the particular cable and bucket equipment to the boom, and connecting the cables up to the hoisting and operating drums 4 and 5; and secondly, the shifting of the clutch mechanisms so that the slow speed drive will be used for dragline bucket operations, and the high speed drive will be used for the clamshell bucket operations. Under these conditions, of course, the boom hoist drum 13 will be employed for peaking the boom in and out as required.

Referring now to Figures 3 to 6 inclusive, it will be noted that there surrounds the shaft 24 intermediate the drum 5 and the boom hoist drum 13, a sprocket gear 30, the sprocket 30 is attached by suitable fastenings to the inner end of the drum 13. Likewise, there is clamped on the shaft 25, and attached by bolts or other fastenings to the end of the drum 4, a second sprocket 31. The sprockets 30 and 31 are permanently applied to the respective parts as shown, or in any suitable manner otherwise than shown. A sprocket chain 32 connects these two sprockets together so as to establish a driving relation between the drum 13 and the drum 4. This driving relation is such as to permit of transmitting motion from the drum 13 to the drum 4 in a direction opposite to the drive adapted to be communicated to the drum 4 when the clutch 29 is rendered operative. In other words, when the boom hoist clutch 13^b is thrown in, and the clutch 29 is thrown out, the drum 4 will be turned in one direction at a relatively slow speed, a speed which we avail of, as will shortly be described, to cause a crowding out movement of the dipper stick of the shovel boom 33. When the clutch 29 is thrown in and the clutch 13^b is thrown out, motion will be transmitted to the drum 4 in a reverse direction to that obtained when the clutch 13^b is active, and at a much higher speed. This adjustment and speed control are used for causing a racking in movement of the dipper stick of the shovel boom 33 as seen in Figure 3.

For the purpose of availing of the boom hoist clutch and drum as a crowding out

clutch and operating member for the dipper stick of the dipper stick 34, we provide at about the middle of the drum 4 a detachable sprocket 35. This sprocket is adapted to be placed on the drum and clamped there by bolts or suitable detachable fastenings when the crane is to be used for power shovel work. Under these conditions it may be noted that the boom 33 of the power shovel, see Fig. 3, does not have to be raised or lowered, and owing to this fact we are enabled to utilize the boom hoist drum for its purpose as an operating drum for the dipper stick 34 when the clamshell and dragline boom and bucket equipments are not being used. It is under these conditions, of course, that the drum 4 is not necessary to be used as a cable drum for which purpose of course it is employed in clamshell and dragline work. Thus it is possible in converting the machinery for the purpose of shovel work to employ the drum 4 as a means for holding the sprocket 35 and driving said sprocket. The sprocket 35 is connected by a sprocket chain 36 with the shipper-shaft 37 on the boom 33, said shaft having a sprocket 39 to receive the chain 36, and also carrying the crowding pinions 38 which operate in conjunction with the dipper stick 34, in the well known manner not necessary to be described.

Recapitulating, having in view the foregoing description, when the crane is being used as a power shovel, the shovel boom and dipper stick provisions are utilized as in Fig. 3, the drum 4 is provided with its detachable sprocket 35, and said sprocket 35 is connected by the chain 36 with the shipper-shaft sprocket 39. Throwing in of the clutch 13^b will operate the hoisting drum 33 and sprocket chain drive from said drum to the drum 4 giving the crowding out drive for the dipper stick and dipper operation. Throwing out of the clutch 13^b and throwing in of the clutch 29 reverses the operation of the drum 4, and drives the drum at increased speed to provide the racking in movement for the dipper stick and dipper. We thus have the machinery of the crane adapted to produce the ordinary shovel crane driving operation.

Supposing it be desired to convert the shovel type crane as thus described into a clamshell bucket type crane. To do this the shovel boom and dipper provisions are removed with the sprocket chain 36. The sprocket gear 35 is detached from the drum 4 and the sprocket chain 32 is removed so as to disestablish the connection between the drum 13 and the drum 4. Placing in position the clamshell boom and bucket and cable equipments and connecting the cables up to the drums 4 and 5 and 13 in the usual manner will create a clamshell bucket type crane for the use of which the high speed drive for the drums is employed. The substitution of a dragline bucket and cable equipment connected up to the clamshell boom and the other usual connections between the cables and drums will convert the clamshell bucket crane into a dragline bucket crane, for which use the slow speed drive involving the throwing in of the clutches 19 and 21 and throwing out of the clutch 17, will be employed. The convertibility phase of the machine according to this invention, involves in no way the removal of any of the main operating parts of the machinery on the car or body of the crane, which main operating parts are employed for all of the different types of boom and bucket equipments. The conversion of the crane into a shovel type crane merely involves the application of certain parts to the main operating parts of the main crane machinery on the car or body. Under these conditions there is no possibility of the great loss of time, and the expense, incident to the removal of the drums, like the drums 4 or 5, and the substitution of a new drum or drums therefor.

It will be understood of course that when the shovel boom and dipper stick provisions are used with our crane machinery, there is no necessity for a boom raising or hoisting drum action, as the boom is adjusted and maintained at a permanent inclination. On this account we are enabled to employ the boom hoist drum as a two function driving member, for driving the boom hoist cable in the clamshell, dragline, or other hoisting operations, and for driving the drum 4 when the shovel type boom and dipper are utilized. The sprocket gear detachably attached to the drum 4 is a driven member operated from the driving member or boom hoist drum 13.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a convertible-type crane, the combination of a car, crane machinery thereon for operating different kinds of boom and bucket equipment and comprising a main operating drum, a shovel boom and dipper stick equipment connected up so the stick may be operated by the said drum, and means for operating the drum in opposite directions and at different speeds including a driving member adapted to operate a driving cable for use with clamshell, dragline, and like equipment, and detachable means to drive the said main operating drum from said driving member in one direction for power shovel work to actuate a dipper stick, the last means being detached when the shovel boom and dipper stick equipment is to be dispensed with, and the main operating drum being then adapted to receive and operate a cable for controlling clamshell, dragline, or general hoisting operations.

2. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operatig drum for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and for connecting the main operating drum to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment.

3. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and other drums for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and in a direction opposite that in which the main drum is actuated by said gearing, and for connecting the main operating drum to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment.

4. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clam shell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operating drum for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and in a direction opposite and at a speed reduced as compared with the speed of the main drum when operated from said gearing, in which the main drum is actuated by said gearing, and for connecting one of said last mentioned two drums to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment.

5. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum and a main operating drum for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operating drum for ordinary clamshell or dragline or similar work, and removable operating connections for driving the main operating drum from the boom hoist drum, and for connecting one of said drums to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment.

6. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operating drum for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and for connecting the main operating drum to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment, the connection for connecting the main operating drum to the dipper stick consisting of a sprocket gear detachably secured to the drum, and a sprocket chain leading from the said sprocket gear to the dipper stick.

7. In a convertible crane, crane machinery which comprises a main hoist drum, a main operating drum, the two drums adapted to receive and operate cables in conjunction

with clamshell, dragline boom and bucket equipments, a boom hoist drum adapted to drive a boom hoist cable for said equipments, and shovel boom and dipper stick equipment adapted to be substituted for corresponding clamshell and dragline equipments, detachable means for connecting the boom hoist drum with the main operating drum for turning the main operating drum at a low speed and in one direction for dipper stick crowding out work, gearing for driving the main operating drum in the opposite direction and at higher speed for dipper stick racking in work, and detachable means to connect the dipper stick with the main operating drum for communicating movement of the main operating drum in opposite directions, to the dipper stick, when the shovel boom and dipper stick equipment is employed in lieu of other boom and bucket equipment.

8. In a convertible crane, crane machinery which comprises a main hoist drum, a main operating drum, the two drums adapted to receive and operate cables in conjunction with clamshell, dragline boom and bucket equipments, a boom hoist drum adapted to drive a boom hoist cable for said equipments, and shovel boom and dipper stick equipment adapted to be substituted for corresponding clamshell and dragline equipments, detachable means for connecting the boom hoist drum with the main operating drum for turning the main operating drum at a low speed and in one direction for dipper stick crowding out work, gearing for driving the main operating drum in the opposite direction and at higher speed for dipper stick racking in work, and detachable means to connect the dipper stick with the main operating drum for communicating movement of the main operating drum in opposite directions, to the dipper stick, when the shovel boom and dipper stick equipment is employed in lieu of other boom and bucket equipment, the detachable means for connecting the boom hoist drum and the main operating drum consisting of suitable gearing adapted to be rendered inoperative when the crane machinery is used for other than shovel boom and dipper stick work.

9. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a separate drum adapted for a driving action, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operating drum for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and for connecting the main operating drum to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment.

10. In a convertible type crane, crane machinery for operating either clamshell, dragline, hoisting, or dipper shovel boom and bucket equipments, comprising a main hoisting drum, a main operating drum, for use to operate a clamshell or a dragline boom and bucket equipment embodying cables adapted to wind on said drums, a special boom hoist drum to operate a hoist cable of the boom of clamshell or dragline bucket equipments, a dipper shovel boom and dipper equipment including a dipper stick to be racked in and crowded out as usual, gearing for operating the boom hoist drum and the main operating drum for ordinary clamshell or dragline or similar work, and operating connections for driving the main operating drum from the boom hoist drum, and for connecting the main operating drum to the dipper stick to operate the same, when the dipper boom equipment is employed in lieu of the clamshell or other boom and bucket equipment, the connection for connecting the main operating drum to the dipper stick consisting of flexible and detachable driving means intermediate the two.

11. In a convertible crane, crane machinery which comprises a main hoist drum, a main operating drum, the two drums adapted to receive and operate cables in conjunction with clamshell, dragline boom and bucket equipments, a boom hoist drum adapted to drive a boom hoist cable for said equipments, and shovel boom and dipper stick equipment adapted to be substituted for corresponding clamshell and dragline equipments, means for connecting the boom hoist drum with the main operating drum for turning the main operating drum at a low speed and in one direction for dipper stick crowding out work, gearing for driving the main operating drum in the opposite direction and at higher speed for dipper stick racking in work, and detachable means to connect the dipper stick with the main operating drum for communicating movement of the main operating drum in opposite directions, to the dipper stick, when the shovel boom and dipper stick equipment is employed in lieu of other boom and bucket equipment.

12. A crane comprising operating machinery as follows: A main operating cable drum and main hoisting cable drum for dragline and clamshell work, a boom hoist-

ing drum, a dipper shovel boom and dipper stick equipment, operating connections between the main operating drum and dipper stick to impart racking in and crowding movements thereto removable to leave the operating drum free for other than shovel work, means to operate the operating drum from the boom hoisting drum at a desired speed and susceptible of being rendered inactive, and means to operate the operating drum independently of the boom hoisting drum and in an opposite direction.

In testimony whereof we affix our signatures.

A. E. HOLCOMB.
LESLIE A. RUSSELL.