Jan. 29, 1946. F. D. GRAHAM 2,393,768

CRANE CONTROLLING AND STEERING DEVICE

Filed Oct. 27, 1941 3 Sheets-Sheet 1

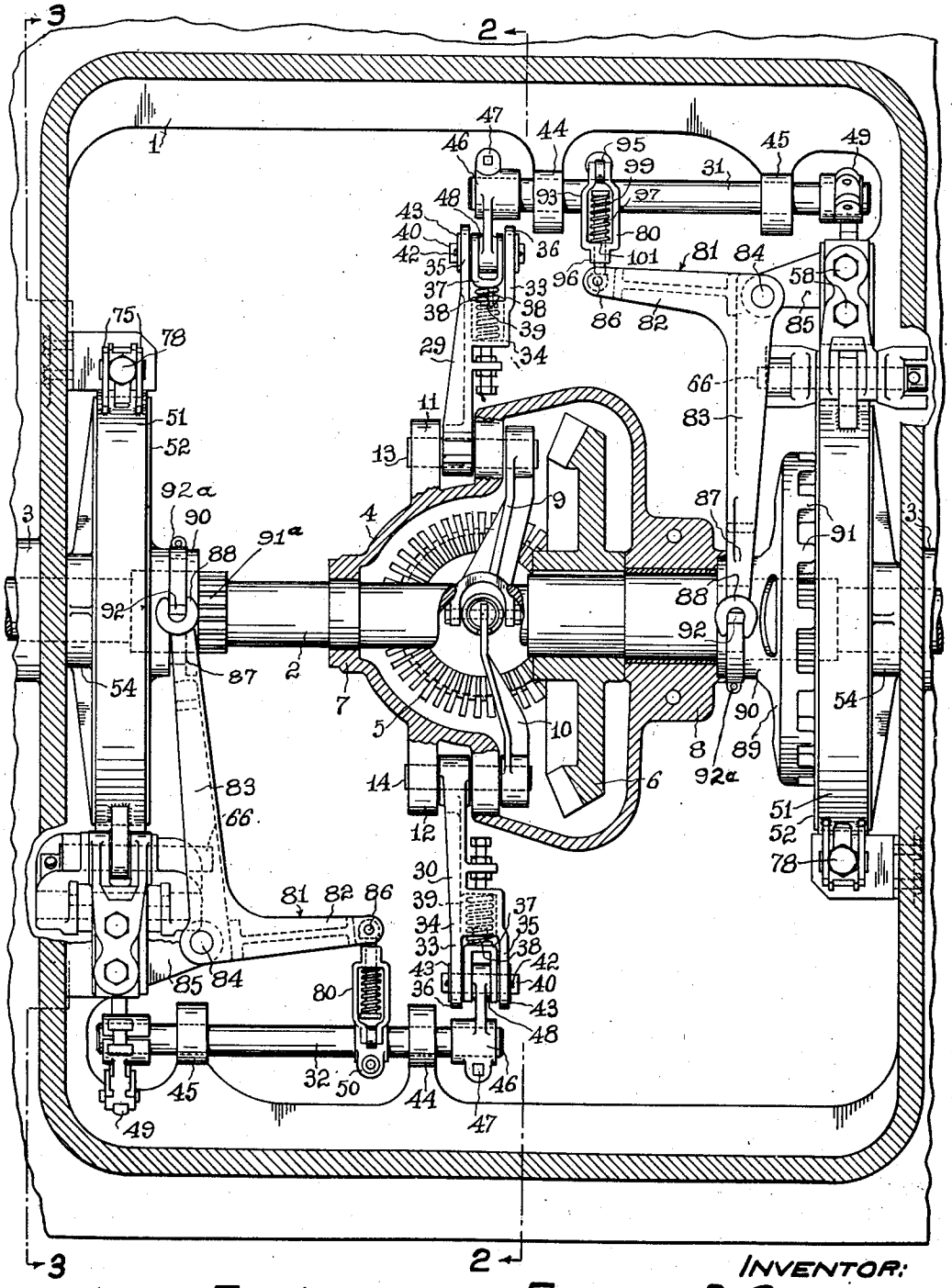


FIG. 1

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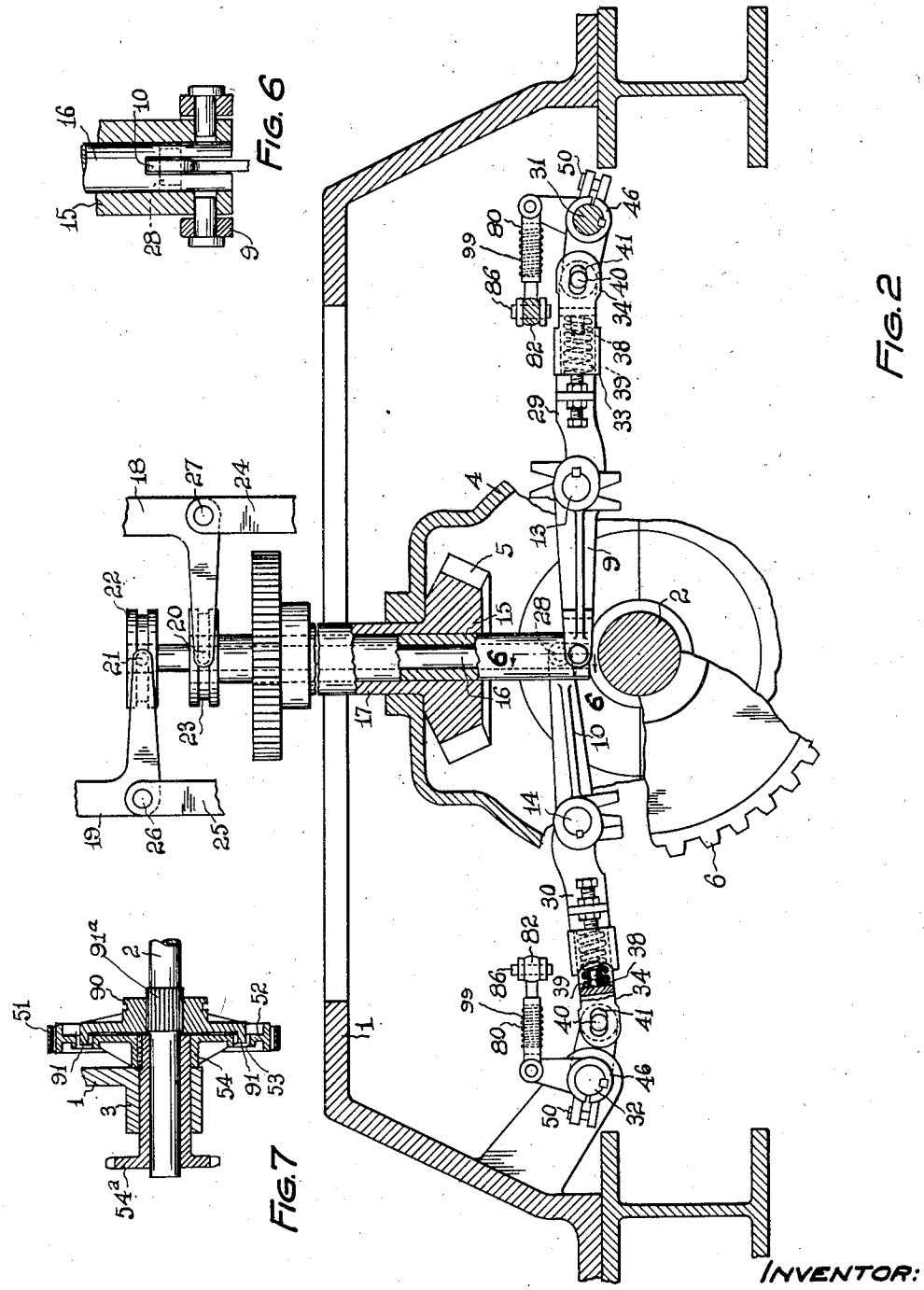


FIG. 2

FIG. 6

FIG. 7

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CRANE CONTROLLING AND STEERING DEVICE

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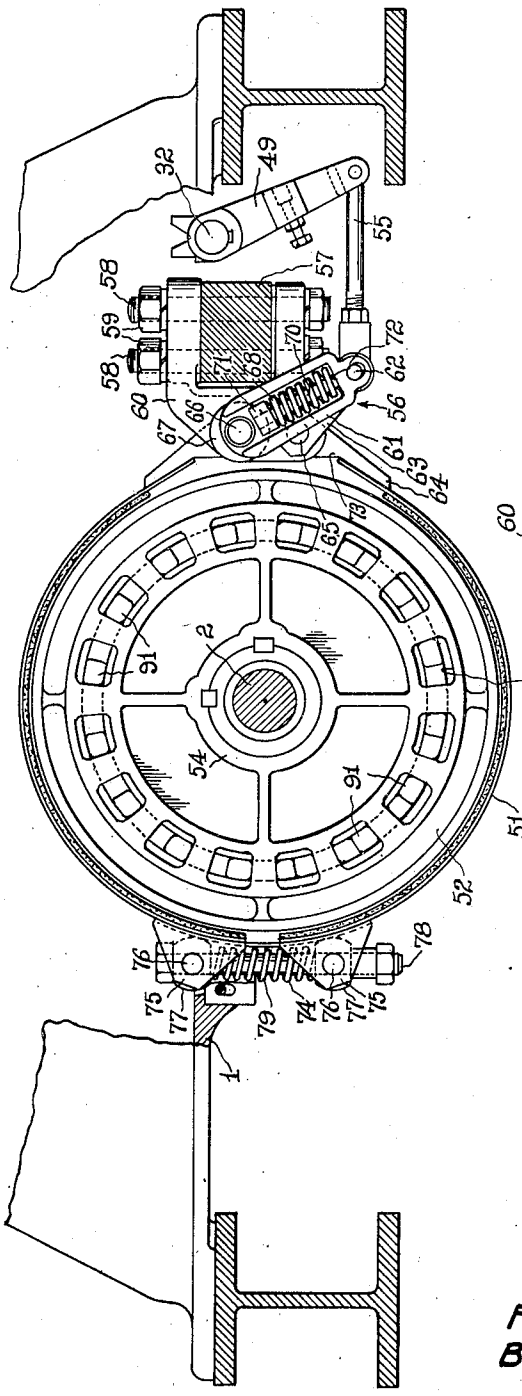


FIG. 3

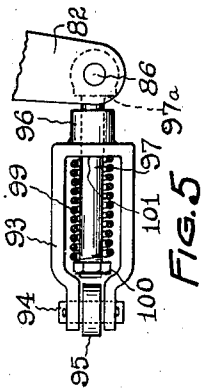


FIG. 5

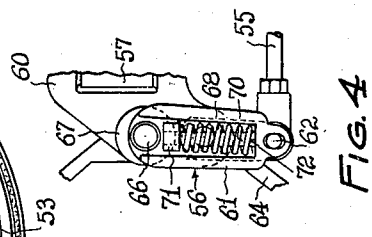


FIG. 4

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UNITED STATES PATENT OFFICE

2,393,768

CRANE CONTROLLING AND STEERING DEVICE

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Application October 27, 1941, Serial No. 416,731

5 Claims. (Cl. 180—9.2)

This invention relates to improvements in steering and driving mechanism particularly useful in large portable machines used for excavation and similar purposes, and particularly directed towards certain improvements in the control devices associated with the driving parts of a crane or the like. It is related to the patent to H. E. Brey No. 1,947,823, issued February 20, 1934, in that it is directed to certain improvements in the mechanism described in this patent. Likewise, it embodies certain features or control means that are described in the Thew Patent No. 593,062, issued November 2, 1897, in that the control mechanism operates through the center pin as described in that patent.

It should be understood that this control mechanism is adaptable for other uses aside from that in cranes and the like, particularly where separate traction devices support the crane mechanism in its operating movement.

The important feature of this invention is the improved method of control of the jaw clutch mechanism in cooperation with the brake mechanism and embodies a safety unit including an automatic means for permitting the operation of the brake preliminary to the withdrawal of the clutch, and, thereafter, the automatic withdrawal of the clutch from engagement with the driving mechanism for the traction devices.

It has been found in the practical use of the mechanism of the above mentioned patent that under certain operating conditions, as for instance, when the machine is being operated down a grade, or under similar circumstances, the application of the brake means is difficult and sometimes impossible because the withdrawal of the clutch from engagement with its comating member is retarded or prevented by the friction between the clutch parts previously established in order to obtain the necessary driving torque.

The invention is particularly adapted for use where it is desirable to readily withdraw the clutches from engagement with the traction operating gears in order to permit a rapid stop in the movement of the crane or device by application of the brakes in the mechanism in which this invention is incorporated. Owing to the fact that by use of this invention the brakes may be applied to the brake drums, while the clutches are still engaged in their driving operation, it will be seen that the tendency of the frictional engagement of the clutch with its comating member will be reduced to a minimum and easy withdrawal of the clutch members will be effected.

In view of the novel construction of the invention under discussion very simple operating parts are employed, and controls that are readily operable from a generally central position are available.

It will be understood that the steering of the crane or like device to which this invention is applied will be effected in a similar manner to that described in the Brey patent above referred to.

For a complete understanding of the invention including certain detailed features of novelty, reference is here made to the following description in connection with the accompanying drawings.

In the drawings:

Figure 1 is a bottom view of the traction frame partly in section, and illustrating the complete connections between the braking means and the clutch means, and also the drive mechanism with certain portions of the driving connections omitted.

Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1, illustrating in elevation certain cooperating portions of the device.

Figure 3 is a sectional view taken on the line 3—3 of Figure 1, looking in the direction of the arrow.

Figure 4 is a detail sectional view of the brake band operating device.

Figure 5 is a detail view of the safety control device which is a feature of this invention.

Figure 6 is a sectional view of the lower end of the contact members on the line 6—6 of Figure 2.

Figure 7 is a sectional view on a reduced scale showing the driving connection between the brake and traction device operating member at each end of the traction shaft.

Describing the details of the construction of this device, in Figure 1 a traction frame, generally denoted 1, is shown as having supported thereon a traction shaft 2 in suitable bearing portions 3 at the sides thereof, and a central gear case or housing 4, through which the traction shaft 2 is driven by a bevel gear 5 to a bevel gear 6 on the traction shaft, thus forming a constant driven connection for the bevel gear of the traction shaft. The housing 4 embodies suitable bearing members 7 and 8, for the traction shaft 2 which are adapted to support operating levers 9 and 10, in suitable bearing portions 11 and 12 on shafts 13 and 14.

Referring more particularly to Figure 2, the operating means for the brake and clutch mechanisms are shown as comprising concentric mem-

bers 15 and 16, which are concentric with the drive shaft 17 on which the bevel gear 5 is mounted. These concentric operating shafts are adapted to slide within the drive shaft 17 upon actuation of control levers 18 and 19, which through means of yokes 20 and 21 operating in grooved members 22 and 23, raise and lower the concentric operating shafts 15 and 16 for the purpose to be hereafter described. As shown in Figure 2, the control levers 18 and 19 are supported on suitable bearing members 24 and 25 which are connected to the traction frame in any suitable manner and are pivoted on the pivots 26 and 27 for the operation of the concentric operating shafts.

At the lower ends of the concentric operating shafts 15 and 16, the levers 9 and 10 are suitably engaged with their respective concentric operating shafts by means of a yoke on the lever 9 connecting with the operating shaft 15, and a slot in the operating shaft 16 connected pivotally at 28 with the operating lever 10. The operating levers 9 and 10 are keyed or otherwise suitably engaged with the pivot pins 13 and 14, previously mentioned, and adapted to operate through keyed connections therewith, the actuating shaft levers 29 and 30. The actuating shaft levers 29 and 30 are connected to the actuating shafts 31 and 32 by means of over center spring connecting devices 33, which are exactly similar. These over center spring devices more particularly illustrated in Figure 2 are comprised of yoke members 34 preferably integral with the actuating shaft levers 29 and 30, having bearing portions 35 and 36 adapted to receive therebetween an additional yoke member 37, which has a stud extension 38 at the lower portion thereof, as seen in Figure 1, adapted to enter a compression spring 39, and be engaged with a pin 40 in a tight connection, the said pin 40 being slidable in an elongated slot 41 in the yoke portion 34 of the actuating levers 29 and 30. The pin 40 is suitably maintained in its position in the yoke 33 by any suitable means such as the cotter pin or pins 42 and the washers 43, which washers engage the outer surfaces of the yoke 33. The actuating shafts 31 and 32 are suitably supported in bearing portions 44 and 45, preferably integrally cast with the traction frame, the said actuating shafts 31 and 32 being generally and preferably in a parallel relation one to the other. Adjacent the inner ends of the actuating shafts 31 and 32 are the members 46 suitably connected to the actuating shafts 31 and 32 by means of clamping bolts 47, the members 46 being connected at their inner ends in bearing portions 48 with the pins 40 previously mentioned as being mounted on the actuating levers 30 and 29, for operation thereby. On the outer ends of the actuating shafts 31 and 32, as seen in Figure 1, are brake actuating levers 49 connected with the brake bands in a manner to be described. These brake actuating levers are suitably rigidly engaged with the actuating shafts 31 and 32, by any suitable means such as the clamping bolts 50.

In Figure 3 is illustrated more particularly, the method of connection of the brake actuating levers 49 with the brake bands 51, which operate on the exterior of the brake drums 52, the said brake drums 52 being formed with clutch receiving portions 53 for engagement in a manner to be hereinafter described. The brake drums 52 are rotatably mounted on the traction shaft 2 and are suitably rigidly connected through the hubs 54 thereof with traction device operating gears 54a, also illustrated in the above identified Brey Patent No. 1,947,823. It will be understood that the brake drums are loosely mounted on the traction shaft for purposes to be hereafter described.

Referring again to the brake band operating means, the brake actuating levers 49 are connected to intermediate operating rods 55, to operate compression members 56 for contraction of the brake bands 51 exteriorly of the drums 52 in a manner to be described. One end of the brake bank 51 is connected to a boss 57, preferably cast with the traction frame 1, by means of bolts and nuts 58 and 59. The connection with the boss 57 of the traction frame is by means of an ear-like extension 60, which is held in contact with the boss 57 of the traction frame by the bolts and nuts 58 and 59, previously mentioned.

The compression spring member 56 forms a toggle connection for the operation of the brake band 51, and is comprised of a yoke member 61 connected by means of a pin 62 with the brake actuating rod 55, the said pin 62 likewise engaging a link 63 pivotally connected with the end 64 of the brake band 51, by means of a pivot 65 The other end of the yoke member 61 is pivotally connected at 66 with the bearing portion 67 of the brake band support 60. Located centrally in the yoke 61 is a compression spring 68 suitably confined therein by means of a pin 70, which at one end is connected to the yoke member, and at the other end has a large portion 71 to retain the compression spring 68 between said enlarged portion 71 and the shoulder portion 72 of the yoke member. It will be seen from the foregoing, that when the brake rod member 55 is moved in a left direction, looking at Figure 3, this will cause a clockwise movement of the pin 65 connected with the toggle link 63, said pin also, of course, being connected with the free end 73 of the brake band 51, and thus cause a contraction of the brake band 51 over the surface of the brake drum 52, the compression spring 68 acting to maintain the brake band out of engagement with the drum when rightward movement of the brake rod member 55 takes place. In other words, this compression spring 68 will cause a counterclockwise movement of the end of the yoke 61 in which the pivot 62 is mounted, and thus release the brake band 51. Looking at Figure 3, it will be seen that the brake band 51 is suitably engaged with the traction frame 1 by means of a spring member, generally denoted 74, now to be more particularly described.

The brake band 51 is supplied with upstanding ears 75, which are preferably integral therewith, and which engage by means of pivot pins 76 the sliding members 77 which are adapted to receive a tension bolt member 78, said tension bolt member having a tension spring 79 located centrally thereon between the sliding members 77 to effect a separation of the ends of the brake band 51, when tension is removed from the brake band, as previously described. It will be understood that one of the ears 75 of the brake band engages with the traction frame in any suitable manner to prevent misalignment of the brake band 51, on the brake drum 52.

Referring again to Figure 1, the actuating shafts 31 and 32 are furnished with safety control devices 80, which include energy storing spring means and are adapted to control the actuation of the clutch levers 81 in a manner to be described. The clutch levers 81 are generally L-shaped and are comprised of the arms 82 and

83, the said levers 81 being pivoted at 84 on bosses 85 of the traction frame. The arms 82 are connected to the safety control devices 80 by means of the pivot members 86, and the arms 83 of the levers 81 are formed at the ends thereof with yoke portions 87, which have U-shaped ends 88 integral therewith adapted to operate clutch members 89 in a manner to be described.

The clutches 89 are comprised of bearing portions 90 splined internally thereof, adapted to coact with the splines 91a of the traction shaft. The clutch members 89 are generally circular in conformation, and have at their peripheries teeth 91 adapted to engage the openings 53 of the brake drums previously described, for operation thereof, when the clutch members 89 are moved into engagement with the openings 53 of the brake drum.

The yoke portions 87 of the arms 83 of the clutch levers by means of the U-shaped portions 88 contact lugs or ears 92 formed on the clutch shifter ring 92a turning on members 89 at opposite sides thereof, the yoke portions 87 extending over the outer portions of the bearing portions 90 of the clutch member 89 aforesaid.

The arms 82 of the clutch levers 81 engage the safety control devices, as previously described, the said safety control devices now to be described.

Referring particularly to Figure 5, it will be seen that the safety control devices comprise yoke members 93 adapted to be connected at one end thereof by means of pins 94 with arms 95 suitably engaged with the actuating shafts 31 and 32, for movement thereby, the other end of said yokes 93 being provided with bearing portions 96 adapted to slidably engage pins 97 which are pivotally connected at 86 to the clutch lever arms 82, aforesaid. Confined on the pins 97 are compression springs 99, said compression springs being confined on one end of the springs 97 by means of nuts 100, and the said springs 99 engaging at their other ends with a seat portion 101 of the yoke 93. The actuating shafts 31 and 32, previously mentioned, are rotatable in the bearing portions 44 and 45 to operate the safety control devices 80; for example, upon operation of the operating shaft 32, it will be seen that by rotating the actuating shaft 32 of Figure 2 in a counterclockwise direction, the spring 99 of the device 80 will be compressed to operate the clutch lever 81 on the pivot 84 to withdraw the clutch 89 from engagement with the brake drum 52.

In order to more particularly understand the operation of the invention that operation will now be explained in relation to the upper clutch and brake unit of Figure 1.

The engagement of the clutch 89 with the brake drum 52 may be caused to take place by depressing the concentric operating shaft 15 engaged with the lever 9 looking at Figure 2, and the said lever 9 being engaged with the lever 29, will cause rotation of the actuating shaft 31, for example, since it is connected to the actuating shaft by means of the member 48. The actuating shaft 31 will thereby effect a movement of the yoke member of the upper safety control device 80, toward the bottom of the drawings, looking at Figure 1, the bearing portion 96 of the safety control device coacting with the shoulder portion 97a of the pin 97, causing the clutch lever 81 to pivot in a counterclockwise direction, and through its connection 87 with the clutch shifter ring 92a of the clutch member 89 will cause the clutch member 89 to move into engagement with the brake drum 52.

It will be seen that at the same time, this engagement of the clutch member 89 with the brake drum 52, previously mentioned, will cause a counterclockwise rotation of the brake lever 49 thereby releasing the brake band 51 from its contact with the brake drum 52 by means of the toggle connection 56, as shown in Figure 3. Rotation of the brake drum 52 will be prevented in a manner to cause a relative stopping of the rotation of the traction device operating gear connected thereto by operating the operating shaft 15 in a generally upward direction, looking at Figure 2, which will cause a clockwise rotation of the levers 9 and 29, and, likewise rotation of the brake lever 49 and effect a clamping action of the brake band 51 exteriorly of the brake drum 52, by means of the toggle connection 56 previously described. If there is rotative restraint on the part of the clutch receiving openings 53 of the brake drum with respect to the teeth 91 of the clutch, which would prevent immediate withdrawal of the clutch teeth 91, the compression spring 99 in the safety control device 80 will be compressed owing to the fact that the clutch lever 81 does not move. Since the clutch arm 95 moves, the yoke 93 contacts the spring 99 and compresses the same. Thereafter, when the rotation of the brake drum has been reduced so that the friction connection between the teeth 91 of the clutch member 89 in the openings 53 of the brake drum has reached a point where it is practically negligible, the expansion of the compression spring 99 will automatically operate the pin 97, and move the clutch lever 81 in a clockwise direction and cause a withdrawal of the clutch teeth 91 from the brake drum openings 53 thereby removing the driving rotative force from said brake drum and the traction device operating gears connected thereto.

In the foregoing description, it will be understood that there has been explained the operation of a single one of the clutch and brake units in conjunction with the safety control means employed as a part of this invention. It will be evident that under some conditions, a traction vehicle equipped with the present invention might employ merely a single driving clutch member and a single braking member working in conjunction, as previously set forth, and the safety control device described could be effectively used under such conditions for the purpose of enabling the application of the brake means even though the operator has not been able to disengage the clutch means owing to the friction of the driving torque between the engaging clutch parts. Moreover, the automatic operation of throwing out of the clutch as set forth would be effective under such conditions when the braking operation has been applied sufficiently to retard the speed of the vehicle and relieve and reduce the driving torque enough to permit the disengagement of the clutch elements.

In the special application of the invention, as illustrated in the drawings, under some conditions, the traction vehicle, crane, or whatever other machine is equipped with the invention, may be operating under the driving action of both clutches at the opposite sides of the machine, which actuate the traction members such as crawlers or wheelers at such opposite sides. Then, if the machine descends a grade with the driving torque applied to the clutches, the op-

erator, by the employment of the safety control devices described, can with ease cause the application of both brakes by the downward movement of the concentric actuating shafts 15 and 16, when it is desired to stop the machine. When the brakes are thus applied, they are necessarily actuated independently of the clutches ordinarily due to the fact that the friction of the driving torque will hold the clutch elements in engagement. It is under this particular condition that the safety control devices are important to be used permitting as they do the independent operation of the brake devices in respect to the clutch members 91. Heretofore this has not been a possible operation in machines using the mechanism of the Brey patent previously identified, owing to the fact that in said patented construction the brakes and clutches are so connected by their operating levers as to necessitate simultaneous actuation thereof, to apply the clutches and release the brakes under one condition, and to apply the brakes and release the clutches under another condition.

It will be understood, however, that according to the present construction, the simultaneous actuation of either or both of the clutches to release position and application of either or both brakes to applied position may be effected, as when the machine to which the invention is applied is operating on a level grade.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In controlling and driving mechanism for cranes and like traction machines, in combination, a traction frame, a drive shaft mounted on the frame, a traction shaft for operating traction members by which the frame is supported, steering and driving means carried by the frame including a set of clutch and brake units for each traction supporting member of the frame, each clutch and brake unit comprising a brake and clutch drum, a clutch member cooperating with the said drum, a brake member cooperating with said drum, means connecting said clutch and brake members of each unit for operation to simultaneously release the brake and apply the clutch and vice versa, including an operating member for each clutch and brake unit, and said connecting means including a safety control device comprising a yieldable connection between said operating member and said clutch member for permitting application of the brake independently of operation of the clutch.

2. In controlling and driving mechanism of cranes, in combination, a traction frame, a drive shaft mounted on said frame, a traction shaft carried by said frame driven by said drive shaft, traction driving means on said shaft at each side of said frame, a set of clutch and brake means for controlling each of said traction driving means, a clutch arm for each clutch, a common operating means for each said set, and safety control devices comprising yieldable connections between each clutch arm and the said common operating means, whereby the clutch means is automatically actuated to remove the driving force from the driving means subsequent to the actuation of the brake means, to prevent driving movement of the traction driving means.

3. In controlling and driving mechanism of cranes, in combination, a traction frame, a drive shaft mounted on said frame, a traction shaft carried by said frame driven by said drive shaft, traction driving means on said shaft at each side of said frame, a set of clutch and brake members associated with each traction driving means, an actuating shaft for each set of said clutch and brake members, separate operating means for said actuating shafts coaxial with the drive shaft aforesaid, and a safety control device comprising a yieldable connection between each actuating shaft and its associated clutch member, whereby a brake member may be applied prior to the disengagement of a clutch member and the clutch member subsequently automatically disengaged from the traction driving means associated therewith.

4. In crane driving and steering mechanism, in combination, a traction frame, a drive shaft mounted thereon, a traction shaft carried by said frame and driven by said drive shaft, traction driving means on said shaft at each side of said frame, traction devices operable thereby, a clutch and brake unit associated with each traction driving means, a common actuating shaft for each clutch and brake unit, having a clutch arm for each clutch and a brake arm for each brake, control means coaxial with the drive shaft aforesaid for independent actuation of the respective actuating shafts, and a safety control device comprising a yieldable connection between the clutch arm and its respective actuating shaft operable to automatically disengage the clutch from driving relation with the traction driving means after the brake associated therewith has been actuated to effect a braking action on the part of the traction device controlled by said brake.

5. A safety control device as claimed in claim 4, which comprises a yoke connected at one end to the actuating shaft, a pin slidable in said yoke connected to the clutch operating arm, and a coil spring on the said pin bearing at one end against a shoulder of the yoke and confined on the pin by a nut.

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