Aug. 10, 1937. E. H. KIDDER 2,089,700

HOISTING MECHANISM

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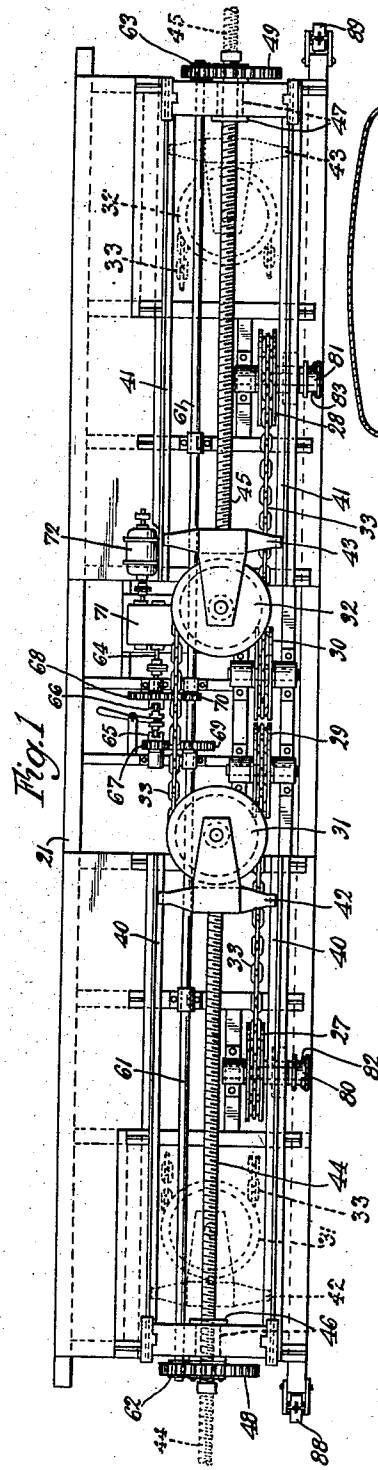


Fig. 1

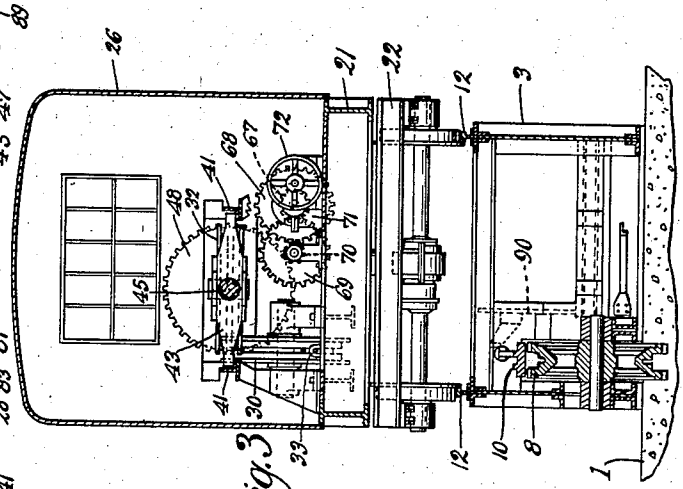


Fig. 3

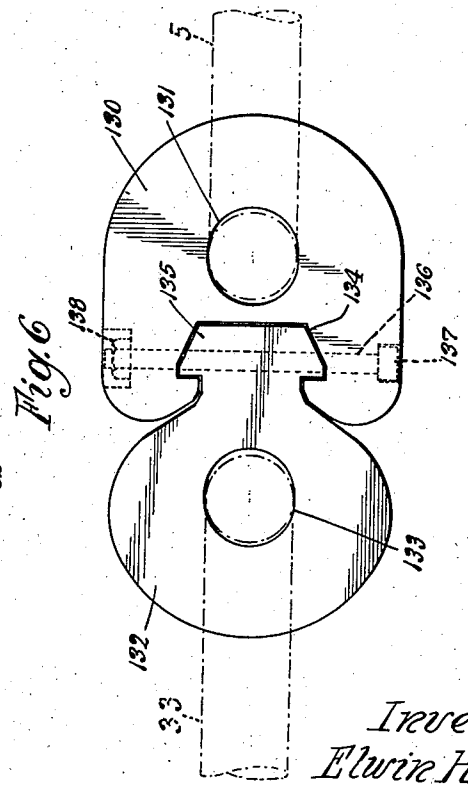


Fig. 6

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HOISTING MECHANISM

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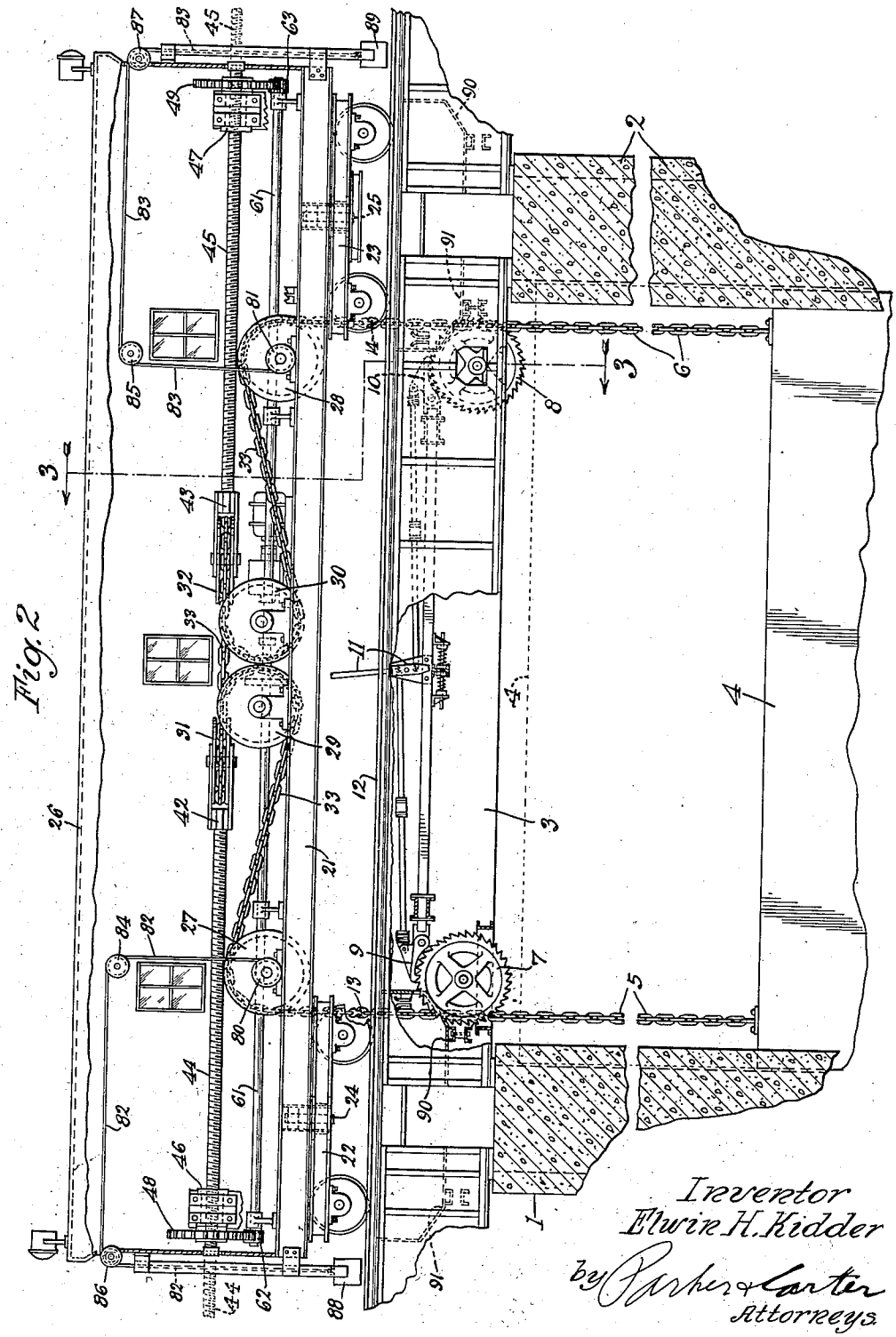


Fig. 2

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HOISTING MECHANISM

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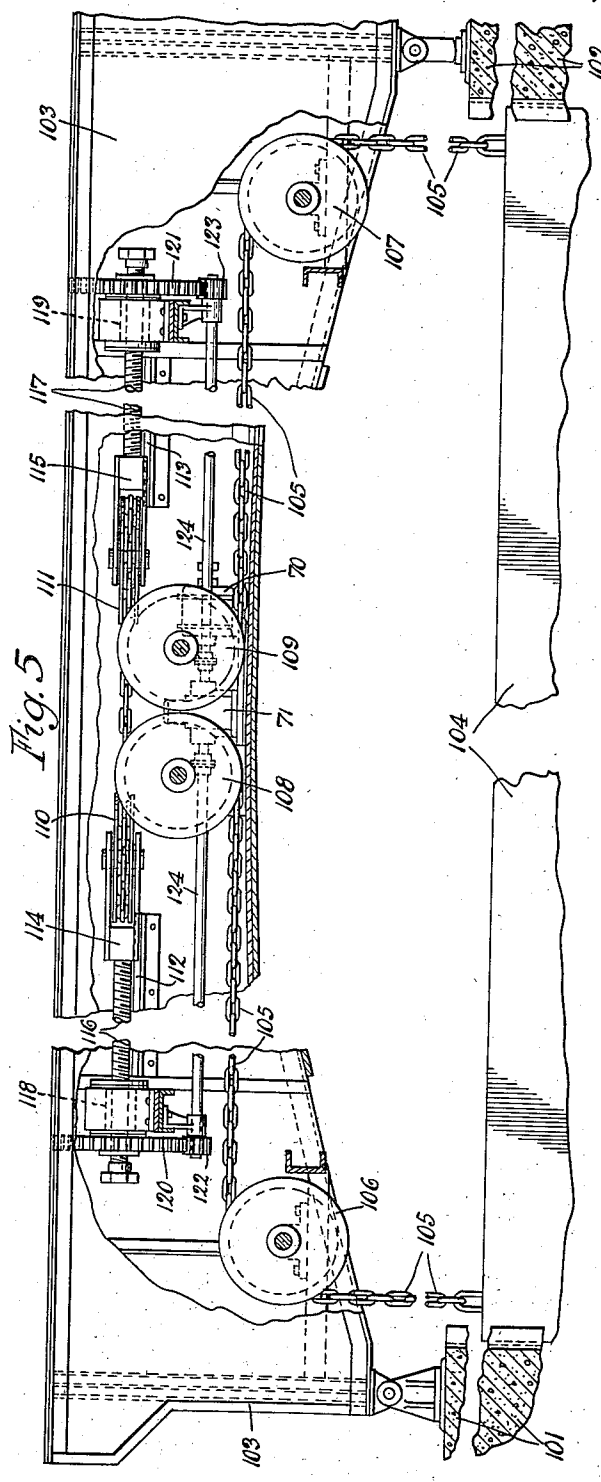


Fig. 5

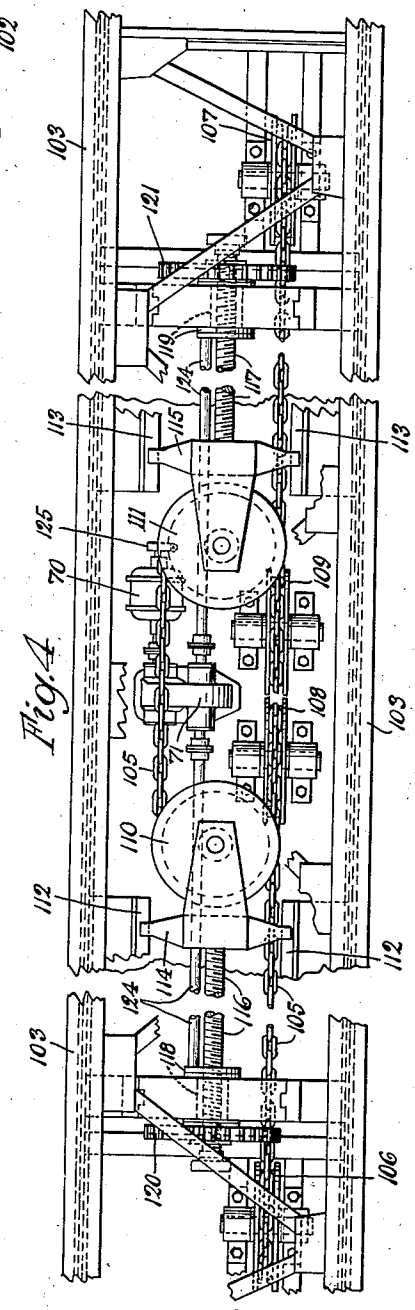


Fig. 4

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HOISTING MECHANISM

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Fig. 7

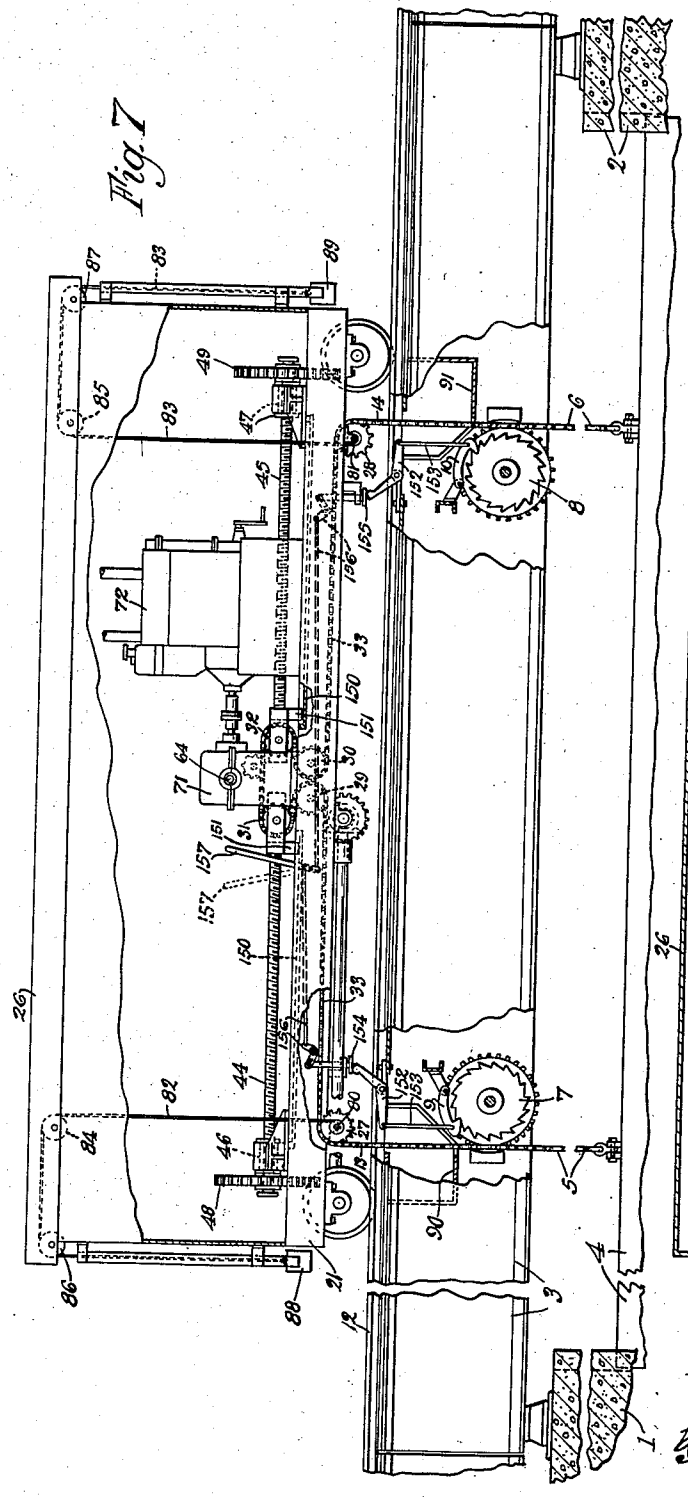
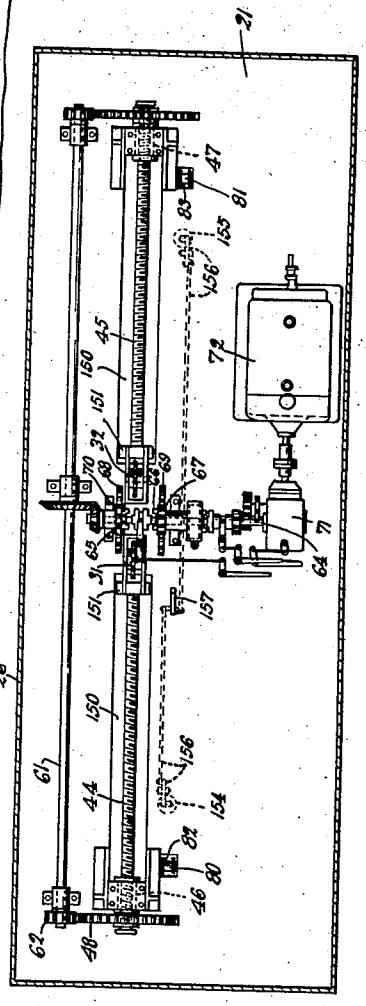


Fig. 8



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HOISTING MECHANISM

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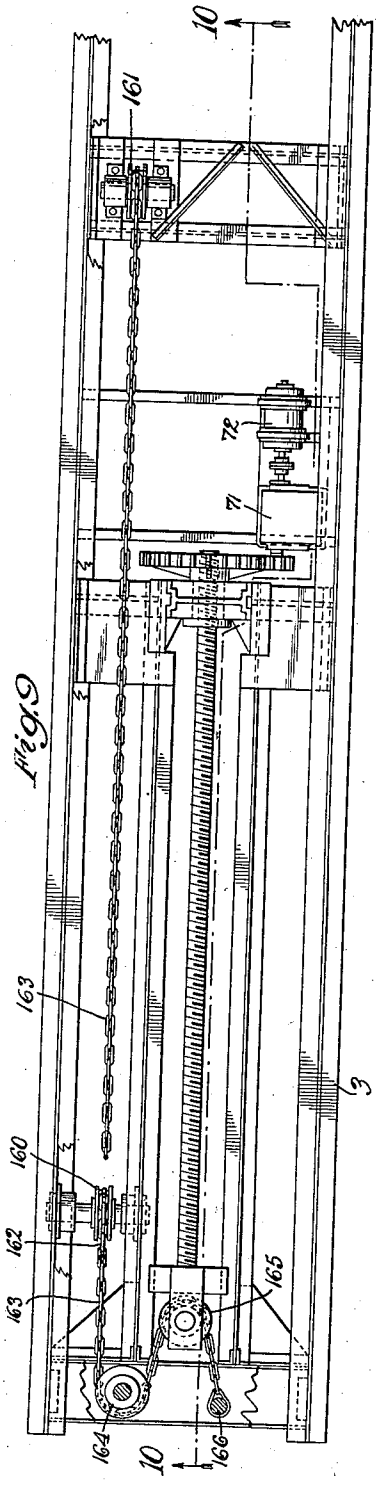



Fig. 9

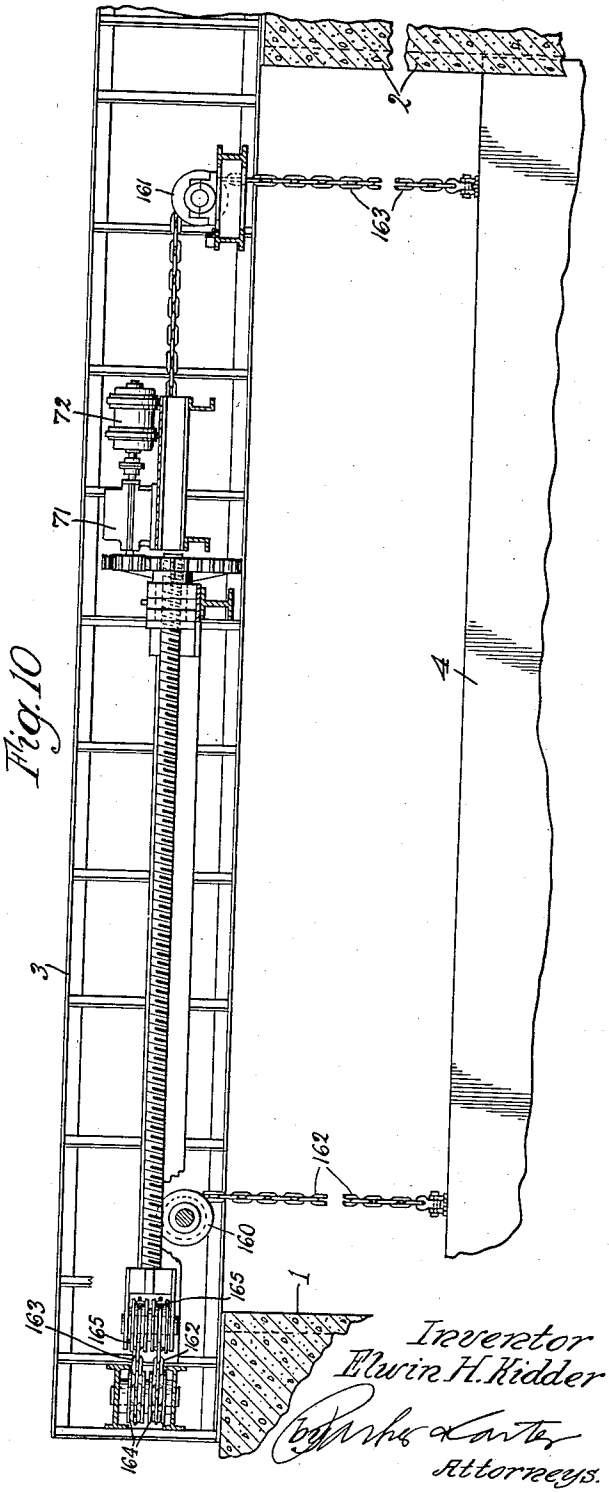



Fig. 10

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# UNITED STATES PATENT OFFICE

2,089,700

## HOISTING MECHANISM

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Application March 2, 1936, Serial No. 66,666

12 Claims. (Cl. 254—189)

My invention relates to improvements in hoisting mechanisms and is especially applicable in connection with a portable mechanism or traveling hoist car adapted to be used in connection with "tainter" gates for dams and the like.

One object of my invention is to provide a mechanism wherein heavy objects may be lifted, by hoisting chains or cables attached at two widely spaced points and whereby the tension in the two chains or cables may be automatically equalized to prevent warping or distortion of the object being lifted.

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

Figure 1 is a diagrammatic plan view with the car body omitted of a hoist car embodying my invention;

Figure 2 is a side elevation of the hoist car, the service bridge and the gate and associated parts;

Figure 3 is a section along the line 3—3 of Figure 2;

Figure 4 is a plan view of a bridge with my structure in place where the hoist is in fixed position;

Figure 5 is a side elevation of the device shown in Figure 4.

Figure 6 is a plan view of a movable shackle;

Figure 7 is a side elevation showing a modified form;

Figure 8 is a plan view of the device shown in Figure 7;

Figure 9 is a plan view of a modification of the device applicable to a fixed installation;

Figure 10 is a section along the line 10—10 of Figure 9.

Like parts are indicated by like characters throughout the specification and drawings.

1, 2, are concrete abutments. They support a service bridge 3, of concrete or structural steel. Mounted between and filling the space between the abutments is a gate 4. It may be of the pivoted "tainter" type or it may be of a sliding gate as the case may be. Adjacent each end of the gate are anchored gate hoist chains 5, 6, which chains extend up to the service bridge 3, traveling over sprockets 7, 8, and associated with them ratchet locks 9, 10, controlled by a lock lever 11. These chains are long enough so that the gate may assume its lowermost position without the chains coming out of contact therewith. 12 is a track extending along the service bridge from end to end. The ends of these chains terminate in shackles 13 and 14.

Mounted to travel along the track 12 is a hoist car comprising a main frame 21 supported on two bogie trucks 22, 23 by the pivot connections 24, 25 and carrying a car body 26. Adjacent each end of the car are sprockets 27, 28 mounted for rotation on horizontal axes on the car frame and adjacent the center of the car are similar sprockets 29, 30, mounted for rotation on the car body about horizontal axes. Between the sprockets 27, 29, and 28 and 30 respectively are sprockets 31, 32 mounted for rotation about vertical axes. 33 is a chain, its two ends adapted to hang downwardly from the sprockets 27, 28 respectively and to be shackled to the chains 5 and 6 by the shackles 13 and 14. This chain extends inwardly over the sprockets 27, 28 beneath the sprockets 29 and 30, upwardly about these sprockets and outwardly about the sprockets 31 and 32, being in so far as that part within the car is concerned, an endless chain.

40, 41 are horizontal cross head guides on the car body 21. These horizontal guides support cross head guides 42, 43 upon which the sprockets 31 and 32 are mounted. Extending outwardly toward the opposed ends of the car are screws 44, 45. These screws are in threaded engagement with nuts 46, 47 in the ends of the car frame. Mounted on these nuts are spur gears 48, 49 and the nuts are held in thrust bearings so that when the sprockets are rotated, the nuts will rotate and the screws will be longitudinally displaced. As shown in full line position, the chain is extended to its maximum. As shown in the dotted line position, the screws have been displaced laterally in both directions, the gate is in the raised position and the ends of the gate associated with the shackles have been drawn into the mechanism on the car which is made possible by the fact that the outer contour of the shackle is the same as the contour of the links of both chains.

Extending longitudinally of the car from end to end, is a long horizontal drive shaft 61. At each end it carries pinions 62, 63 in mesh with the gears 48 and 49. 64 is a clutch shaft carrying clutches 65, 66 associated respectively with a pinion 67 and gear 68. These pinions and gears are in mesh respectively with a gear 69 and pinions 70 on the shaft 61 so as to give two different gear ratios. The clutch shaft 64 is driven through a speed reducer 71 by a motor 72 having the usual speed and direction control. The screws 44 and 45 are provided with right and left hand threads so that rotation of the gears 48 and 49 in the same direction causes opposite movement of the screws and the sprockets 31 and 32.

Mounted for rotation with each of the sprockets 27, 28 are drums 80, 81 about which are wound cables 82, 83 which travel over sprockets 84, 85, 86, 87 on the car body and terminate in counterweights 88, 89. The purpose of these counterweights is to exert a tension on the cable in the hoist car so that after the bridge or gate or other load has been lifted and the chains directly associated with that load have been locked in position,

the movable sprockets may be brought together and both ends of the chain may be paid out from the hoist car so that the hoist car chain may be disconnected from the fixed gate chain. As this is done, the chain is received in chain bins **90, 91** in the service bridge.

In the modified form shown in Figures 4 and 5, **101, 102** are the abutments carrying the bridge **103**. **104** is the gate. It has attached to it adjacent both ends, the endless cable **105** which passes up over the sprockets **106, 107** which sprockets are mounted on horizontal axes, inwardly around sprockets **108, 109** also on horizontal axes, then about sprockets **110, 111** on vertical axes in the same general way as the chain and sprocket relationship prevails on the hoist car. **112, 113** are cross head guides carrying cross heads **114, 115** on the bridge to support the sprockets **110, 111**. The right and left hand screws **116, 117** are threaded in the nuts **118, 119** in thrust bearings and associated with the gears **120**, and **121**, which gears are driven by pinions **122, 123** on the drive shaft **124**, the driving mechanism for which is identical with that shown in Figures 1, 2, and 3. In this case the chain bin is omitted, the shackles are omitted and there is permanent relationship between the load and the hoist and one chain instead of three chains is used.

It will be understood, of course, that such a hoisting mechanism as this can be used for a wide range of purposes both in connection with fixed and movable relationships. In connection with the device of Figures 4 and 5, no locking mechanism is needed except a brake for the motor shown at **125** because the screw and nut furnishes a self-locking mechanism.

No special means are needed for spotting the car and it is not necessary to anchor the car because the tension on the chain will hold it in proper position when it has been spotted and the car may be propelled along the track by any suitable means not shown. The particular control devices for the motor are standard and form no part of my invention and so are not illustrated.

The connecting shackle for connecting the weight chains or gate chains and the hoisting or car chain or cable is shown in detail in Figure 6. It comprises the female member **130** apertured at **131** to engage one link of a chain and a male member **132** apertured at **133** to engage a link of the other chain. The female member **130** is socketed as at **134**, the male member has a shouldered head **135** adapted to engage the socket and a bolt **136** passes through the two arms of the female member and the head locking the parts together. The head **137** of the bolt **136** and the nut **138** are both socketed in the female portion so that they do not change or affect the outer contour of the shackle and so do not differentiate it in size or shape from the other chain links.

For purposes of convenience, I have laid emphasis on the use of the hoist car to carry my hoist and this is the preferred form. Obviously my hoisting mechanism might equally well be used as a fixed structure as shown in Figures 4 and 5 and my claims are intended to cover such a structure also.

Figures 7 and 8 differ from the devices shown in Figures 1 and 2 in that the cross head guide now becomes a single member **150**, and the cross head instead of having an arm on each side has only a downwardly depending arm **151**. The sheaves are on horizontal axes. The relationship is generally the same however. In this case, the pawl on the chain sheave, on the bridge, is controlled by means of a pawl trigger **152**, linkage **153** and pads **154, 155** on the car. These pads are depressed by means of linkage shown diagrammatically at **156** controlled by a lever **157** at the operator's station so that these pawls cannot be released except when the car is properly spotted. In the modified form shown in Figure 9, there are two fixed sheaves **160, 161**. The chains **162, 163** pass up over these two sheaves and to the left over the sheaves **164**, thence over sheaves **165** on the cross head and thence to an anchorage **166**. Or if desired, there may be substituted for the anchorage a single sheave to effect a balance in the tension in both cables.

While I have illustrated my invention in connection with a device primarily intended to handle "tainter" gates in connection with dams and the like and a device wherein chain cable is used, it will be understood that my device is equally well applicable to handling other kinds of weights under other circumstances and that any flexible tension member or cable may be used. When a chain is used, the wheels over which it travels would normally be sprocket wheels. If a cable were used, the wheels would of course be smooth sheaves and not sprockets. In some of the claims, I have used the term "cable" and "sheave." It is understood that I use these terms in the broad sense, chain and sprocket being specific types of cable and sheave.

I claim:

1. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear connected to each nut, a drive shaft extending parallel with the screws, means for rotating it and pinions on it in mesh with the gears, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out.

2. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear connected to each nut, a drive shaft extending parallel with the screws, means for rotating it and pinions on it in mesh with the gears, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out, the axes of the fixed sheaves being horizontal and of the movable sheaves vertical.

3. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear

connected to each nut, a drive shaft extending parallel with the screws, means for rotating it and pinions on it in mesh with the gears, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out, and independent means for automatically rotating the end sheaves in a direction to pay out the cable ends.

4. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear connected to each nut, a drive shaft extending parallel with the screws, a motor and a power transmission system between it and the shaft adapted to give a plurality of gear ratios between the prime mover and the drive shaft, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out.

5. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear connected to each nut, a drive shaft extending parallel with the screws, means for rotating it and pinions on it in mesh with the gears, a pair of fixed intermediate sheaves on axes in a plane tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out, the drive nuts being spaced beyond the end sheaves whereby the screws are always in tension.

6. In a hoist, a plurality of widely separated fixed sheaves, a movable sheave and means for displacing it with respect to the fixed sheaves, a single continuous cable wrapped about all said sheaves and having two free ends, the ends depending downwardly one from each of the fixed sheaves, the direction of movement of the movable sheave being such that when moved in one direction it exerts a tension on the cable to draw in both ends over the fixed sheaves and when moved in the opposite direction, it pays out the ends of the cable, and additional automatic means tending to rotate the fixed sheaves in a direction adapted to cause the cable to be paid out.

7. In a hoist, a plurality of fixed sheaves, a pair of movable sheaves, a single continuous cable wrapped about all said sheaves and having two free ends, the ends depending downwardly, one from each of the fixed sheaves, means for moving the movable sheaves toward and from one another to cause the cable to be drawn in over the fixed sheaves as the movable sheaves move apart and to be paid out over the fixed sheaves as the movable sheaves approach one another, and automatic means tending to rotate the fixed sheaves in a direction adapted to cause the cable to be paid out.

8. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, means for rotating it, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out.

9. In a hoist, a pair of aligned cross head guides, a cross head carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw, a gear connected to each nut, a drive shaft extending parallel with the screws, means for rotating it and pinions on it in mesh with the gears, a pair of fixed intermediate sheaves tangential to the two movable sheaves, fixed end sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the end sheaves in such relationship that when the movable sheaves are separated one from another, the cable is drawn in over the end sheaves and when the sheaves approach toward one another, the cable ends are paid out.

10. In a hoist, a plurality of fixed sheaves, a movable sheave and means for displacing it with respect to the fixed sheaves, a single continuous cable wrapped about all said sheaves, the ends depending downwardly one from each of the fixed sheaves, the direction of movement of the movable sheave being such that when moved in one direction it exerts a tension on the cable to draw in the ends over the fixed sheaves and when moved in the opposite direction, it pays out the ends of the cable, and means associated with the fixed sheaves for yieldingly tending to resist the inward movement of the cable.

11. A pair of aligned cross head guides, cross heads each carrying a sheave and mounted for movement one along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw and means for rotating the nuts in unison to move the sheaves toward and from one another, a pair of fixed sheaves, a cable extending about all of said sheaves and having its two ends depending downwardly one from each of the said fixed sheaves.

12. A pair of aligned cross head guides, cross heads each carrying a sheave and mounted for movement along each cross head guide, oppositely threaded screws connected to each cross head, a drive nut for each screw and means for rotating the nuts in unison to move the sheaves toward and from one another, a pair of fixed sheaves, a cable positioned about all of said sheaves having its two ends depending downwardly one from each of the said fixed sheaves, and yielding means associated with the fixed sheaves tending to move the ends of the cables downwardly over said sheaves.

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