No. 764,600. PATENTED JULY 12, 1904.

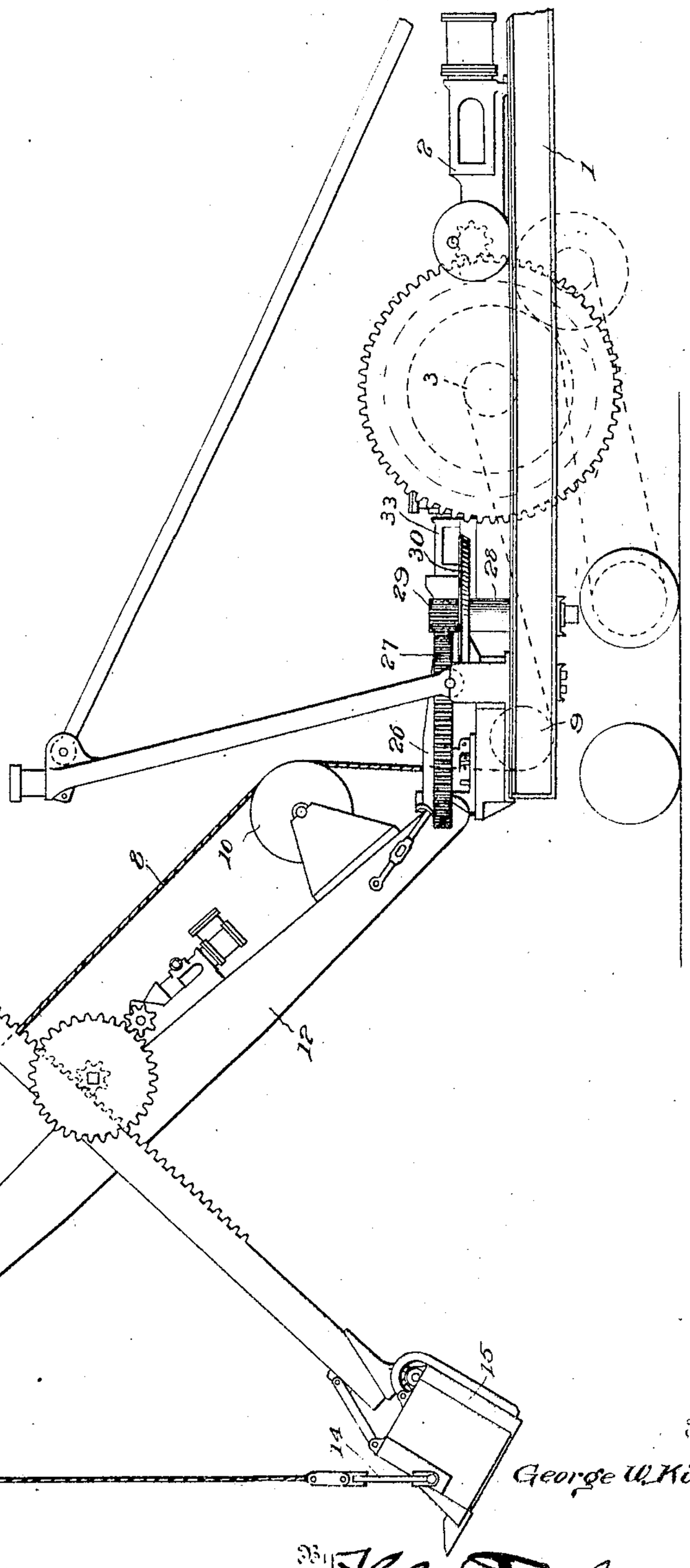
G. W. KING.

STEAM SHOVEL.

APPLICATION FILED MAY 9, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

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## STEAM SHOVEL.

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NO MODEL. 3 SHEETS—SHEET 2

Fig. 2.

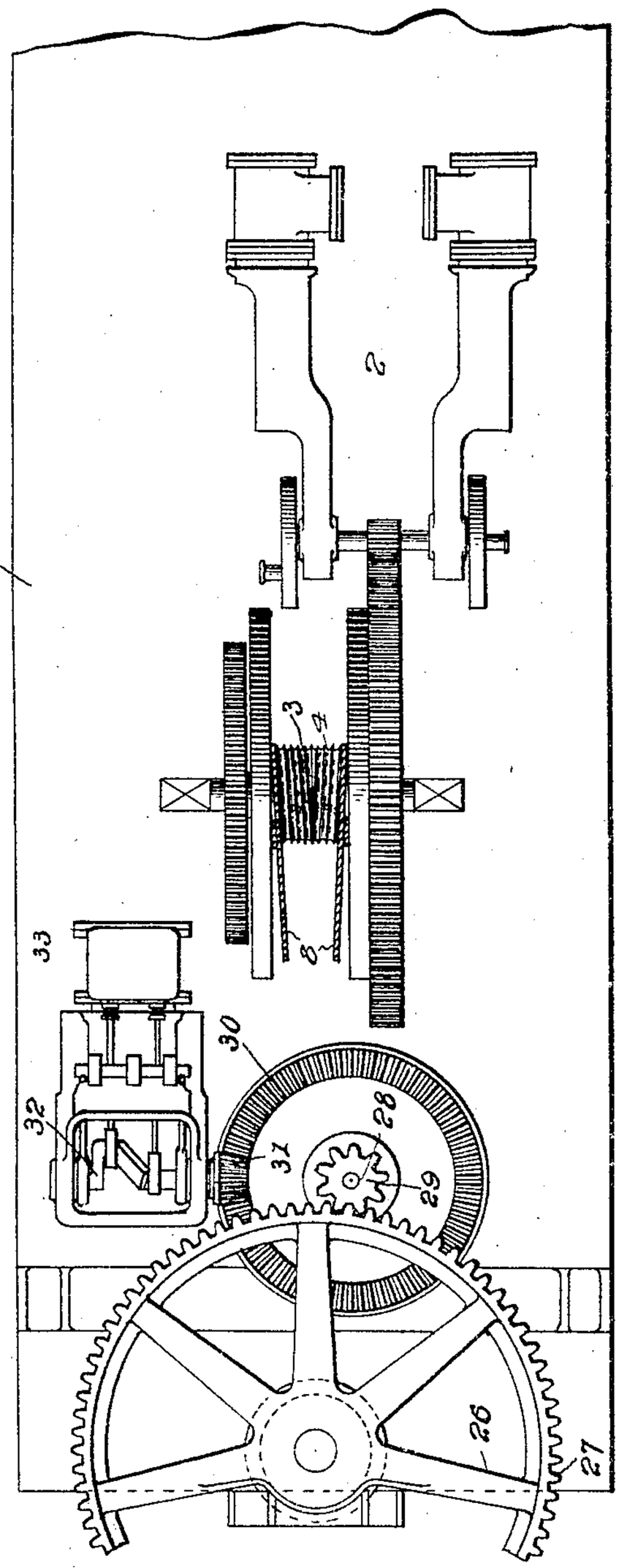



Fig. 4.

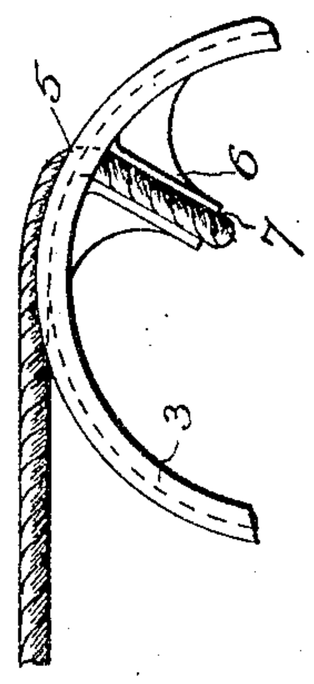
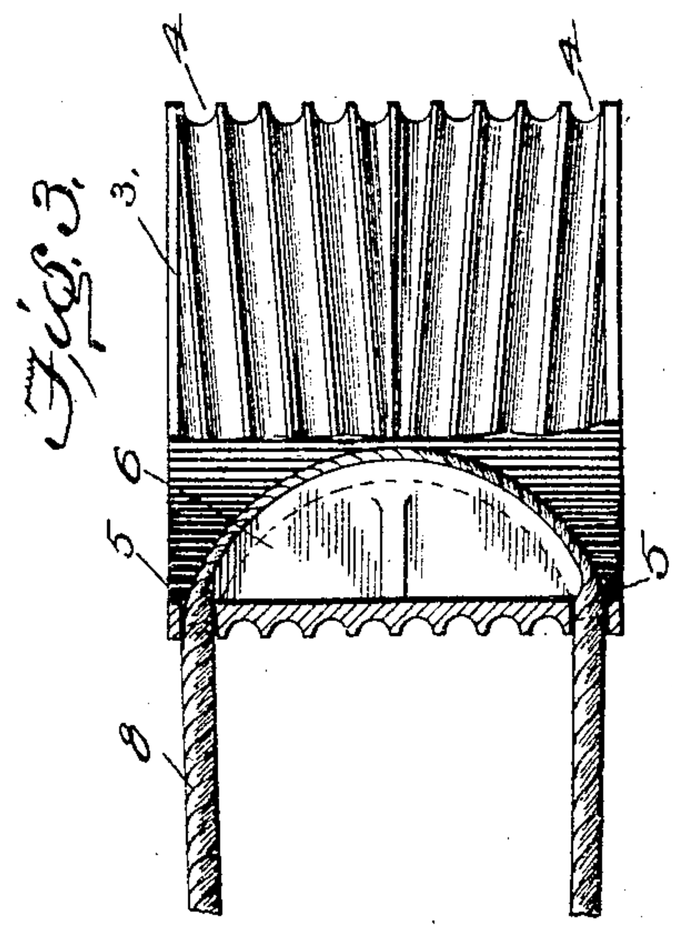



Fig. 3.

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## STEAM SHOVEL.

APPLICATION FILED MAY 9, 1904.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5.

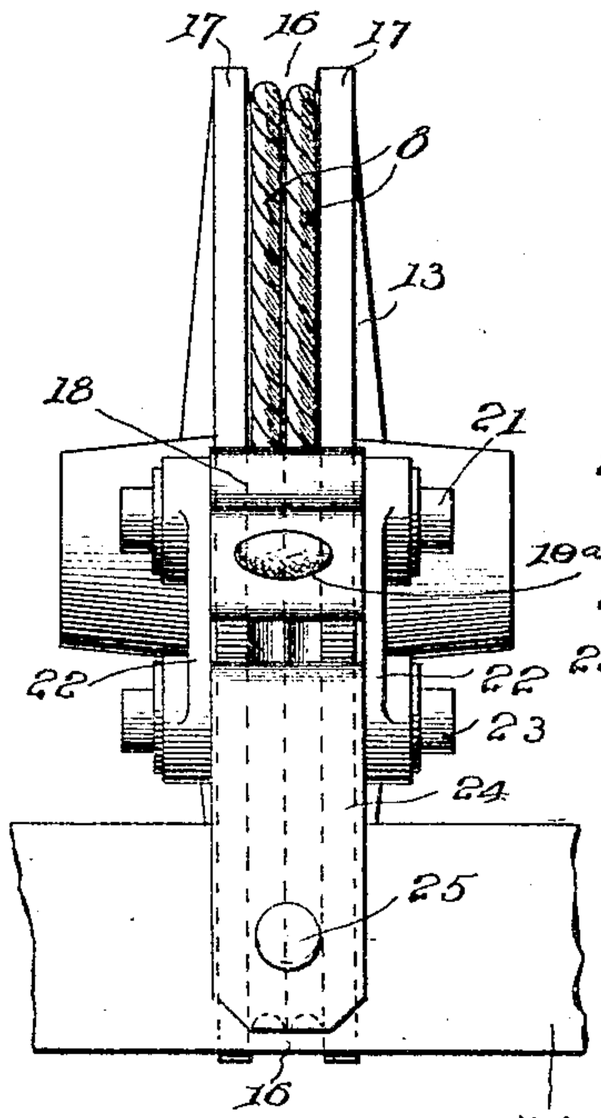



Fig. 6.

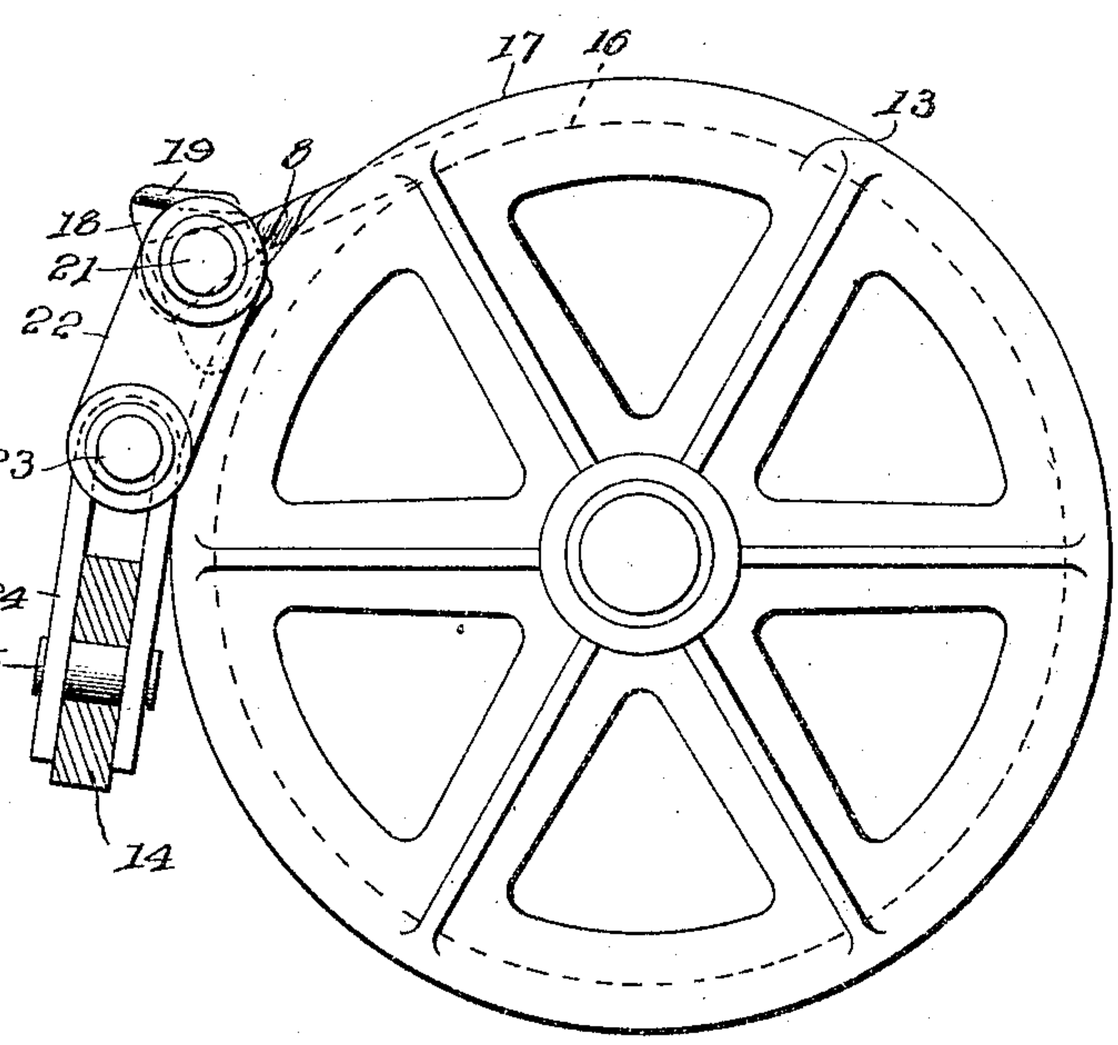



Fig. 7.

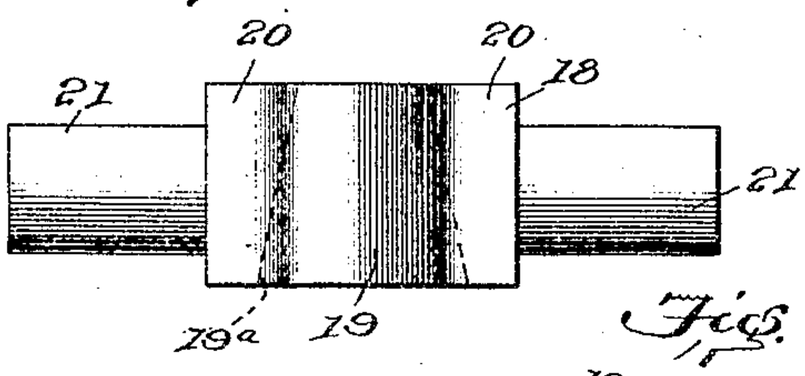



Fig. 8.

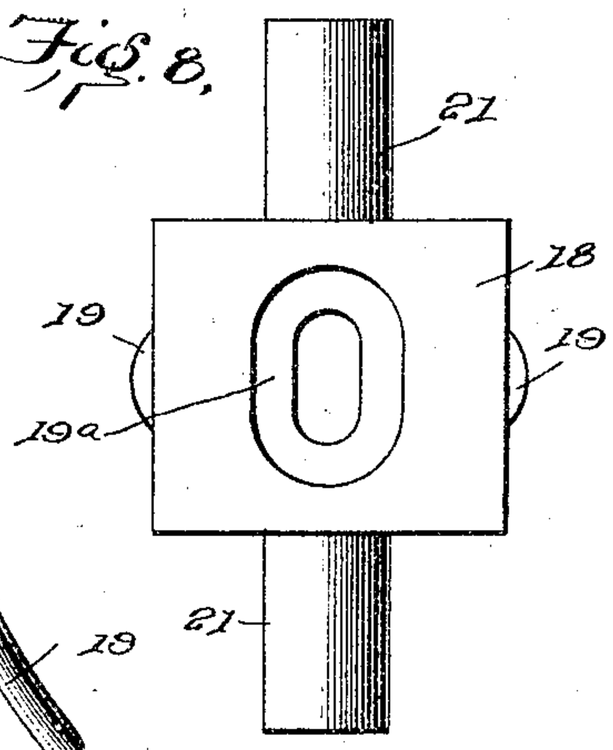
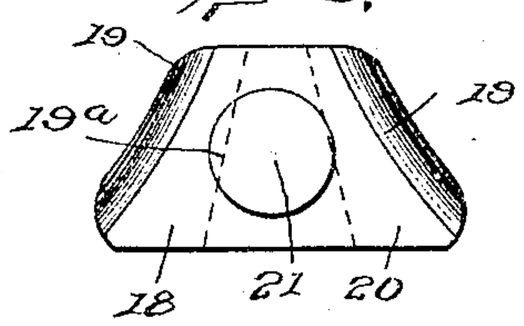



Fig. 9.




Witnesses

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# UNITED STATES PATENT OFFICE.

GEORGE W. KING, OF MARION, OHIO, ASSIGNOR TO THE MARION STEAM SHOVEL COMPANY, OF MARION, OHIO, A CORPORATION OF OHIO.

## STEAM-SHOVEL.

SPECIFICATION forming part of Letters Patent No. 764,600, dated July 12, 1904.

Application filed May 9, 1904. Serial No. 207,010. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. KING, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Steam-Shovels, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to steam-shovels, and has for its object to provide an improved construction and arrangement of the hoisting-cable and its connections by means of which the dipper is raised and lowered. Heretofore a single cable or single lead of cable has been employed between the dipper and hoisting-drum, the load being such as to require a cable of large diameter and also a correspondingly large drum and guiding-sheaves.

My present invention contemplates the employment between the dipper and hoisting-drum of two cables or two parallel leads of a single cable, whereby the cable of smaller diameter may be employed, the greater flexibility of which permits the employment of sheaves and a hoisting-drum of correspondingly smaller diameter. In order to equalize the strains upon the two leads of the cable and insure the equal distribution of the load, the ends of the cable are connected to the dipper, while the bight or loop of the cable where it is doubled upon itself is located at the hoisting-drum, the cable passing through apertures in the cylindric body portion of the drum and resting within the interior thereof upon a bearing in the form of a grooved saddle, along which the cable is free to slide, so as to equalize the strains on the two leads thereof. The outer surface of the cylinder-body of the drum is spirally grooved in opposite directions from its ends toward its center, so as to prevent side strain upon the machinery at the hoisting-drum.

The invention also contemplates an improved connection between the hoisting-cable and dipper-bail whereby a maximum lift of the dipper is obtained in connection with a minimum height of the sheave at the upper end of the boom, the parts being constructed with a view to preventing side motion and to obtaining a maximum of strength and durability, relieving the cable of the liability to sharp breaking or kinking at its point of connection, and making provision for resisting the lateral motion and twisting strains caused by the dipper when in use.

A further feature of my present invention relates to the construction and arrangement of the swinging mechanisms by which the swinging-circle on which the boom is mounted is operated. The construction now in general use comprises a drum, an engine for operating the same, and cables or chains for transmitting the movement of the drum to the swinging-circle. This arrangement not only lacks compactness, but is undesirable on account of the constant stretching of the swinging cables or chains. My present invention contemplates the employment of a swinging-engine located immediately adjacent to the swinging-circle, preferably laterally with relation thereto, the engine-shaft being directly connected by bevel-gearing with a vertical shaft having a pinion which meshes with a gear or segmental rack on the swinging-circle, thus operating said circle directly, rendering the construction more compact, and avoiding the employment of cables, chains, or other power-transmitting devices which are liable to stretch.

To the preceding ends my present invention consists in certain novel features, which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a steam-shovel embodying my invention in one form, only so much thereof being shown as is necessary to an understanding of the features of novelty. Fig. 2 is a plan view of the same with the boom and adjacent parts omitted. Fig. 3 is an enlarged detail plan view, partly in horizontal section, of the hoisting-drum. Fig. 4 is a detail end elevation of the same. Fig. 5 is a front elevation of the structure at the point of the boom, illustrating the connection between the cable and dipper-bail. Fig. 6 is a side elevation of the same. Fig. 7 is a plan view of the socket-piece forming a part of the cable con-

nection. Fig. 8 is an elevation of the same, and Fig. 9 is an end view.

In the accompanying drawings, 1 indicates the body or support of the steam-shovel, which in the present instance is shown as a car-body. Upon this body is mounted the hoisting-engine 2, which by means of suitable intermediate gearing drives the hoisting-drum 3. This drum, which is shown in enlarged detail views in Figs. 3 and 4, has a cylindrical body, the outer surface of which is spirally grooved, as indicated at 4, there being two spiral grooves, one beginning at each end of the drum and their direction being opposite, so that they extend to and meet at the central or middle portion of the drum. At each end of the drum there is formed through its body an aperture 5, and between these apertures there extends on the inner side of the drum, lengthwise thereof, a bridge or saddle 6, having formed therein a groove 7. This bridge or saddle has its grooved edge preferably formed in the arc of a circle, as shown more particularly in Fig. 3, to permit the hoisting-cable to slide freely over the same. The hoisting-cable (indicated by the reference-numeral 8) is double in the sense that it comprises two leads extending from the hoisting-drum to the dipper, these leads being preferably formed by employing a single cable of double length threaded through the apertures 5 of the hoisting-drum and having the loop or bight which constitutes the portion connecting the two leads arranged to lie in the groove 7 of the saddle 6. This double cable may be conducted to the point of the boom in any suitable manner, that which I prefer being the manner shown, in which the cable passes under a double sheave 9, located below the swinging-circle and over double sheaves 10 and 11, located, respectively, on the upper and lower portions of the boom 12. The two leads of the cable finally pass around a double sheave 13, mounted on the point or upper extremity of the boom, the ends being connected to the bail 14 of the dipper 15. This connection is effected in the manner shown in detail in Figs. 5 to 9 of the drawings, in which it will be seen that the sheave 13 has a peripheral groove or channel 16, (shown in Fig. 5,) located between marginal flanges 17 on each side thereof, the leads of the cable 8 lying well within said groove.

18 indicates a socket-block having a socket or opening $19^a$ formed therethrough, in which the ends of the cable 8 are secured in any approved manner. This socket-block is trapezoidal in cross-section, one of the inclined sides thereof resting against the face of the sheave 13 when the dipper is raised to its maximum height and the block being constructed with its two inclined sides similar, so as to permit it to be reversed. Each of the inclined sides of the block is provided with a rib or projection 19, which is adapted to enter the groove 16 in the sheave 13 when the block is raised, so as to contact with said sheave, and this engagement of said rib or projection with the groove of the sheave prevents lateral displacement of the block when in contact with the sheave. The socket-block is of a width about equal to the width of the face of the sheave, so that when it is in contact with the same its projection 19 lies within the groove 16, while the flat or plane portions 20 of the inclined face of the block lying on each side of the rib or projection 19 rest upon the peripheral portions of the flanges 17 of the sheave. The block 18 is provided at each end with a trunnion 21, and on these trunnions are pivoted the upper ends of two links 22, which are separated by a distance equal to the width of the face of the sheave 13, so that said sheave may enter the space between the links 22, which lie on opposite sides thereof when in the position shown in Fig. 6. The lower ends of the links 22 are pivotally mounted on the extremities of a pin 23, on which is mounted between said links the upper or pivotal end of a clevis 24, the lower end of which is connected by a pivot-pin 25 to the dipper-bail 14.

From the foregoing description it will be seen that by employing a double lead of cable between the hoisting-drum and dipper a cable of smaller diameter and greater flexibility may be used, thus permitting the employment of a drum and sheaves of smaller diameter. It will also be seen that this cable is self-equalizing, since any unequal strain caused by inequality in the lengths of the two leads arising from stretching of the cable or any other cause will be automatically remedied by the slipping over the bridge or saddle 6 of that portion of the cable connecting the two leads when the cable had been paid out from the hoisting-drum until the strains on the two leads of the cable have become equalized. The employment of the right and left spiral grooves on the hoisting-drum prevents any side strains upon that portion of the machinery. With the connection between the dipper-bail and cable now in common use the dipper cannot be lifted above a certain point without bending the cable sharply at the point where it leaves the socket-block, thereby rendering it exceedingly dangerous to lift the dipper to a height such that the block will come in contact with the sheave at the end of the boom. Furthermore, when this occurs with the construction now in common use the lateral motion and twisting strains caused by the dipper further tend to strain and break the cable or connection. With the construction which I have devised these objections are avoided. The pivoting of the socket-block permits the cable to leave the face of the sheave at a tangent and always enter the socket-block in a direction at right angles thereto even when the socket-block is pulled up against and

partly around the sheave, thus preventing any sharp bend of the cable at the point where it enters the block. Furthermore, this pivoting of the socket-block, in conjunction with the employment of connecting-links between said block and the dipper-bail clevis, permits said block to be pulled up partly around the sheave, thus giving a maximum lift of the dipper for a minimum height of the terminal sheave of the boom. The attainment of this result is further aided by the fact that the links are so spaced apart as to permit the entry between them of the peripheral portion of the sheave. It should also be noted that both by the engagement of the socket-block with the groove of the sheave and by the entry of the sheave between the connecting-links lateral strains arising from the action of the dipper are effectually resisted and their transmission to the cable is prevented.

Referring now to that portion of my present invention which relates to the swinging-circle and its operating mechanism, 26 indicates the swinging-circle supporting the boom in the usual manner and provided around its margin with a segmental gear or rack 27. 28 indicates a vertical shaft located in the rear of the swinging-circle and provided at its upper end with a pinion 29, which meshes with the rack 27. The shaft 28 also carries a large horizontal bevel-gear 30, which meshes with a bevel-pinion 31 on the shaft 32 of the swinging-engine 33, said engine being located immediately adjacent to the swinging-circle 26 at one side of the car-body and of the gear 30. By reason of this construction the mechanism for operating the swinging-circle is rendered very compact, occupying only a relatively small space, and the disadvantages attendant upon the employment of cables or similar flexible chains between the swinging engine and circle arising, as hereinbefore pointed out, from their liability to stretch are entirely done away with.

I do not wish to be understood as limiting myself strictly to the precise details of construction hereinbefore described and shown in the accompanying drawings, as the same may obviously be modified without departing from the principle of my invention. Moreover, while I have described my invention in connection with a steam-shovel it is obvious that the same is applicable to other forms of hoisting apparatus.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a dipper, and a hoisting-drum and intermediate guiding-sheaves, of a double cable connecting said drum and dipper, substantially as described.

2. The combination, with a dipper, and a hoisting-drum and intermediate guiding-sheaves, of a double cable connecting said drum and dipper, the two leads of said cable being connected with each other at the drum and being movable relatively to the drum to automatically equalize the strain of the leads, substantially as described.

3. The combination, with a dipper, and a hoisting-drum having its outer surface provided with right and left grooves, of a double-lead hoisting-cable connecting the dipper and drum, said leads respectively occupying the grooves of the drum when coiled thereon, substantially as described.

4. The combination, with a dipper and guiding-sheaves, of a hoisting-drum having an aperture through its body near each end of the face thereof, and a grooved bridge or saddle arranged longitudinally of the drum within the interior thereof between said apertures, and a double hoisting-cable, the two leads whereof connect said dipper and drum, said cable passing through said apertures and having its connecting portion arranged in said grooved saddle or bridge and adapted to slide therein, substantially as described.

5. The combination, with a dipper and guiding-sheaves, of a hoisting-drum having an aperture through its body near each end of the face thereof, and a grooved bridge or saddle arranged longitudinally of the drum within the interior thereof between said apertures, and a double hoisting-cable, the two leads whereof connect said dipper and drum, said cable passing through said apertures and having its connecting portion arranged in said grooved saddle or bridge and adapted to slide therein, said saddle or bridge having its grooved periphery formed in the arc of a circle, substantially as described.

6. The combination, with a dipper and guiding-sheaves, of a hoisting-drum having an aperture at each end of its body, and spiral right and left grooves extending respectively from said apertures to the central portion of the drum, and a double hoisting-cable connecting said dipper and drum, the ends of the leads of said cable passing through said apertures and being connected within the drum and movable relatively thereto, substantially as described.

7. The combination, with a dipper and guiding-sheaves, of a hoisting-drum having an aperture at each end of its body, and spiral right and left grooves extending respectively from said apertures to the central portion of the drum, and a double hoisting-cable connecting said dipper and drum, the ends of the leads of said cable passing through said apertures and being connected within the drum and movable relatively thereto, said drum being provided on its interior with a saddle or bridge extending longitudinally thereof between said apertures and having a grooved peripheral portion formed in the arc of a circle, substantially as described.

8. The combination, with a dipper and a hoisting-cable, of a connection between the

two comprising a socket-block pivoted on an axis transverse to the line of travel of the cable, substantially as described.

9. The combination, with a hoisting-cable, and a dipper provided with a bail and clevis, of a socket-block, and connecting-links pivoted at one end to the socket-block and at the other end to the clevis, substantially as described.

10. The combination, with a boom-sheave, a hoisting-cable passing around the same, and a dipper provided with a bail and clevis, of a socket-block to which the cable is secured, and parallel links connecting said socket-block and clevis, to which they are pivoted at their ends, said links being separated by a distance sufficient to receive between them the peripheral portion of the boom-sheave, substantially as described.

11. The combination, with a hoisting-cable, and a grooved sheave around which said cable passes, of a dipper, and a socket-block having a pivotal connection with the dipper and having the cable secured therein, said socket-block having a rib or projection on its face adapted to enter the groove of the sheave, substantially as described.

12. The combination, with a hoisting-cable, and a grooved sheave around which said cable passes, of a socket-block in which the cable is secured, said socket-block having a rib or projection adapted to enter the groove of the sheave, a dipper provided with a bail and clevis, and links pivoted to said clevis and to the ends of the socket-block, said links being separated so as to receive between them the peripheral portion of the sheave, substantially as described.

13. The combination, with a sheave and a hoisting-cable passing around the same, of a dipper, and a socket-block to which the cable is secured, said socket-block having a pivotal connection with the dipper and being provided with an inclined face adapted to contact with the face of the sheave, substantially as described.

14. The combination, with a hoisting-cable, and a grooved sheave around which said cable passes, of a socket-block in which the cable is secured, said block having a body of a width equal to that of the face of the sheave, and an inclined contact-face provided with a rib or projection to enter the groove of the sheave, said block being provided with projecting trunnions at its ends, a dipper provided with a bail and clevis, and links pivoted at their lower ends to said clevis, their upper ends being pivotally mounted on the trunnions of the socket-block, said links being adapted to receive between them the peripheral portion of the sheave, substantially as described.

15. In a steam-shovel, a swinging-circle provided with a gear-segment upon its periphery, in combination with a swinging-engine located adjacent to said swinging-circle, and a train of gearing between said engine and said gear-segment, directly and positively connecting the engine and circle, substantially as described.

16. In a steam-shovel, the combination, with a body or support, of a swinging-circle mounted thereon and provided with a peripheral gear-segment, a vertical shaft mounted in said body adjacent to said circle and having a pinion to mesh with the gear-segment thereof and a bevel-gear, and a swinging-engine mounted on said body adjacent to the circle and having its shaft provided with a bevel-pinion to mesh with the bevel-gear of the vertical shaft, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE W. KING.

Witnesses:
ROBERT G. LUCAS,
GEO. A. CHENEY.