No. 626,322. Patented June 6, 1899.

F. S. FARR & C. F. NYBERG.

ICE MOTOR.

(Application filed Sept. 30, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

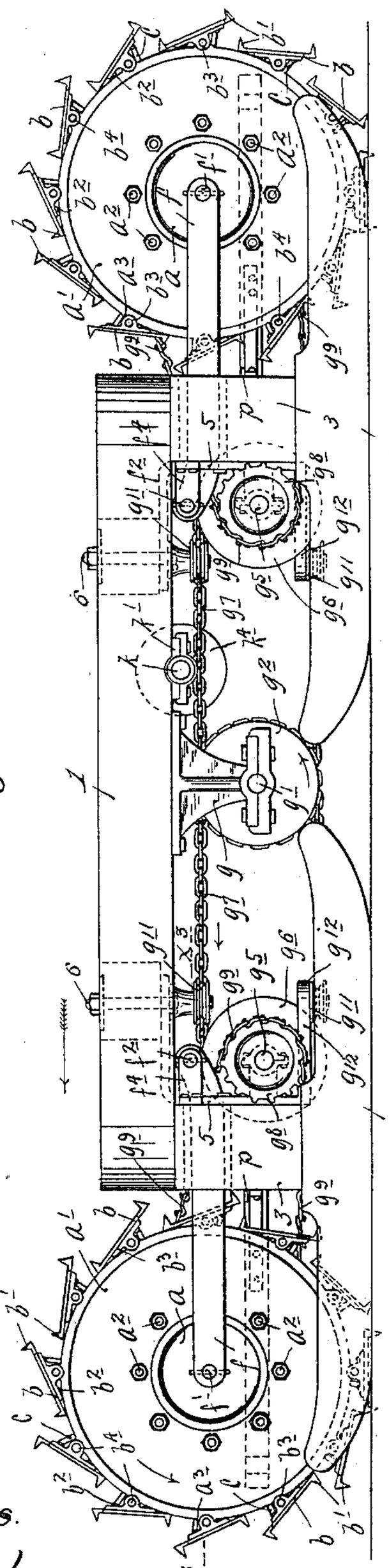
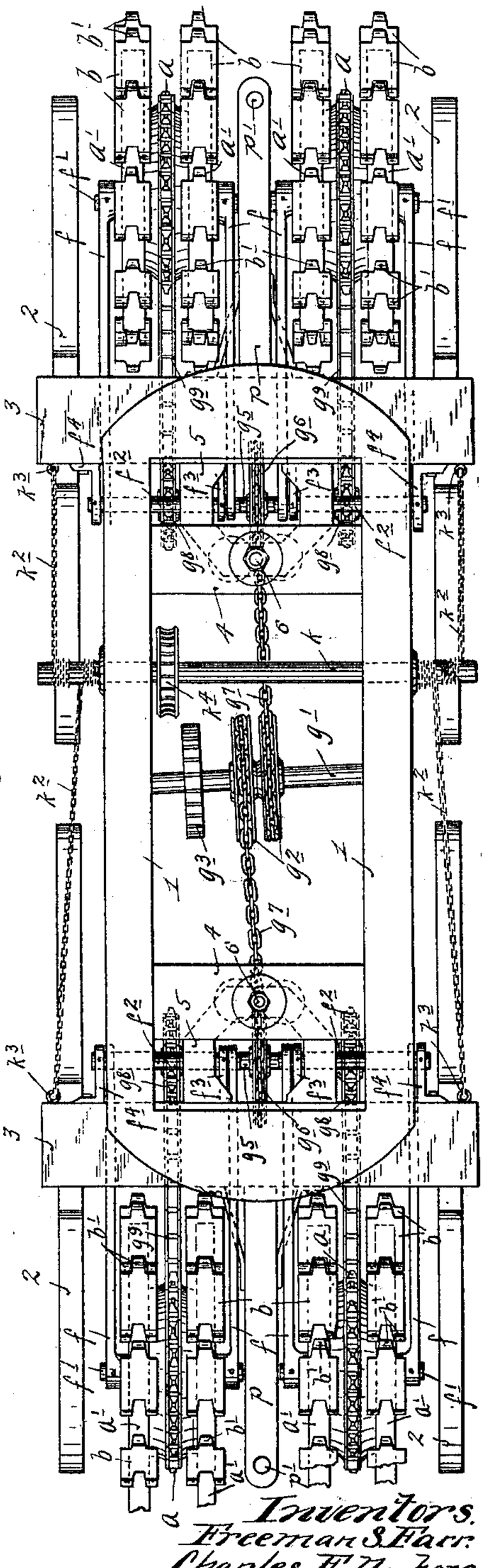


Fig. 2.



Witnesses.

Harry Kilgore,

F. D. Merchant.

Inventors.

Freeman S. Farr.

Charles F. Nyberg.

By their Attorney.

Jas. F. Williamson

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(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

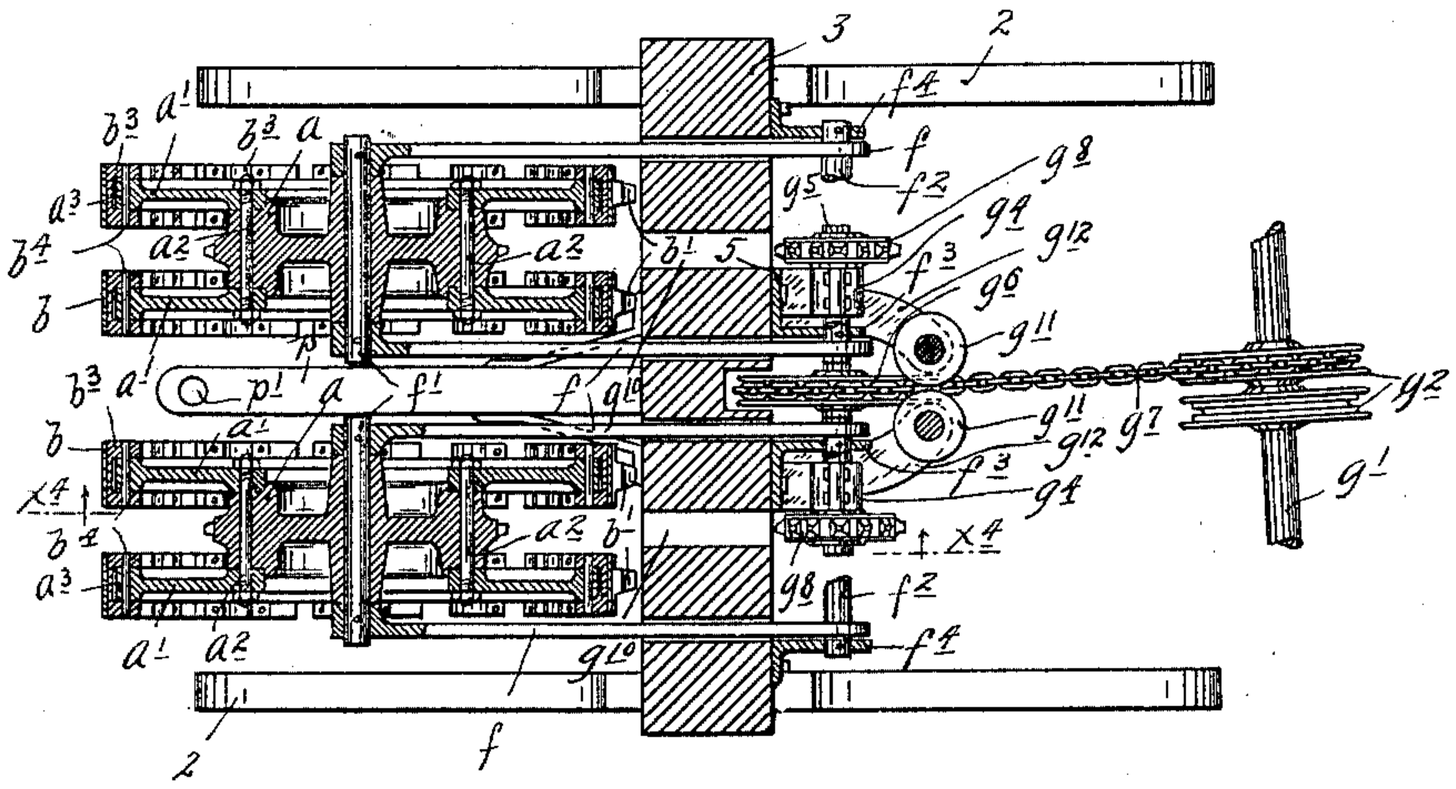

Fig. 4.

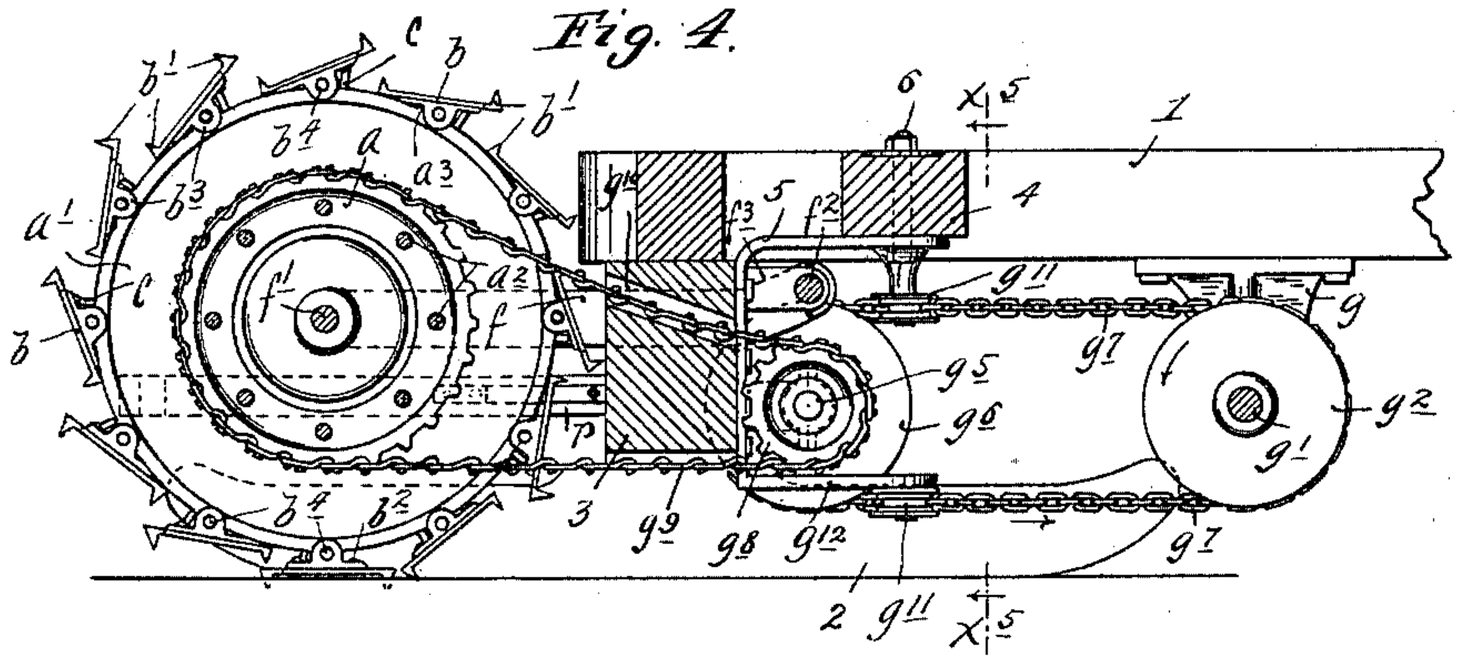

Fig. 5.

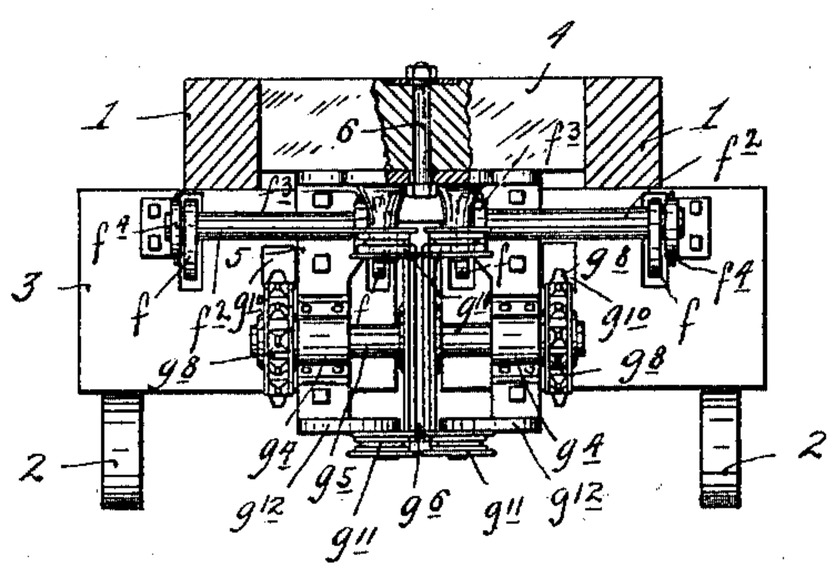

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Fig. 6.

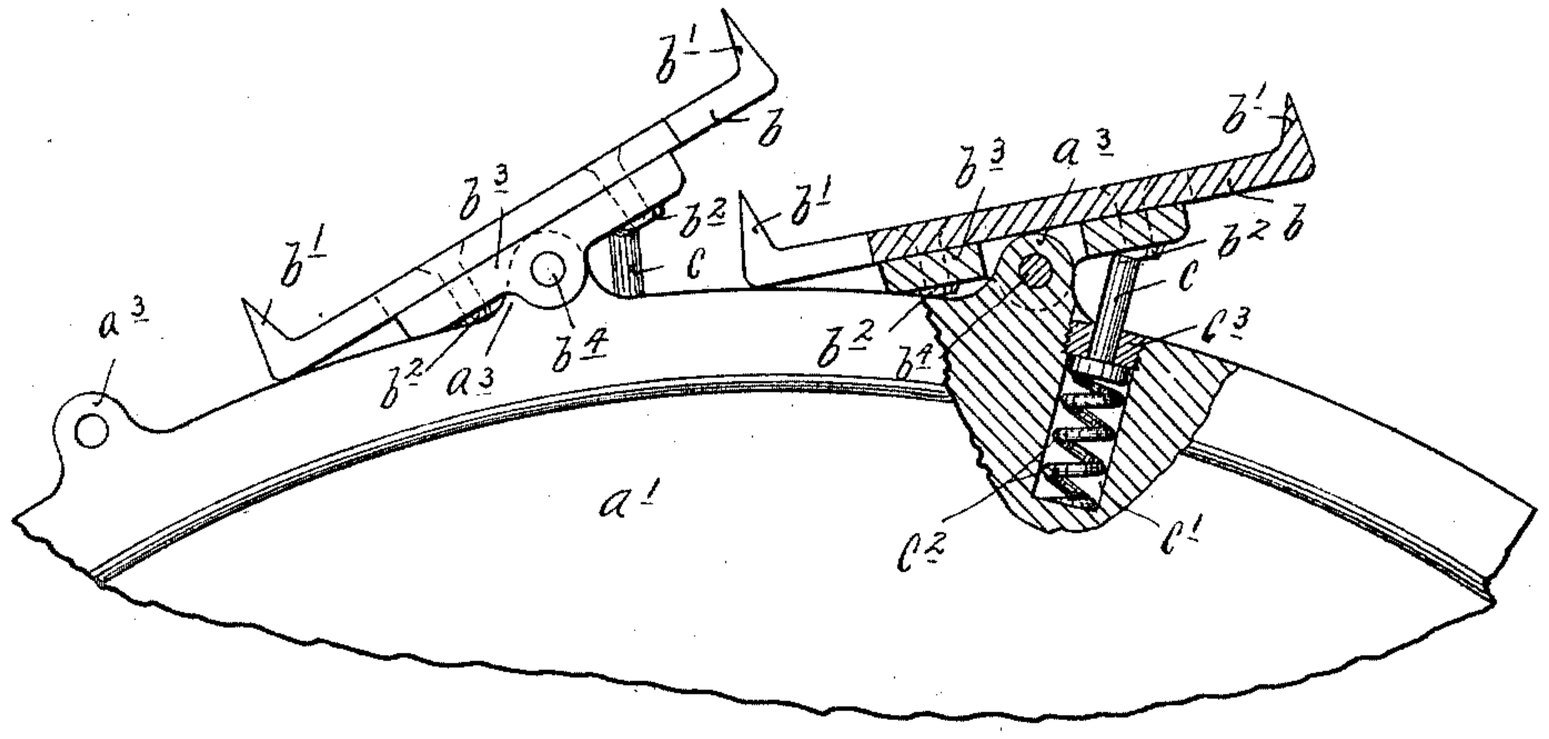


Fig. 7.

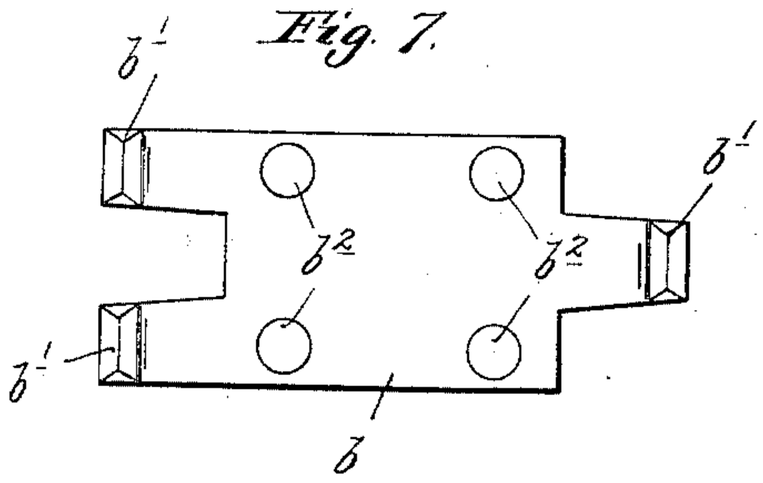
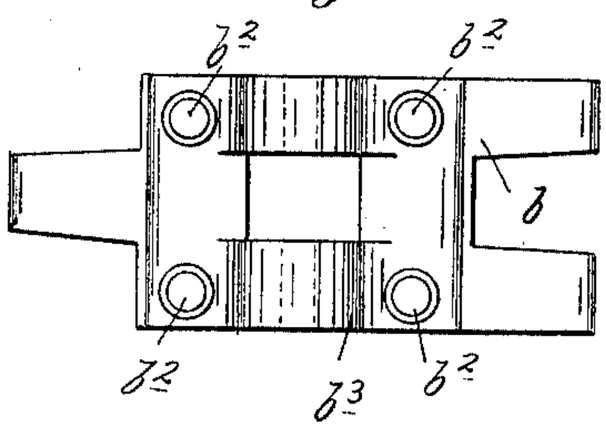


Fig. 8.



Witnesses.
Harry Kilgore
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Inventors.
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Charles F. Nyberg.
By their Attorney.
Jas. F. Williamson

UNITED STATES PATENT OFFICE.

FREEMON S. FARR AND CHARLES F. NYBERG, OF MINNEAPOLIS, MINNESOTA.

ICE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 626,322, dated June 6, 1899.

Application filed September 30, 1898. Serial No. 692,292. (No model.)

To all whom it may concern:

Be it known that we, FREEMON S. FARR and CHARLES F. NYBERG, citizens of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Ice-Motors; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our present invention relates to ice or snow motors, and has for its primary object to provide an efficient motor of this character especially adapted for use in pineries or other logging districts for hauling heavy loads or trains of logs. As is well known, in such places the cut logs are hauled on heavy sleds and deposited on the frozen river or at other distant points for transportation in the spring by the running stream or other means. The heavy logging-sleds are run over artificial and icy road-beds, usually constructed with well-glazed channels, which permit the sleds to be drawn with much greater ease and safety than would be possible over an ordinary road-bed of snow. It requires considerable care and labor to keep these artificial road-beds in proper condition. Various traction-motors have been constructed for use on these road-beds, but in every case known to us they have been found either inefficient to perform the work or so destructive to the road-bed as to render their use impracticable and unprofitable. In fact, prior to our invention draft-animals have been found to be the only practicable means of hauling these heavy sleds and their loads over such road-beds.

Our invention provides a power device in the nature of an ice-motor which is practicable for the purposes above noted and which, while reasonably simple in construction, has all that could be required by way of efficient traction and does not cut or distort the road-bed to any considerable extent.

The preferred form of our invention is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figures 1 and 2 are respectively views in side elevation and plan of the so-called "ice-motor." Fig. 3 is a horizontal section taken approximately on the line x^3 x^3 of Fig. 1. Fig. 4 is a vertical longitudinal section taken on the line x^4 x^4 of Fig. 3. Fig. 5 is a transverse vertical section taken on the line x^5 x^5 of Fig. 4. Fig. 6 is a side elevation with some parts broken away and others shown in section of a portion of one of the traction-wheels. Figs. 7 and 8 are plan views of one of the so-called "calk-plates" showing, respectively, the bottom and top of the same.

In the illustration given, 1 indicates an approximately rectangular frame or body, the ends of which are shown as slightly segmental in form.

2 indicates the runners, and 3 the transverse beams, to which the runners 2 are secured in pairs to form sleds. There are two pairs of these sleds, one located at the front and the other at the rear of the frame 1, with their transverse beams 3 bearing one under each segmental end portion of said frame. The frame 1 has also a pair of transverse intermediate beams 4, to which the sleds are pivotally connected by means of coöperating brackets 5, rigidly secured to the respective beams 3 and pivotally attached to said beams 4 by king-bolts 6.

Working in front or outward of each end of the frame 1 is a pair of complex traction-wheels, each of which in the preferred construction consists of the following details, connected and mounted in the following manner: a indicates a sprocket-wheel having a very heavy hub and flange, and a' indicates a pair of heavy annular flanges or rims, which are secured together and to the rim of the sprocket-wheel a by nutted bolts a^2. These flanges or rims a' are provided with a plurality of evenly-spaced peripheral lugs a^3, to each of which a calk-plate is pivotally secured. These so-called "calk-plates" (indicated at b and best shown in Figs. 6, 7, and 8) are provided with calks b', and in the construction illustrated they are secured by rivets b^2 to blocks b^3, that are directly pivoted to the coöperating lugs a^3 by pins b^4. The disposition of the calks b' is best illustrated in Figs. 6 and 7, by reference to which it will be seen that the calk-plates b are provided at their ends which project in one common di-

rection with laterally-spaced pairs of said calks and are provided at their ends that project in the other common direction with single centrally-located calks that are adapted to work between the laterally-spaced calks of the adjacent calk-plates. It thus becomes evident that each calk-plate when thrown into contact with the runway or road-bed will have very much the action of a horse-shoe, and it will be later more clearly indicated that these calk-plates are brought into contact with and removed from contact with the road-bed flatwise or by a movement parallel to the surface which they engage, so that all three of the calks will be simultaneously embedded into the road-bed and in a similar manner removed therefrom. This action is of the utmost importance, as it causes the minimum damage to the road-bed and does not crack or tear the ice of the road-bed, as is the case with devices wherein the calks are rocked or moved while embedded.

The fact that the calk-plates *b* have a pair of calks at one end spaced apart from each other, and have, at the other end, a single centrally-located calk, and that adjacent plates *b* are so disposed that the single central calk of any given plate works between the pair of calks on the next adjacent plate, is an important feature of construction, for the reason that, in virtue of this feature, balling from mud or snow is prevented. Otherwise stated, in virtue of this feature, the plates are self-clearing. Without this feature the mud and snow would accumulate under some conditions between the plates and the wheel-rim and on the plates themselves to such an extent as to prevent the successful operation of the traction device.

To prevent the calk-plates from rattling while raised from the road-bed, we employ spring devices, which, as best shown in Fig. 6, consist of headed plungers *c*, that work in seats *c'*, formed in the flanges or rims *a'*, and are spring-pressed outward by coiled springs c^2. The projecting ends of the stems or plungers *c* bear against the coöperating calk-plates, as shown in said Fig. 6, and in the construction illustrated they are removably secured in place by perforated screw-threaded plugs c^3.

The traction-wheels above described are independently mounted each by a pair of arms *f*, that are rigidly secured at their projecting ends to an axle or shaft *f'*, passed through the hub of the coöperating sprocket *a*. The said arms *f* work through suitable passages in the sled-beams 3 and are pivoted at their inner ends on short shafts f^2, that are mounted in flanges f^3 of the brackets 5, and in bearings f^4, directly secured to said sled-beams 3. In this manner the traction-wheels are so mounted that they are free for a sufficient up-and-down movement with respect to the sleds and framework of the device to permit them to pass over rough roads, but are held for angular movement with the sleds, so as to permit of the proper steering action. It will be noted that the centers of the pivot-shafts f^2 are above—that is, higher from the ground than are the centers of the axles *f'*. This feature is very important, as will hereinafter be indicated.

Approximately at the center of the frame 1, extending transversely thereof and mounted in suitable bearings *g*, depending therefrom, is a power-driven shaft *g'*, provided with a pair of chain-sheaves g^2. As shown, the shaft *g'* is also provided with a spur-gear g^3, which forms a part of a suitable driving-gear from an engine or motor, (not shown,) but which would be mounted on and carried by the frame 1. Mounted in suitable bearings g^4, which, as shown, are formed on the brackets 5 at each end of the device, is a counter-shaft g^5, which extends transversely of the sled which carries it at a point below the corresponding pivot-shaft f^2. Each of these counter-shafts g^5 is provided with a chain-sheave g^6, over which and the coöperating chain-sheave g^2 on the driving-shaft *g'* a driving-chain g^7 runs. Again, each counter-shaft g^5 is provided with a pair of sprocket-wheels g^8, which stand in line, one with each of the sprocket-wheels *a* of the traction-wheels. Sprocket-chains g^9, which run over the coöperating sprocket-wheels *a* and g^8, transmit motion to the said traction-wheels. As shown in Figs. 3 and 4, the sled-beams 3 are provided with passages g^{10}, through which the chains g^9 run.

When the sleds are given an angular movement with respect to the frame 1, as is necessary when the device is run on a curve, it is of course evident that the chain-sheaves g^6 will change their angular position with respect to the chain-sheaves g^2, and this would tend to cause the chains g^7 to run off from the said sheaves g^6. However, this is prevented by guide-sheaves g^{11}, which coöperate in pairs, between which the chains g^7 run. These guide-sheaves g^{11} are located so as to engage the chain g^7 approximately in vertical line with the centers of the king-bolts, so that the steering movements of the sleds will not change the tension or slack of the said driving-chains g^7. The upper pairs of these guide-sheaves g^{11} are mounted on the upper flange of the bracket 5, and the lower pairs of the same are mounted on horizontally-extended projections g^{12} of said brackets 5.

The steering device consists of a transverse shaft *k*, mounted in suitable bearings *k'* on the frame 1, and two pairs of chains k^2, that are wound on the projecting ends of said shaft *k* and are attached to the outer ends of the sled-beams 3, as shown at k^3. The chains k^2 on a given side of the machine are so attached to the shaft *k* that one movement of said shaft will simultaneously wind up both of said chains and the other movement thereof will simultaneously unwind the same. Again, the said chains are so connected to the shaft *k* that one movement of the said shaft will

simultaneously wind the two chains on one side of the machine and unwind the two chains on the other side of the machine, while the reverse movement of said shaft will do the same thing with the said chains, but in reverse order. In this manner the two sleds are given simultaneous and equal movements in the steering action and all of the chains which move them are always kept taut. In the particular construction illustrated the shaft *k* is shown as provided with a worm-gear k^4, with which a worm (not shown) would coöperate. This shaft *k* may be driven either by hand-operated devices or by intermediate power devices driven by the engine or motor which is to be carried by the machine, but preferably by the latter-indicated arrangement.

Between the adjacent pairs of complex traction-wheels we project from the coöperating sled-beams *b* pole-brackets *p*, that are rigidly braced and secured to said beams, and, as shown, are provided at their outer ends with pin-seats *p'*, to which, by means of a pin, (not shown,) the tongue or pole of the sled or bob to be drawn may be detachably secured. The outer ends of these brackets *p* are projected approximately at such distances that when the trailer-sled or attached bob is connected, as just indicated, and the device is run on a curve the runners of the sleds of the entire train will be held tangential to the arc traveled.

Operation: The motor bob or sled above described is adapted to be run in either direction. For the purposes of illustration assume it to be driven in the direction indicated by arrows marked on Fig. 1. When driven in this direction, it is obvious that the lower strands of the forward endless driving-chains g^7 and g^9 will be drawn taut, while the upper strands of the rearward members of said chains g^7 g^9 will be drawn taut. Now it is obvious that inasmuch as the sprocket-wheels g^8 are located below the pivot rods or shafts f^2 and in virtue of the relation thereof to the sprocket-wheels *a* this driving strain from the chains g^9 will draw downward on the traction-wheels, as previously briefly indicated. Now the force with which the traction-wheels will be drawn downward into contact with the road-bed is not directly dependent either on the weight of the traction-wheels themselves or on the weight of other parts of the motor, although, of course, these devices to some extent affect the actions of the traction-wheels. When the traction-wheels are called upon to do but very light work, the strains on their driving-chains will be correspondingly light, and the downward pulls on the traction-wheels, in addition to their own weight, will be proportionately reduced; but when the traction-wheels are called upon to do heavy work, either on account of the heavy load to be drawn or the steepness of the grade, or both, the strains put upon their driving-chains will of course be increased to perform the work, and the downdraw upon the traction-wheels will be proportionately increased, and this, as is obvious, will give an increased traction by causing the calk-plates to more tightly bear against the road-bed and their calks to be more deeply embedded.

The action above described in a traction device we consider to be broadly new, and would consider as within the scope of our invention any device or devices which act to increase the traction of the traction wheel or wheels without direct dependence upon the weight of the load, but in proportion to the force required to draw the said load.

The important actions of the pivoted so-called "calk-plates" have already been noted. By reference to Fig. 4, wherein the action is best shown, it will be seen that the calk-plates are free for such pivotal movements that they will be brought into contact with the road-bed flatwise and similarly removed from the same, so that all of the calks of a given plate will be simultaneously caused to enter the road-bed and be simultaneously removed therefrom. Furthermore, the calks are embedded and removed by vertical movements and are not moved laterally or otherwise than vertically from the time that they commence to enter the road-bed until they have been completely drawn therefrom. This, as is obvious, does the minimum amount of damage to the road-bed. The traction-wheels are located inward of the runners 2 of the motor-bob, so that they are adapted to run over the surfaces of the road-bed which are usually trodden by the horses or draft-animals when such animals are used. Hence the icy channels in which the runners of the bobs pass are not nicked or roughened by the calks of the traction-wheels.

It is of course evident that the so-called "complex traction-wheels" might involve a greater or less number of peripheral rows of calk-plates and that a greater or less number than shown of the said traction-wheels might be employed.

We wish it clearly understood that while the production of an efficient ice or snow motor has been the primary object of our invention we do not limit ourselves to the use of the several novel devices and combinations of devices for this specific purpose. We ourselves well understand that there are many other possible uses of these features and have contemplated the construction of traction-engines or motors having wheels instead of sleds adapted for movement over bare ground.

What we claim, and desire to secure by Letters Patent of the United States, is as follows:

1. A traction-wheel provided with peripheral calk-plates pivoted thereto and adapted for flatwise contact with the road-bed, said calk-plates each having laterally-spaced calks at one end, and a centrally-located calk-plate at the other end adapted to work between the laterally-spaced calks of the adjacent calk-plate, substantially as described.

2. A traction-wheel, involving a chain-wheel having a peripheral flange, and a plurality of calk-plates pivotally secured to said peripheral flange and adapted for flatwise contact with the road-bed, substantially as described.

3. The combination with a movable support, of a traction-wheel connected to said support and provided with peripheral calk-plates adapted for flatwise contact with the road-bed, and driving connections for said traction-wheel acting on said wheel to propel and draw downward on the same, substantially as and for the purposes set forth.

4. The combination with a movable support, involving a pair of pivoted steering-sections, such as sleds, of a steering device involving a windlass-shaft with flexible connections extending from both ends to the corresponding sides of both of said steering-sections, said parts operating substantially as described.

5. The combination with a frame or support having ground-engaging sections, at least one of which is pivoted, of a traction device connected for angular movement with said pivoted section, a driving-gear for said traction device involving a flexible driving connection extending across the axis of said pivoted section, and guides applied to said driving connection in the vicinity of said axis, substantially as described.

6. The combination with a support or frame, having ground-sections, at least one of which is pivoted, of a traction device connected for angular movement with said pivoted section, and a driving-gear for said traction device involving a pair of chain-wheels, one on said support and the other on said pivoted ground-section, a chain or flexible driving connection running over said chain-wheels and across the pivotal axis of said pivotal ground-section, and guide sheaves or wheels arranged to cooperate in pairs and to engage said chain or driving connection in the vicinity of said axis, substantially as described.

7. The combination with a frame or support, having ground-sections, at least one of which is pivoted, of a pole-connecting bracket or arm carried by said pivoted section, and projecting rearward and outward from the same, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

FREEMON S. FARR.
CHARLES F. NYBERG.

Witnesses:
JAS. F. WILLIAMSON,
F. D. MERCHANT.