No. 669,210. Patented Mar. 5, 1901.

C. E. S. BURCH.

ICE LOCOMOTIVE.

(Application filed June 11, 1900.)

(No Model.) 2 Sheets—Sheet 1.

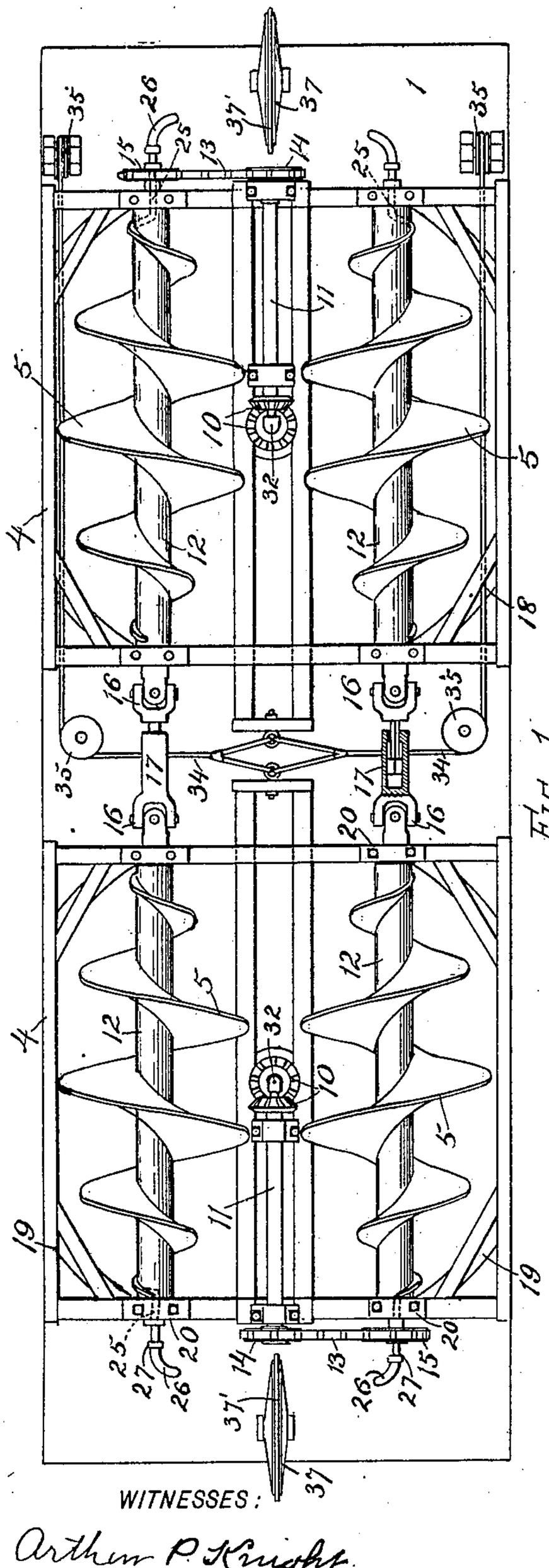

FIG. 1.

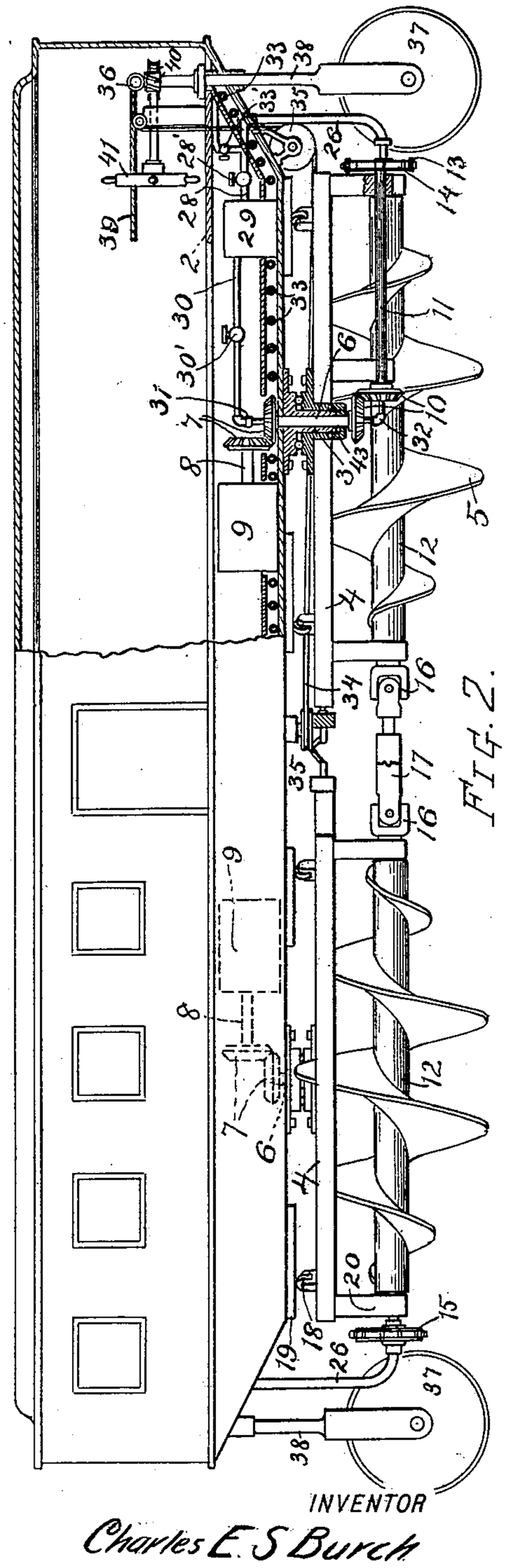

FIG. 2.

WITNESSES:

Arthur P. Knight.

Jamm McWilliams

INVENTOR

Charles E. S Burch

BY

Pierre Barnes

his ATTORNEY

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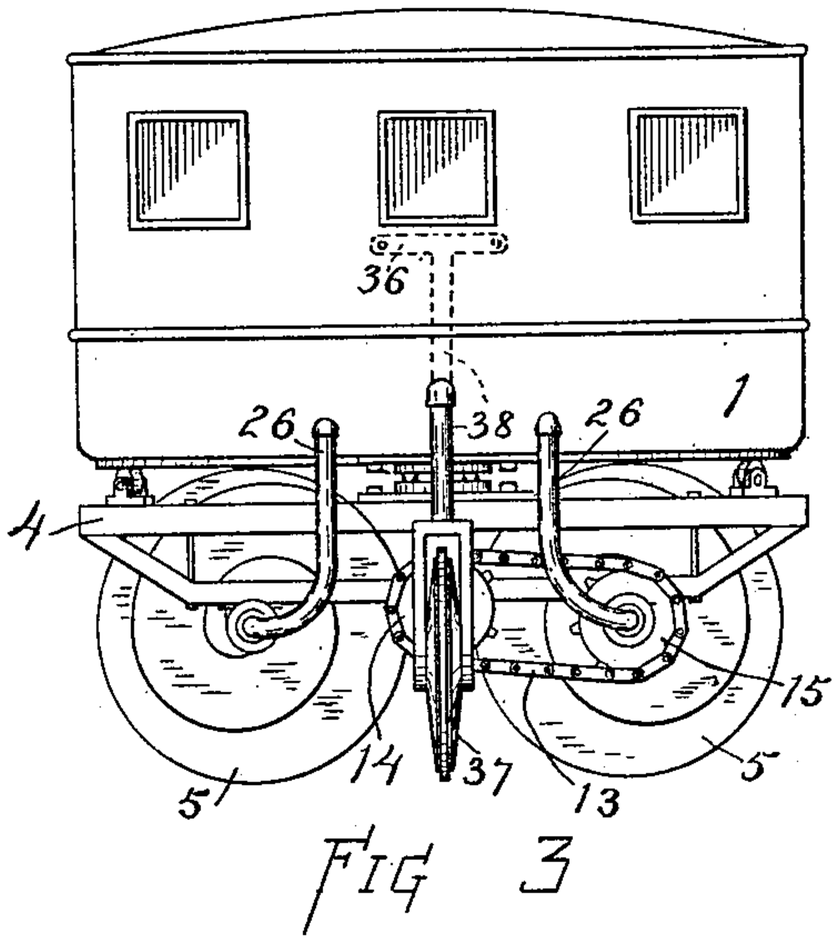

FIG 3

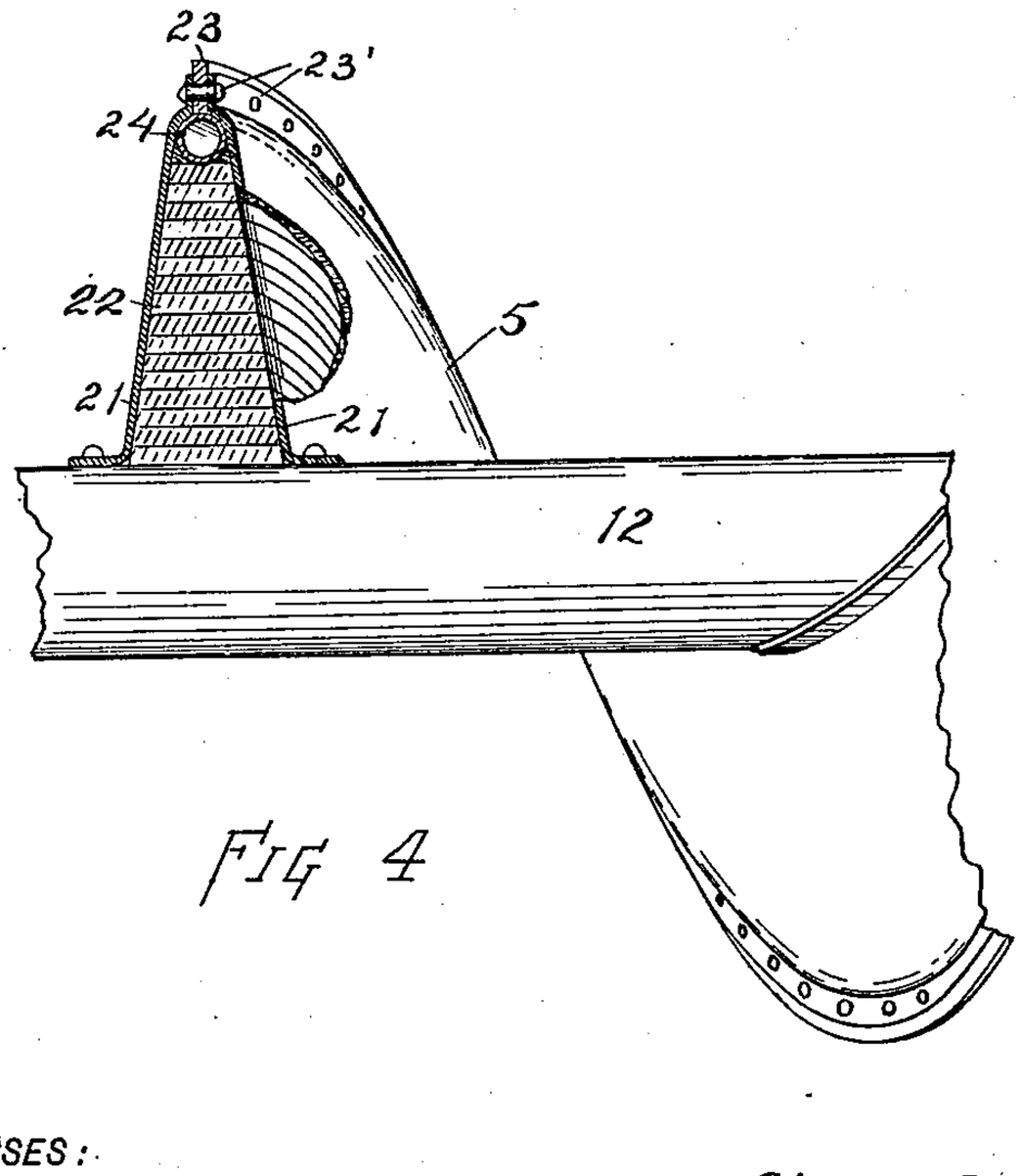

FIG 4

WITNESSES:
Arthur P. Knight
James McWilliams

INVENTOR
Charles E. S. Burch
BY
Pierre Barnes
his ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES E. S. BURCH, OF SEATTLE, WASHINGTON.

ICE-LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 669,210, dated March 5, 1901.

Application filed June 11, 1900. Serial No. 19,886. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. S. BURCH, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Ice-Locomotives, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in ice-locomotives—that is, a vehicle capable of propelling itself and, if desired, of drawing other vehicles over the surface of ice and snow.

The object of the invention is to provide a vehicle which is capable of traversing rough or hummocky ice, deep snow, slush, and frozen tundra and at the same time is safeguarded against any danger of submersion, owing to the breaking in of the ice over water. To this end I provide a body or shell the lower part of which is waterproof up to the probable limit of submersion, and below this body I arrange supporting and propelling trucks or devices, comprising screw or spiral skate devices, adapted to engage the ice and snow and propel the vehicle forward. The invention comprises the general construction and arrangement of the vehicle-body and screw, giving flexibility and adaptability to the uneven ice surface; the special construction of the screw to enable it to resist the strains brought thereon, to enable renewal, and to insure its easy passage through or over rough ice; means for preventing freezing up of the screw-skate in the ice and for prevention of freezing of the various journals; means for enabling the screw devices or the trucks carrying same to be swiveled or turned in steering; special power-transmitting means to drive the screws while being so swiveled; supplementary steering means for steering the vehicle independently of the action of the screws, and certain details of construction, as hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is an under side view of an ice-locomotive constructed according to my invention. Fig. 2 is a partly-sectional side elevation, and Fig. 3 is an end view of the same. Fig. 4 is a detail view of a portion of the driving-screw.

The body 1 of the ice-locomotive is rounded or beveled on the sides and ends to more readily pass the obstructions of ice and snow and is made waterproof up to a certain line—for example, the line of deck 2, which is above the deepest possible line of immersion—that is, the flotative capacity of the vehicle-body 1 when immersed up to this line would be more than sufficient to overcome the weight of such body with all of its attached mechanism. The vehicle-body will be constructed with a metal external sheathing.

Through the bottom of the body 1 pass king-bolts 3, which pivotally connect such body to truck-frames 4 4, carrying the supporting and propelling screws 5. Said king-bolts are hollow and are traversed by shafts 6, connected at their upper ends by bevel-gearing 7 and shaft 8 to separate driving-engines 9 and at their lower ends connected by bevel-gearing 10 to shafts 11, driving the propelling-screws. There are two of such screws to each truck, and the shafts 12 of the said screws are preferably connected to the driving-shafts 11 in the manner shown—that is to say, the shaft 11 on the forward truck is connected by chain 13 and sprockets 14 15 to the screw-shaft 12 on one side of said truck, which is connected by universal joints 16 and extensible coupling or spline joint 17 to the shaft 12 on the same side of the rear truck, so that such shafts rotate together, while by means of the flexible and extensible connections 16 17 the trucks are permitted to turn freely on their king-pins to a limited extent. Similarly the shaft 11 of the rear truck is connected to shaft 12 on the other side of that truck and thence through similar couplings 16 17 to the corresponding shaft of the forward truck. The screws 5 on each side are thus driven from separate engines, a feature which is of advantage in turning, as the screws on one side have then to travel faster than those on the other side. Supplementary bearing devices, such as rolls 18 on the truck 4, bear on segmental plates or ways 19 on the body 1, so as to prevent an undue tilting motion. Stuffing-boxes 43 are

provided where the shafts 6 pass through the king-pins to prevent leakage in case of accidental immersion, and the flanges of such stuffing-boxes also prevent the truck from falling from the body in such case.

Each of the screw devices 5 12 is preferably of substantially the construction shown—that is to say, the shaft 12, journaled in bearings 20 in the truck-frame, has a screw 5 attached thereto of a double conical form that is tapering toward both ends. At the mid-length of the screw, however, it is made with one full turn of uniform diameter, so that as the screw rotates the lowermost bearing-point of the screw remains at a constant distance from the axis, and thus there is no vertical vibration, such as would result if the tapering were to take place from the very middle of the screw. From each end of this middle portion, of equal diameter, the screw tapers gradually toward the corresponding end of the screw, so that it strikes and rides upward on or cuts through any obstruction gradually, thus preventing any sudden uplift or descent of the truck. The screw 5 is made with converging sides strongly truss-braced or secured to the shaft and to one another, so as to resist the strains developed in operation, which will be considerable. An advantageous construction is to make the core of the screw of wooden stringers 22, bent to shape and wrapped around the shaft in superimposed layers, as shown in Fig. 4, and firmly bolted to the shaft and to one another, the converging side plates 21 of the screw being bolted or screwed to the shaft and to this wooden core. At the outer edge of the screw is the skate or rail 23, clamped by bolts or rivets 23′ to the side plates, so that when the skate wears out it may be renewed and a fresh one inserted.

In order to prevent binding of the skate or screw in the ice, due to freezing in when the machine is stopped, or to enable it to be thawed out when frozen in, I provide means for warming the skate, such means consisting of a pipe or tubular conduit 24, extending along the spiral edge of the screw, under the rail, and connected by a bore 25 in the end of the shaft 12 and a coupling-thimble 27, permitting relative rotation, to a connection 28, including a flexible hose which leads from a source of hot air or steam 29 in the body of the vehicle, the heating medium from which is thus led the entire length of the skate and finally exhausts through a bore in the farther end in heating proximity to the universal joint. The side walls inclosing the tube or conduit 24 also serve as an enlargement directly on the inner side of the skate, providing an increased bearing or traveling surface when the skate breaks through on account of the softness of the surface. From the same source of hot air or steam or another source a pipe 30 leads through thimble 31 to each shaft 6, which is made hollow, and from the other end of said shaft a thimble-and-elbow connection 32, permitting free rotation, leads to the shaft 11, also hollow, the steam or hot air exhausting from the farther end of such shaft 11. Another pipe or heating-conduit 33 passes from the heating source 29 around the body 1 of the vehicle and in heating proximity to the metallic walls thereof. Valves 28′, 30′, and 33′ are provided in the pipes 28, 30, and 33 to control the passage of the heating medium therein. In case the skates become frozen fast to the ice they may be thawed out by turning the steam or hot air into pipe connections 28, 27, 26, 25, and 24, and at the same time the bearings of the screws are warmed so as to run freely. By the pipe connections 30 31 6 32 the bearings of the transmitting-gearing may also be warmed. Finally, in case the vehicle-body falls into slush or water and is frozen tight it may be freed by the use of the heating-pipes 33. The latter may be simply conduits or channels formed in the outer wall of the vehicle in any suitable manner.

To steer the vehicle, I provide cables 34, attached to ends of truck-frames 4 and passing over sheaves 35 to tiller-arms 36. It will be understood that by turning the trucks by these cables to one side or the other the vehicle will be swerved or directed correspondingly. I prefer, however, to provide supplementary steering means consisting of a wheel 37, acting as a rudder and journaled by a vertical pivot or rudder post 38, carrying the tiller-arms 36 aforesaid. A cable (indicated at 39) connects the tiller-arms at opposite ends of the vehicle, so that the steering-wheels move in correspondence. When the steering-wheel is placed "straight" with the vehicle, it has a tendency to steady the same, and when turned it can effect slight steering movements without the help of the truck-swiveling means; but in case the steering is effected by swiveling the trucks then the steering-wheels should be correspondingly shifted at the same time. For this purpose all these steering devices are operated from the tiller-arm 36, as shown, the said arm being operated by worm and worm-wheel connection 40 from the wheel or lever 41, the worms serving to lock the mechanism in all positions against accidental displacement. The steering-wheel is preferably made in the form of a double convex disk, of skeleton construction, so as to give great strength, with a minimum of weight and with a peripheral skate or bearing-ring 37′.

I am aware that screw devices have heretofore been proposed in vehicles of this class, but such constructions have heretofore been defective in not permitting of the passage of the screw over the extremely rough and hummocky ice which is found in those places where alone the use of such a device is a commercial desirability—for example, the arctic

or subarctic regions. To be successful in such locations, the machine must have its screw-spiral extending a considerable depth below the vehicle-body, and the spiral itself must be of large diameter, so as to stand out well from the shaft and lift the latter clear of obstructions, while the spiral winds its way over or around same or pushes the same aside. The feature of a large spiral screw with a comparatively small shaft is therefore of importance in this connection. Generally the screw will, so to speak, step over any obstacle in its path; but if the obstacle is squarely in the path of the spiral or is too large to enter between the turns of the spiral the latter will ride up on it and then down again with a gradual easy movement.

It will be understood that this vehicle can be used to draw other vehicles of any suitable description, if so desired.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an ice-locomotive, the combination with the body, of a plurality of supporting, steering and propelling screw devices below the body, each such screw device having a screw-spiral of large diameter or a comparatively small shaft, so as to raise the shaft and the body supported thereby, clear of obstructing ice and enabling the spiral to work around and over such obstacles.

2. In an ice-locomotive, the combination with the body, of a plurality of rotatably-movable trucks, each of said trucks having a spiral screw or screws tapering gradually toward each end, substantially as and for the purpose set forth.

3. In an ice-locomotive, the combination with the body, of a plurality of supporting, steering and propelling screw devices therefor, below the body, each such screw device having a screw-spiral with a middle portion of uniform diameter and tapering gradually from such portion toward each end.

4. In an ice-locomotive, the combination with the body, of a plurality of truck-frames pivoted to said body, supporting and propelling screw devices mounted on said truck-frames, means for operating said screw devices, and steering means for controlling the position of said truck-frames.

5. In an ice-locomotive, the combination, with the body, and a truck, of a hollow king-pin connecting said body and truck, a supporting and propelling screw device, mounted in said truck, motive device on the body and a driving connection from such motive device, through the aforesaid hollow king-bolt, to the propelling screw device.

6. In an ice-locomotive, the combination with the body, and a truck, of a hollow king-pin connecting said body and truck, a supporting and propelling screw device on said truck, a motive device on said body, a shaft passing through said hollow king-pin, mechanical connections from one end of said shaft to the said motive device and mechanical connections from the other end of said shaft to the aforesaid screw device.

7. In an ice-locomotive, the combination with the body, of a truck pivoted thereto, supporting and propelling screw device on said truck, and steering means for controlling the position of said truck relatively to the body.

8. In an ice-locomotive, the combination with the body, of trucks pivoted thereto, supporting and propelling screw devices on said truck and a steering-wheel, and steering devices for controlling the position of said truck and for controlling the position of said steering-wheel.

9. In an ice-locomotive, the combination with the body, of a plurality of trucks pivoted thereto, propelling and supporting screw devices on each truck and flexible and extensible rotative driving connections between the screw devices on the different trucks.

10. In an ice-locomotive, the combination with the body, of trucks pivoted thereto, supporting and propelling screw devices on said trucks, and separate motive devices and separate driving connections therefor to the screw devices in the respective sides.

11. In an ice-locomotive, the combination with the body, of a supporting and propelling screw below same, and provided with a removable spiral skate.

12. In an ice-locomotive, the combination with the body, of a supporting and propelling screw below same, provided with a conduit, and means for supplying a heating medium in said conduit.

13. In an ice-locomotive, the combination with the body, of a supporting and propelling screw for same, provided with a conduit extending in proximity to its spiral periphery, and tubular connections and means for supplying heating medium to such conduit.

14. In an ice-locomotive, the combination with the body, of a supporting and propelling screw for same, gearing and shaft mechanism for driving said propelling-screws and tubular heating connections extending in heating proximity to the journals of such mechanism, to supply heat to same.

15. In an ice-locomotive, a screw propelling and supporting device comprising a shaft and a spiral extending therefrom and having converging sides, substantially as and for the purpose set forth.

16. In an ice-locomotive, a screw propelling and supporting device comprising a shaft, a spiral core formed on said shaft with converging sides and converging side plates embracing said core.

17. In an ice-locomotive, the combination with the body having waterproof lower portion, of a truck or trucks pivoted thereto, propelling and steering screw devices on said

truck or trucks, and means for controlling the position of said truck or trucks relatively to the body.

18. In an ice-locomotive, the combination with the vehicle-body, having a metallic wall, of a heating-conduit in heating proximity to such wall and means for supplying heating fluid to such conduit.

19. In an ice-locomotive, a screw propelling and supporting device having a spiral peripheral skate, and an enlargement extending on the inner side of said skate.

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

CHARLES E. S. BURCH.

Witnesses:

PIERRE BARNES,

ARTHUR P. KNIGHT.