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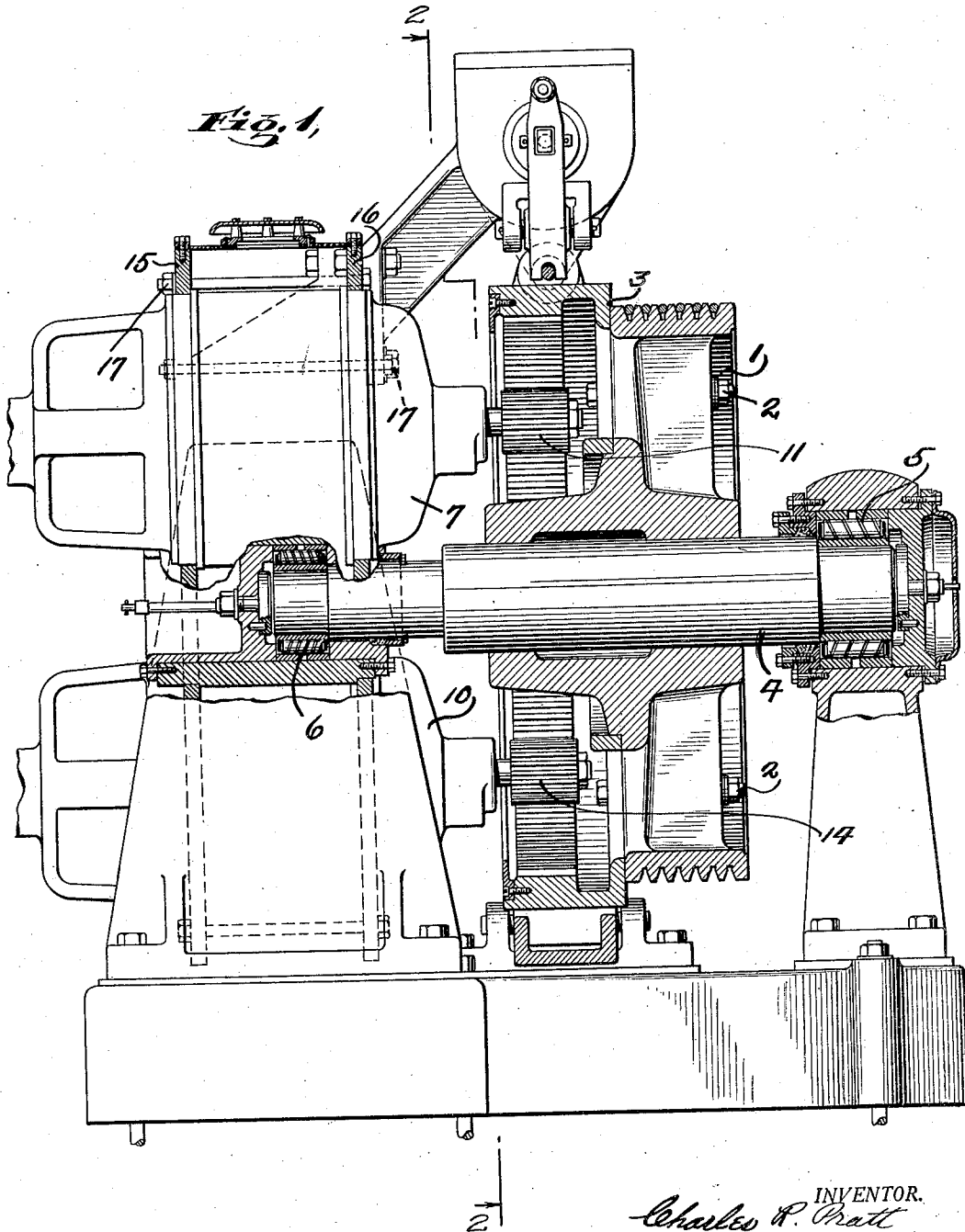
C. R. PRATT

1,828,748

HOISTING APPARATUS

Filed July 26, 1928

3 Sheets-Sheet 1



INVENTOR.
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BY *Kiddle, Morgan and Hornidge.*
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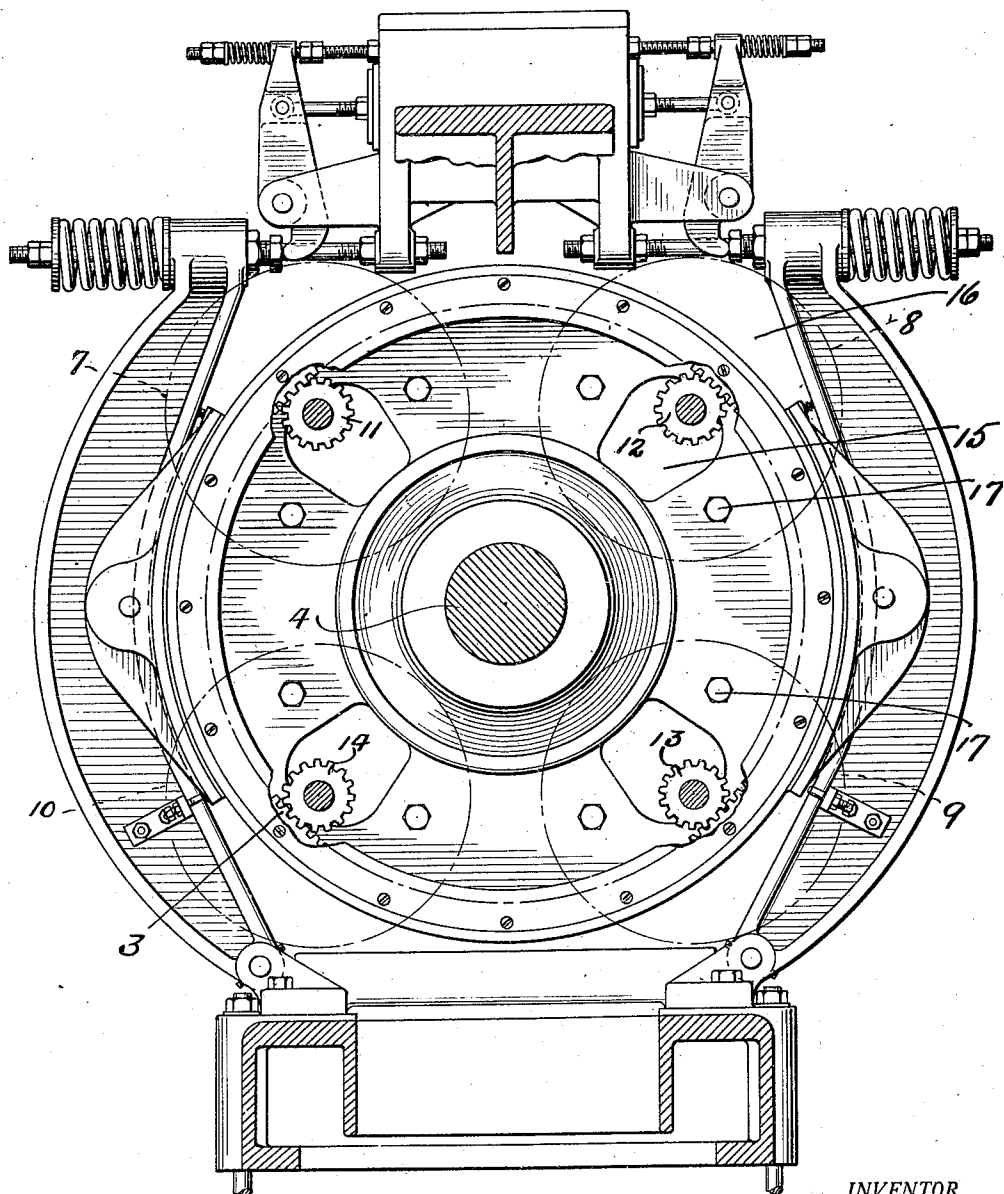
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Fig. 2.



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Fig. 3,

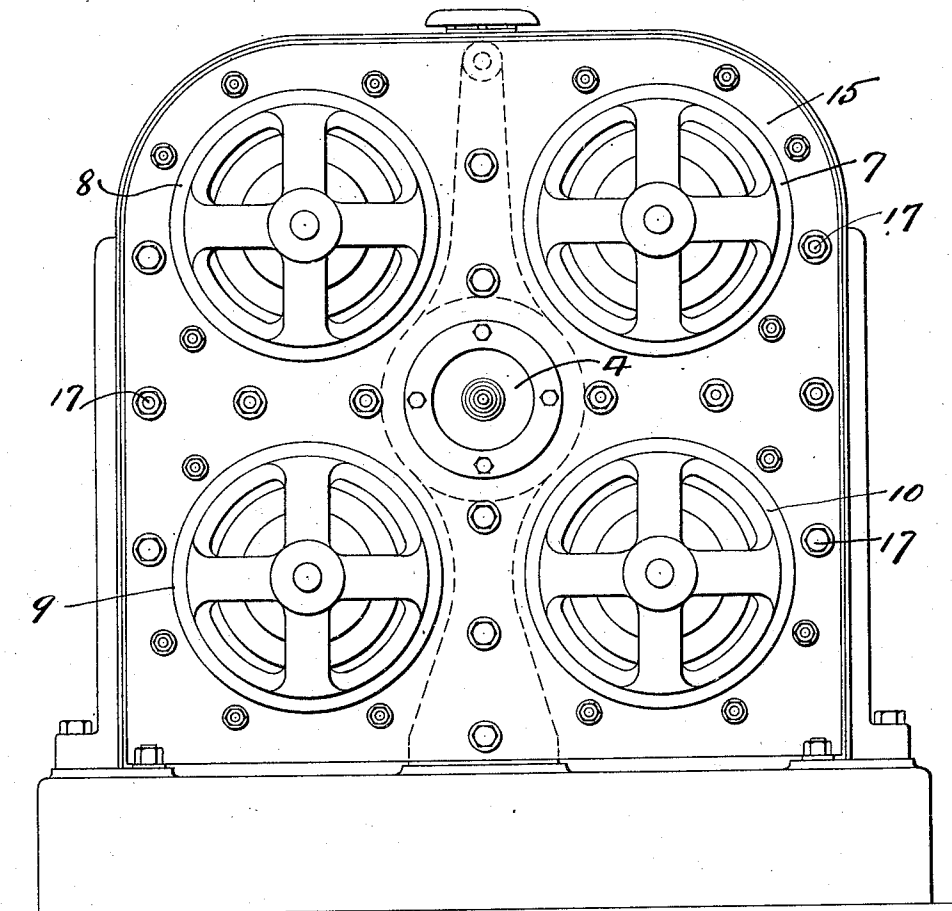
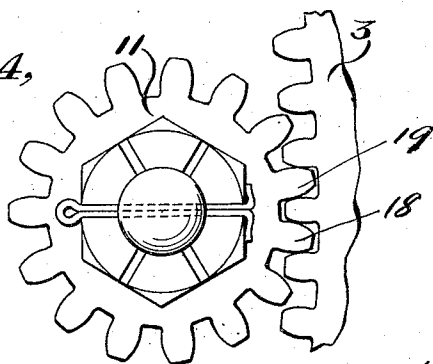


Fig. 4,



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UNITED STATES PATENT OFFICE

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HOISTING APPARATUS

Application filed July 26, 1928. Serial No. 295,539.

My invention relates to an improvement in hoisting machines and is particularly adapted for elevator service. One of the objects of my invention is the provision of a hoisting machine of new and novel construction which is inherently relatively free of vibration and smooth in operation.

A further object of my invention is the provision of a hoisting machine employing a multi-motor drive which by compact design is considerably smaller than a gearless or a worm gear hoisting machine for the same service.

More specifically the present invention provides a hoisting machine which is capable with ease of a car speed from two hundred to twelve hundred feet per minute. This is a decided advance over worm gear elevator machines, these machines being unsuited for speeds over three hundred feet per minute. My improved machine is superior to the gearless machines which are not adapted for speeds below six hundred feet per minute. In other words in the hoisting machine art today there is a speed hiatus between three hundred and six hundred feet per minute which is bridged by my invention.

A still further object of my invention is the provision of a spur gear driven hoisting machine which as mentioned above will be relatively free of vibration and in which the drive is so arranged as to prevent detrimental tooth strains.

A further object of the present invention is the provision of a hoisting machine equipped with a brake pulley which is provided with internal teeth so that this pulley not only functions as a brake pulley but as an internal spur gear to which the traction sheave is directly attached.

More specifically the present invention provides a hoisting machine of high efficiency which is particularly well adapted for use in elevator installations in which an internal spur gear, as mentioned above carried by the brake pulley and directly attached to the traction sheave, is driven by a plurality of electric motors, each motor being provided with a spur gear pinion in staggered mesh with the internal spur gear giving a smooth,

silent and durable transmission, not less than two teeth of each pinion being at all times in mesh with the internal gear.

The present invention employs a plurality of motors for driving the internal spur gear as above mentioned and while it is impossible to obtain perfectly synchronous torque in the several motors employed for driving this internal spur gear, by employing an internal spur gear and spur gear pinions effective reaction between the motors is permitted and hence satisfactory operation obtained as distinguished from a worm gear drive employing several motors in which effective reaction between the motors is resisted by the locking action of the several motors driving the one worm gear which causes initial tooth strain as well as interrupted motion of the elevator car or other apparatus being hoisted or lowered.

My invention by employing a plurality of motors each with a spur gear pinion meshing with an internal spur gear affords a further advantage as compared with slow speed gearless motors in that the several high speed motors employed by me weigh and cost less than a single slow speed gearless motor of a horse power equal to the combined horse power of the several high speed motors. No extra space is required in installing my invention, the several high speed motors employed together with the internal spur gear occupying only the space now occupied by the worm gear case on a worm gear machine for equal duty.

The machine of this invention is also constructed so that the plurality of motors employed for driving are held between two steel plates, obtaining a parallel alignment of the armature shafts of the motors and perfect mesh of their respective pinions with the large internal driven spur gear.

In the accompanying drawings, Fig. 1 is a part sectional side elevational view of an embodiment of my invention;

Fig. 2 is an end view partly in section of my improved machine, the section being taken on the line 2-2 of Fig. 1;

Fig. 3 is an end view of the machine of Fig. 1, looking from left to right;

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Fig. 4 is an enlarged view of one of the spur gear pinions employed together with the internal driven spur gear.

1 designates a traction cable sheave shown in section on Fig. 1, this traction sheave being rigidly attached as by bolts 2 to a brake pulley 3 provided on the inside with spur gear teeth.

The traction sheave 1 is mounted on a shaft 4 which is supported for rotation in a bearing 5 at one end and a bearing 6 at the other end. This latter bearing is provided in plates to be hereinafter referred to by which the several motors employed for driving the internal spur gear 3 or brake drum are mounted.

As above pointed out my improved machine comprises a plurality of electric motors, two or more, for driving the internal spur gear 3. I may say at this point that the member 3 will be hereinafter referred to as an internal spur gear, it being borne in mind that I make use of, in the present instance, the brake drum as this gear. By way of illustration four motors designated 7, 8, 9 and 10, respectively, have been shown for driving the internal spur gear 3, these motors being provided with spur gear pinions 11, 12, 13 and 14, respectively.

As above pointed out a construction is provided for insuring perfect alignment of the armature shafts of these motors and perfect mesh between the teeth of the several pinions 11, 12, 13 and 14 and the internal spur gear 3. I have, therefore, provided two plates 15 and 16 bored for the reception of the driving motors, each motor having its outer body or frame turned concentric with its armature shaft with shoulders at each end. These shoulders abut the plates 15 and 16 and bolts 17 clamp the structure together into a unitary structure, the motors being held in perfect alignment thereby. The shaft 4 hereinbefore mentioned is also received by the two plates 15 and 16 which provide a bearing therefor so that the entire structure including the motors, internal spur gear 3, etc. are held in perfect axial alignment to give the desired alignment and mesh between the teeth of the pinions 11, 12, 13 and 14 and the teeth of the internal spur gear 3. To further insure this desired construction the plates 15 and 16 are bored originally while bolted together so that their bores are necessarily exactly alike.

The teeth of the pinions are in staggered mesh with the teeth of the internal spur gear 3 and as mentioned above not less than two teeth of each pinion are always in mesh with the gear 3. I have attempted to illustrate this in Fig. 4, an inspection of which figure will show that the teeth 18 and 19 are in mesh with the teeth of the internal spur gear.

In actual practice to obtain the staggered

mesh desired and not less than two teeth of each pinion in constant mesh with the internal gear 3 I employ for example four pinions, each having fifteen teeth with a pitch diameter of three and three-quarter inches while the internal spur gear may have a pitch diameter of thirty-seven and one-quarter inches and be provided with one hundred forty-nine teeth. This gives me a construction in which the driving torque of four motors is applied direct to the traction cables dividing the total load equally between the four motor pinions, whereby the cables are driven by from eight to twelve pinion teeth and solid steel pinions which are practically silent may be used, although if desired laminated steel or non-metallic pinions can be used for greater silence. Also by this arrangement one tooth of one pinion is at all times in perfect mesh with an internal gear tooth, the teeth in the other three pinions successfully approaching this perfect mesh thereby substantially eliminating vibration, noise and wear inherent in any single pinion drive machine.

It will be apparent also to those skilled in this art that my invention provides for desirable reaction between the several driving motors.

It will be seen from the foregoing, therefore, that I have provided a hoisting machine employing a plurality of driving motors, in the present instance four, each motor being provided with a pinion and these pinions being arranged in staggered mesh with a large internal spur gear which is formed on the brake drum.

Obviously changes may be made in the details of construction above described and in the controller arrangement within the purview of my invention.

What I claim is:—

1. A hoisting machine comprising a traction sheave, a gear secured thereto, a shaft for mounting the traction sheave, a pair of plates providing a bearing for said shaft, a plurality of electric motors so mounted in said plates that the plates provide bearings for the housings of said motors, to provide a unitary structure with the motors disposed symmetrically about said shaft, and a pinion mounted on and driven by the armature shaft of each motor, all of said pinions meshing with said gear.

2. A hoisting machine comprising a traction sheave, an internal spur gear secured thereto, a shaft for mounting the traction sheave, a pair of plates providing a bearing for said shaft, a plurality of electric motors having their housings mounted directly in said plates and clamped thereby, to provide a unitary structure for holding the motors rigidly in symmetrical relation to the sheave shaft, and a pinion mounted on and driven by the armature shaft of each motor, said

pinions being in staggered mesh with said gear.

3. A hoisting machine comprising in combination a traction sheave, an internal gear for driving the same, a shaft carrying said sheave, a pair of plates providing a bearing for said shaft, a plurality of electric motors having their housings mounted directly in and supported directly by said plates, a pinion on the armature shaft of each motor, said pinions meshing with said internal gear.

4. A hoisting machine comprising in combination a spur gear, a plurality of electric motors, a pinion attached to the armature shaft of each motor and meshing with said spur gear, the outer surface of the field structure of each motor being formed concentric with its armature shaft and provided with spaced shoulders, plates bored to fit the field structures and rigidly engaging the shoulders on the field structures rigidly to support the motors, a shaft carrying said spur gear, said shaft having a bearing in said plates located centrally with respect to the bores for the motors, whereby all of said pinions are held in precise axial alignment and in accurate radial mesh with the spur gear.

This specification signed this 24th day of July, 1928.

CHARLES R. PRATT.