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WINCH.

APPLICATION FILED MAR. 9, 1921.

1,413,292.

Patented Apr. 18, 1922.

2 SHEETS—SHEET 1.

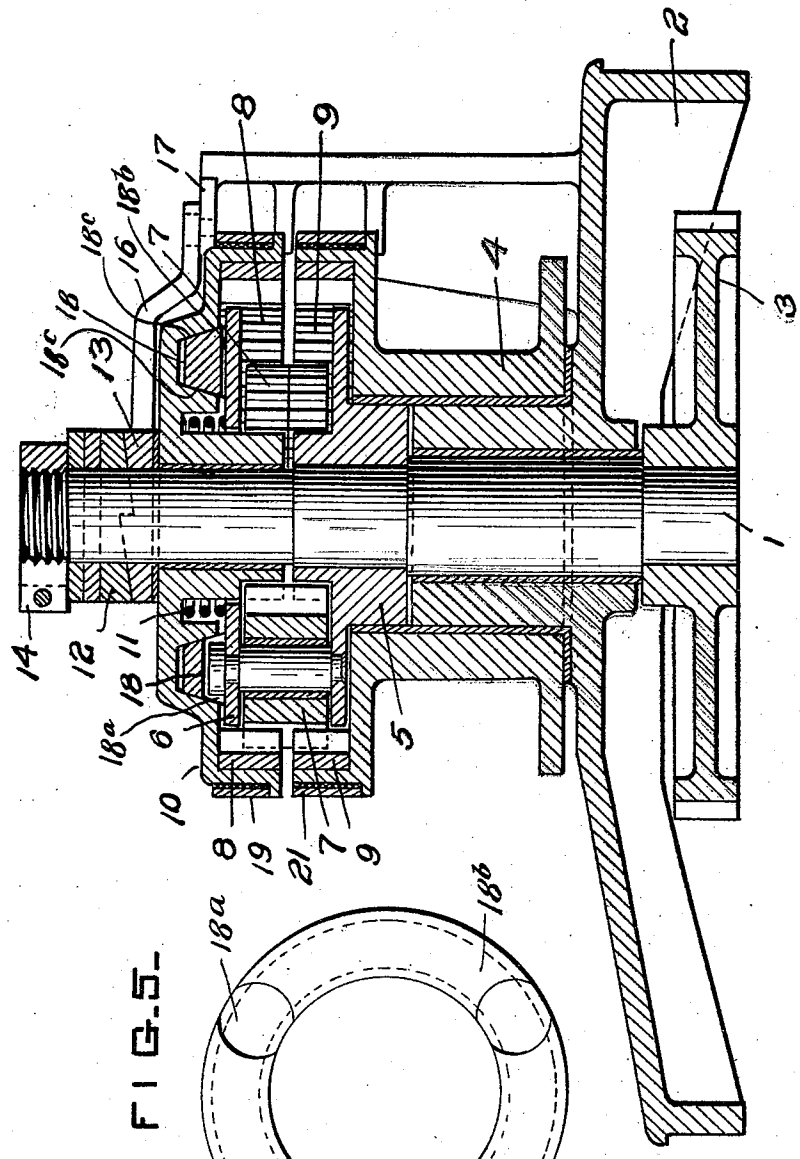


FIG. 1.

FIG. 5.

WITNESSES

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2 SHEETS—SHEET 2.

FIG. II.

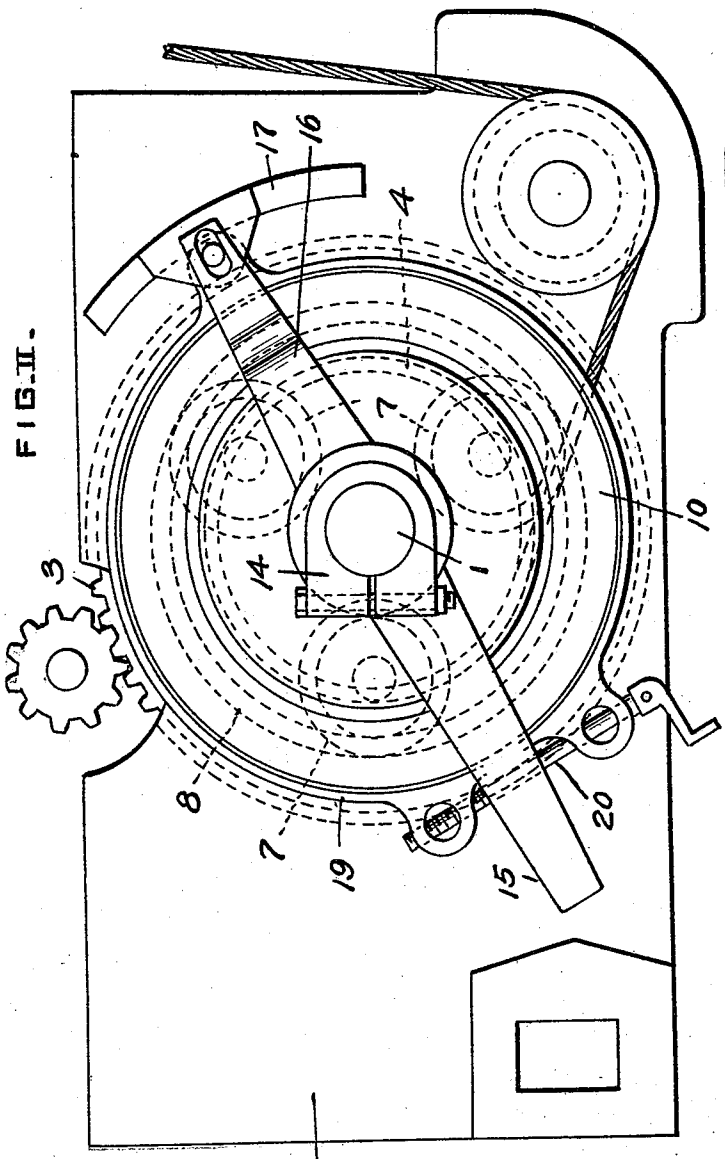


FIG. IV.

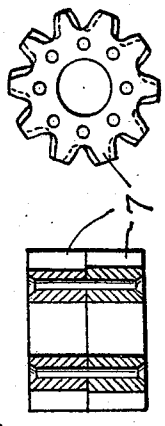
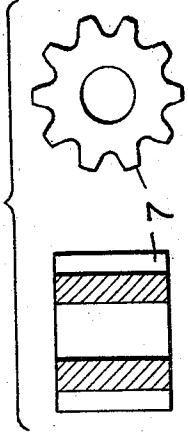


FIG. III.



WITNESSES

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WINCH.

1,413,292. Specification of Letters Patent. Patented Apr. 18, 1922.

Application filed March 9, 1921. Serial No. 451,009.

To all whom it may concern:

Be it known that I, EDWARD P. RAUSCHER, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Winches, of which improvements the following is a specification.

My invention relates to improvements in power-driven winches, and consists in a winch capable of being driven from a constant source of power at one or another of several rates of rotation, and in which a grading of the rate of rotation may under the control of the operator be had, from zero to the predetermined limits of higher and lower speed.

The invention, though not so limited in applicability, I have found useful in machines for mining coal. The function of a coal mining machine is to cut a scarf into the breast of coal in the room of a coal mine. In the performance of its work the machine (which is necessarily heavy) has to be dragged from the truck which carries it through the mine passages to cutting position, against the breast of coal, and then be dragged back again; and, in addition to that, the machine has to be advanced across the breast of coal, in order to develop the cut or scarf. These movements of the machine about within the room of the mine are effected by cables or chains anchored in the walls of the room, and pulling strains are exerted upon these cables or chains to move the machine about by means of power-driven winches or windlasses, mounted on the machine itself. Different speeds of windlass rotation are required, in order properly to effect these various movements of the machine bodily in the room of the mine; and hitherto it has been the usual practice to provide two winches at least, one for a high-speed dragging of the machine (as when it is being moved from the truck to cutting position), and the other for a low-speed dragging (as when cutting is in progress). My invention, as is already intimated, makes it possible to dispense with one winch, and to do all the requisite work with the other.

The winch is illustrated in the accompanying drawings; Fig. I is a view in longitudinal (and, in the case of the mining machine, vertical) section through the winch; Fig. II is a plan (from above); Figs. III and IV are views in plan and axial section of certain pinions which enter into the structure, as presently will be explained; and Fig. V is a view in plan from below of a certain wedge ring which forms part of the structure.

The axle of the winch 1, is suitably journalled for rotation. In this case it is mounted in vertical position on the deck 2 of a mining machine. It is further provided with means for rotation, here shown to be a gear 3, mounted rigidly upon it, which pinion 3 it will be understood may be rotated from a suitable source of power—ordinarily an electric motor also carried by the machine itself.

Concentrically mounted with shaft 1, is the rotatable drum 4, the actual cable-engaging (or chain-engaging) member. Rotation from shaft 1 is imparted to drum 4 through the instrumentalities which remain to be described.

Keyed to shaft 1 and conveniently adjacent drum 4 is a collar or plate 5, and, integrally assembled with plate 5 (as by being bolted thereto) is a second plate 6 which also extends collar-like around shaft 1 (though at an interval therefrom) and extends parallel with plate 5 and stands separated from plate 5 at an interval. It will be understood that shaft 1, and plates 5 and 6 rotate at all times as a unit.

The plates 5 and 6 with their spacing bolts constitute a cage. In this cage is journalled a pinion 7 conveniently, and as shown in Figure I of the drawings, this pinion 7 turns upon one of the spacing bolts as an axle. Preferably there is a plurality of such pinions; in the machine illustrated I employ three such pinions, arranged at intervals of 120° apart around the axis of shaft 1. When a plurality of pinions is employed they necessarily, as presently will appear, are not identical in form; Figs. III and IV illustrate the variation in this regard. On the inside—that is to say, on the side toward the axis of shaft 1—the teeth of these pinions are free, and the parts which in the assembly are situated inside the pinions may if necessary be recessed, to permit free turning of the pinions.

The bolting together of plates 5 and 6 may be effected in the intervals between pinions 7.

On the outside—that is, the side remote from the axis of shaft rotation,—are arranged two internally toothed gear wheels,

8 and 9, with which the teeth of pinions 7 mesh. The two gear wheels 8 and 9 differ one from the other in the number of teeth with which they are provided. In this instance gear 8 is provided with 40 teeth and gear 9 with 41. These two gears, in order that they may be engaged both of them by a single pinion, are necessarily equal in diameter; since each, separately considered, is engaged by a pinion of a certain size having a predetermined number of teeth, the factors are present which would ordinarily require that the gear wheels 8 and 9 be provided with a certain number of teeth—no more, no less. And this ideal number would necessarily be the same for both wheels. In order, however, to effect the ends in view, I here depart from the minute principles of gear construction and adopt a compromise. I so proportion the parts that—in this instance, for example—the diametral pitch for gear wheels 8 and 9 is $4\frac{1}{20}$ (the diameter of wheels 8 and 9 be it parenthetically remarked is 10 inches); but instead of cutting the teeth to this diametral pitch exactly, I cut the teeth on wheel 8 to a pitch of 4 (which gives 40 teeth), and the teeth on wheel 9 to a pitch of $4\frac{1}{10}$ (which gives 41 teeth). Inasmuch, then, as the gear wheels 8 and 9 depart in this matter of proportion from theoretical correctness, they are what the theoretical engineer terms bastard gears.

It will of course be understood that gear wheels 8 and 9 might be made unequal in diameter and pinion 7 be made a compound pinion, to engage both. But this would be merely a superadded complication, and if only for simplicity I have shown wheels of equal diameter and a pinion of uniform diameter throughout. If the variant suggested were adopted, still it would be necessary to make modification and arbitrarily change and make unequal the ratio between pinion and gear wheels in order to achieve my invention.

Turning to Figs. III and IV it will be observed that the teeth of the pinion shown in Fig. III are continuous from end to end, whereas in the pinion of Fig. IV there is discontinuity mid-way the length of the pinion and the teeth are off-set. The reason for this is now apparent; it lies in the unequal number of teeth borne by gears 8 and 9. As has been said, in this particular winch three pinions 7 are employed (the number is theoretically unimportant). One of these (the one shown in Fig. III, and the one shown in assembly in Fig. I) is a normal pinion. It is inserted at the point in the circumference where the teeth of the two gear wheels 8 and 9 stand opposite, in alignment. The other two pinions are remote from the one just mentioned at equal angular distances of 120°. Since in number of teeth gear 9 exceeds gear 8 by one, the displacement of opposite gears at the points where these other two pinions stand is one third the tooth interval. Accordingly, in one of these two pinions the teeth to engage gear wheel 9 are formed out of line with the teeth to engage gear wheel 8, being displaced to the right one third the tooth interval; while with the other of these two pinions the displacement is one third the tooth interval to the left. Of course, the practical way to make these discontinuous pinions of Fig. IV is to cut such a pinion as Fig. III shows in two, and put the parts together again with proper displacement.

If the number of pinions 7 were varied and their spacing about shaft 1 changed the degree of displacement of the teeth (cf. Fig. III) would be correspondingly altered.

Gear wheel 8 is borne by a member which I call a feed drum 10; gear wheel 9 is borne by drum 4.

Feed drum 10 is mounted upon a bushing which encircles shaft 1, so that there is no direct connection between the two parts, but shaft 1 may turn within the sleeve-like hub of the drum. Feed drum 10 is shiftable longitudinally of shaft 1, and may be shifted, as by a wedge device, against the tension of a spring 11, into more or less completely binding engagement, hub to hub, with plate 5—which, as has been said, is assembled integrally with shaft 1.

The wedge device alluded to, for shifting feed drum 10, consists of two collars 12 and 13, with obliquely disposed meeting faces, interposed between feed drum 10 and a washer-faced ring 14 secured to shaft 1. Collar 13 is movable longitudinally of shaft 1, but is held against rotation by means of an arm 16 extending from it, which arm is pinned to a standard 17 erected on deck 2 of the machine. The pin is sufficiently long to permit of the play indicated. Collar 12 may be rotated upon shaft 1 as a pivot, by means of a hand lever 15. In order to vary the effective throw of collar 12, ring 14 is adjustable upon shaft 1. It is a split ring with a bolt for clamping it securely in whatever position it may be; and, furthermore, it is screw-threaded to the shaft, to the end that, when the clamping bolt is loosened, it may be moved longitudinally of the shaft. When properly placed the ring is bolted securely. This construction affords delicacy of adjustment, and the possibility of compensation for wear.

A wedge ring 18 (with recesses 18^a as shown, to afford clearance for the trunnions of pinions 7) is interposed between the flange-like web of feed drum 10 and plate 6. This wedge ring 18, as will be seen on comparing Figs. I and V, is in cross section wedge shaped; the adjacent bearing surfaces of plate 6 and of feed drum 10 are corre-

spondingly shaped, to the end that as downward thrust is imposed upon feed drum 10, frictional engagement of feed drum 10 with the surfaces 18c of the wedge ring and of the surface 18b of the wedge ring with the surface of the plate 6 will be made. Thus the surfaces of contact between feed drum 10 and parts borne rigidly by shaft 1 are extended, to make more effective the frictional engagement, that, with reasonable application of power on hand lever 15, feed drum 10 and shaft 1 may turn as a unit.

The outer periphery of feed drum 10 is so formed as to be engaged by a brake band 19, and this brake band 19 may be tightened and loosened by a manually turned screw 20. This braking surface of feed drum 10 is conveniently the external cylindrical surface of gear wheel 8.

The rope drum 4 also may be provided with a brake, conveniently in the form of a band 21 which may be constricted on the exterior of gear wheel 9. The brake bands 19 and 21 may be supported from deck 2, as the drawings indicate.

Coming now to the operation of parts, it will be understood that shaft 1 normally is in constant rotation. Collar 12 being in retracted position and brake bands 19 and 21 being slack, the winch is inactive: Plates 5 and 6 are rotating with shaft 1, and they are carrying pinions 7 around in planetary orbit; pinions 7 are in constant engagement with gear wheels 8 and 9, and the rotation of shaft 1 expresses itself in the idle rotation of one or all of pinions 7, feed drum 10 and rope drum 4. If under these conditions any drag be exerted on drum 4, it will simply cease turning—if it had theretofore been turning at all—and pinions 7 and feed drum 10 will turn idly at an altered rate; but no winding pull can now be exerted by the winch.

If rope drum 4 is to be turned at slow speed, brake band 19 is tightened on the face of feed drum 10. Feed drum 10 is held secure against rotation while shaft 1 turns freely within it. By virtue of the fact that gear wheel 9 exceeds gear wheel 8 in number of teeth (by one) for every rotation of shaft 1 rope drum 4 will be turned under positive rotative force relatively to the now stationary feed drum 10 through the angular interval of one tooth—that is, through one fortieth of a revolution. That is to say, if shaft 1 be rotating at forty revolutions a second, and if then brake band 19 be applied to hold feed drum 10 firm against rotation, rope drum 4 will turn at the rate of one revolution a second.

If rope drum 4 is to be turned at high speed, brake band 19 being slack, collar 12 is turned, and feed drum 10 is shifted to make secure frictional engagement with shaft 1 and the parts integrally carried thereby, so that thereafter shaft 1 and feed drum 10 rotate as a unit. The teeth of pinions 7 then serve as clutch members, uniting gear wheels 8 and 9, and the consequence is that rope drum 4 also rotates as a unit and at equal speed with shaft 1.

Nor is this all. It will be apparent that brake band 19 may be constricted upon feed drum 10 with any degree of tension, from zero to such amount as will hold feed drum 10 firm against rotation, and that accordingly rope drum 4 may by these means be caused to turn at slow speed increasing to a maximum which in this case amounts to one fortieth of the speed of shaft 1. Similarly feed drum may by collar 12 be shifted to a frictional engagement with shaft 1 and the parts carried integrally thereby, which in security may vary from zero to an amount sufficient to carry feed drum 10 as a unit with shaft 1 in its rotation (the load of course will be a factor in determining the value of necessary force). Accordingly, the speed of the rope drum 4 when so driven may vary from zero to the speed of shaft 1.

Under all conditions of service brake band 21 is available to regulate the speed of the rotating rope drum.

I have in the course of this specification indicated the essential principles of structure, and intimated that the particular showing of the drawings is exemplary merely. I would add the statement that departures in details of structure from what I have shown in this exemplary manner will constitute no departure from my invention so long as the essential features be retained.

I have described the invention as embodied in a winch for a mining machine. I repeat what was said at the beginning; the invention is applicable to winches generally, wherever such variability of speed is desired.

I claim as my invention:

1. In a winch the combination of a rotary shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with and movable longitudinally of said shaft, and in the range of its longitudinal movement standing alternately free from and subject to the rotative impulse of the shaft, a gear wheel borne by said rope drum and a gear wheel borne by said feed drum, and a pinion journalled in bearings which are revoluble about the axis of the shaft and in unison with the shaft and meshing with both of said gear wheels.

2. In a winch the combination of a rotary shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with said shaft and movable longitudinally of said shaft and in the range of such longitudinal movement standing alternatly free from and subject to the rotative impulse of said shaft, a gear wheel borne by said rope drum and

a gear wheel borne by said feed drum, a pinion journalled in bearings which are revoluble about the axis of said shaft and in unison with the shaft and meshing with both of said gear wheels, means for shifting said feed drum longitudinally of said shaft, and means for securing said feed drum against rotation.

3. In a winch the combination of a rotary shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with and movable longitudinally of said shaft, and in the range of its longitudinal movement standing alternately free from and subject to the rotative impulse of said shaft, a gear wheel borne by said rope drum, a gear wheel borne by said feed drum, and a pinoin journalled in bearings revoluble about the axis of said shaft and in unison with the shaft and meshing with both of said gear wheels, the effective dimensional ratio being different in the two cases between pinion and gear wheel.

4. In a winch the combination of a rotary shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum movable longitudinally of said shaft and by virtue of such movability adapted to become frictionally united, in a union of varying security, with the said shaft, a gear wheel borne by said rope drum, a gear wheel borne by said feed drum, and a pinion borne in planetary orbit by said shaft and engaging both of said gear wheels, substantially as described.

5. In a winch the combination of a rotatable shaft, a collar keyed to said shaft and extending therefrom, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with said shaft, said feed drum and said collar being movable, one relatively to the other, in a direction longitudinal of said shaft and in the range of such relative movement coming into and receding from engagement one with the other, gear wheels borne by the rope drum and the feed drum, a pinion journalled in said collar and meshing with the teeth of both of said gear wheels.

6. In a winch the combination of a rotatable shaft, a cage keyed to and encircling said shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with said shaft said feed drum and cage being movable, one relatively to the other, longitudinally of the shaft, a friction ring interposed between the opposite faces of cage and feed drum, gear wheels borne by rope drum and feed drum and a pinion journalled in said cage and meshing with the teeth of both of said gear wheels.

7. In a winch the combination of a rotatable shaft, a cage keyed to and encircling said shaft, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with said shaft, said feed drum and said cage being movable, the one relatively to the other, longitudinally of said shaft, said cage and feed drum forming by and between their adjacent faces an annular recess of wedge-shaped cross section, a wedge ring arranged in said recess, gear wheels borne by rope drum and feed drum and a pinion journalled in said cage and meshing with the teeth of both of said gear wheels.

8. In a winch, the combination of a rotatable shaft, a cage keyed to and encircling said shaft, a pinion journalled in said cage, a rope drum mounted for rotation in axial alignment with said shaft, a feed drum mounted in axial alignment with said shaft, said cage and feed drum being relatively movable longitudinally of the shaft and by virtue of such relative movement coming into and receding from frictional engagement, said rope drum and said feed drum being provided each with a gear wheel, the aforesaid pinion meshing when the parts are assembled with the teeth of both of said gear wheels, means for effecting relative movement of cage and feed drum, and a brake for said feed drum.

9. In a winch the combination of a rotatable shaft, a rope drum mounted for rotation in axial alignment with said shaft and operatively related to said shaft through the following instrumentalities: namely, a planetary pinion and a feed drum; said planetary pinion being mounted for revolution about the axis of the shaft and in unison with the shaft and for free rotation in such mounting, said feed drum being mounted for rotation in axial alignment with said shaft, and movable longitudinally of said shaft and in the range of movement becoming alternately subject to and free from the rotative influence of said shaft, said rope drum and feed drum being further provided with gear wheels with both of which, when the parts are assembled, the said pinion meshes.

In testimony whereof I have hereunto set my hand.

EDWARD P. RAUSCHER.

Witnesses:
B. P. TRACY,
J. L. GOSS.