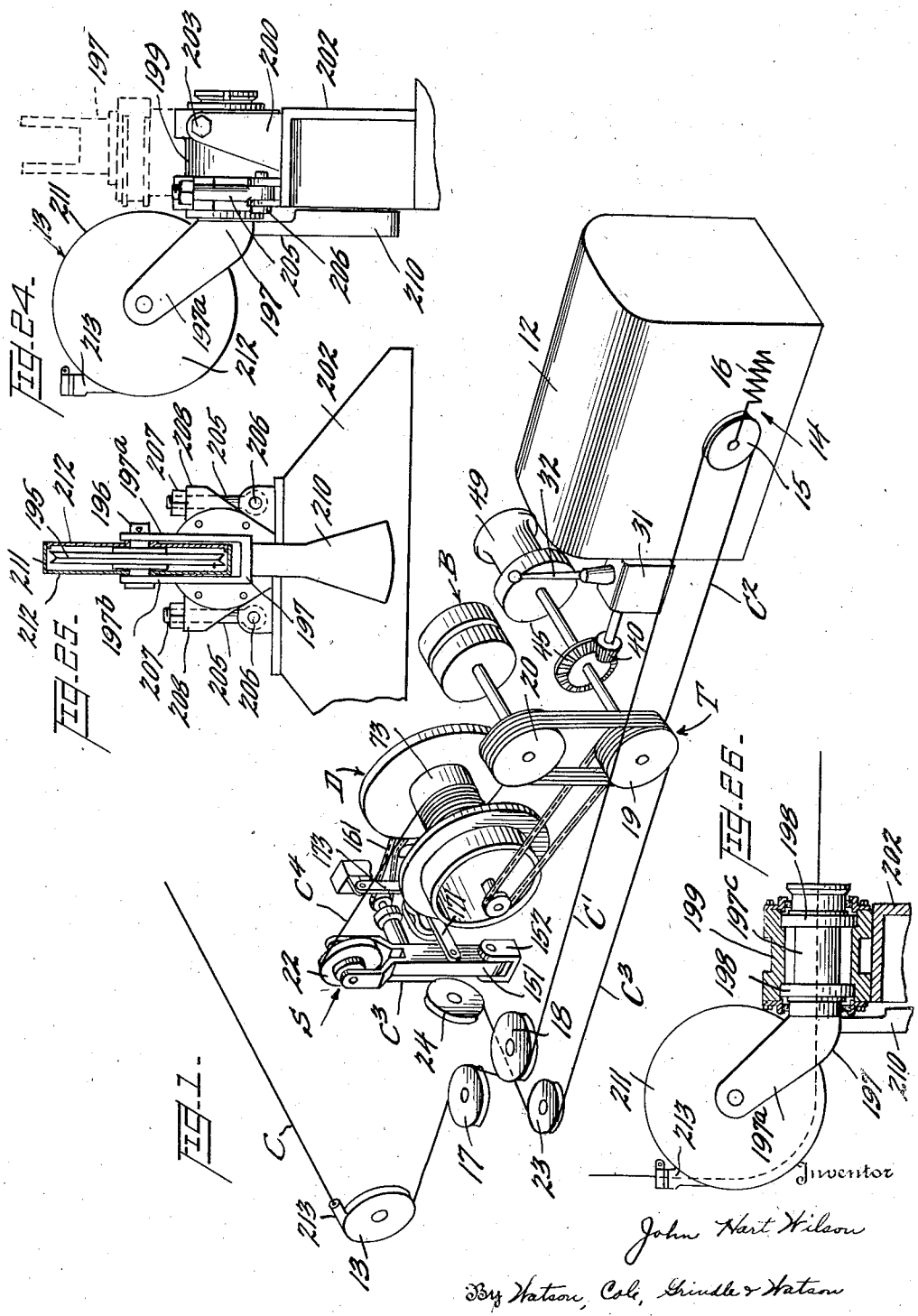
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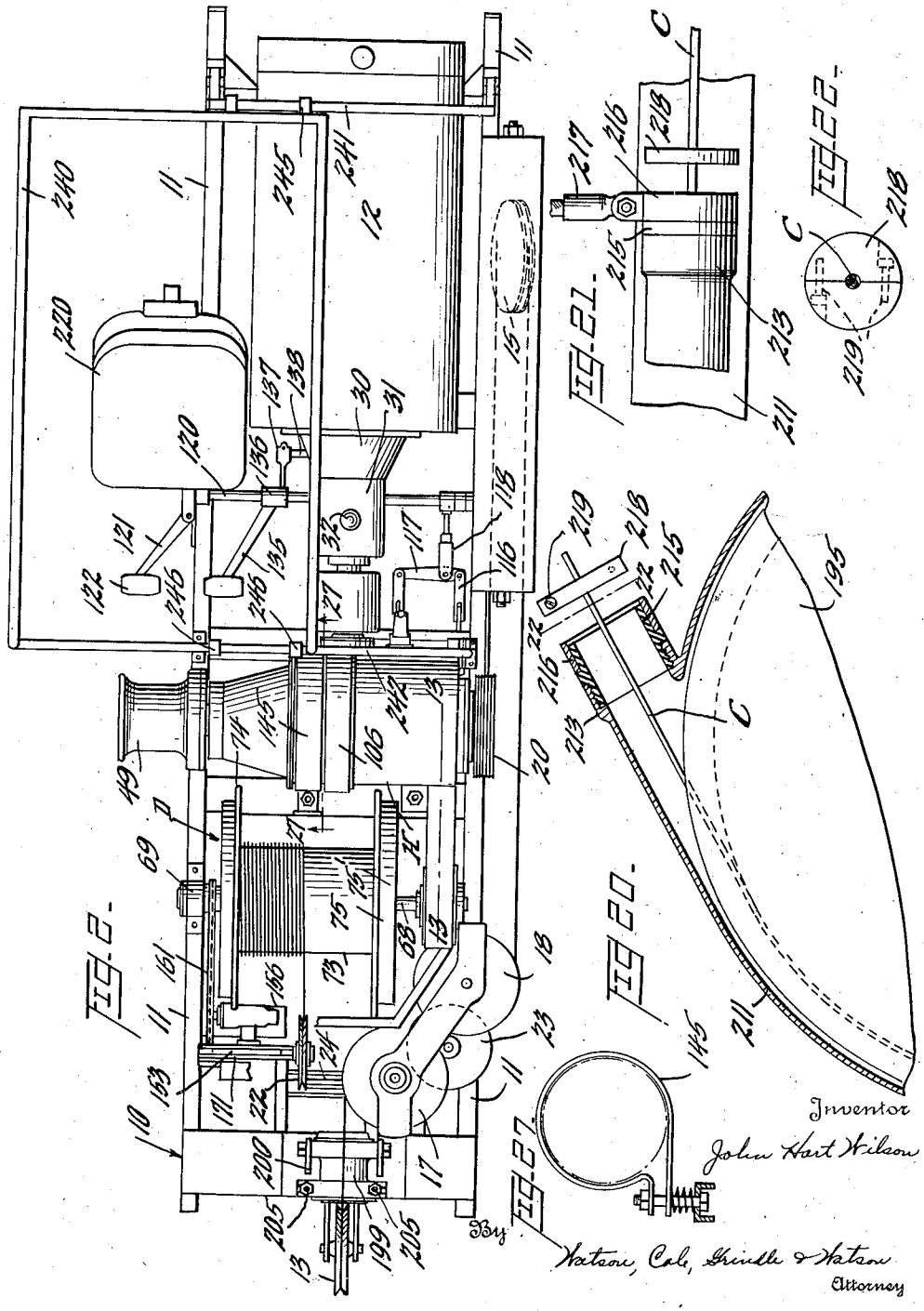
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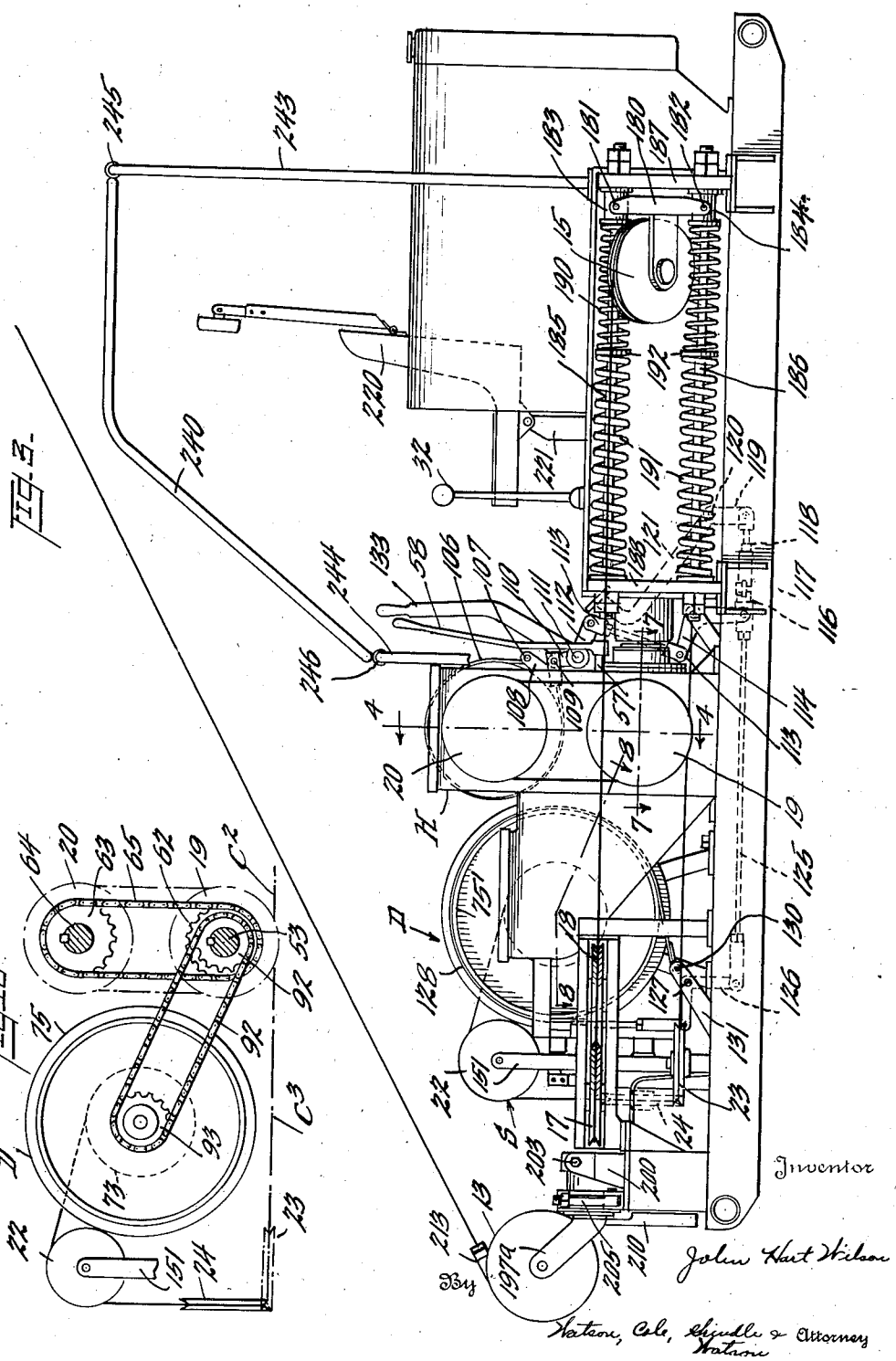


FIG. 3.

FIG. 13.

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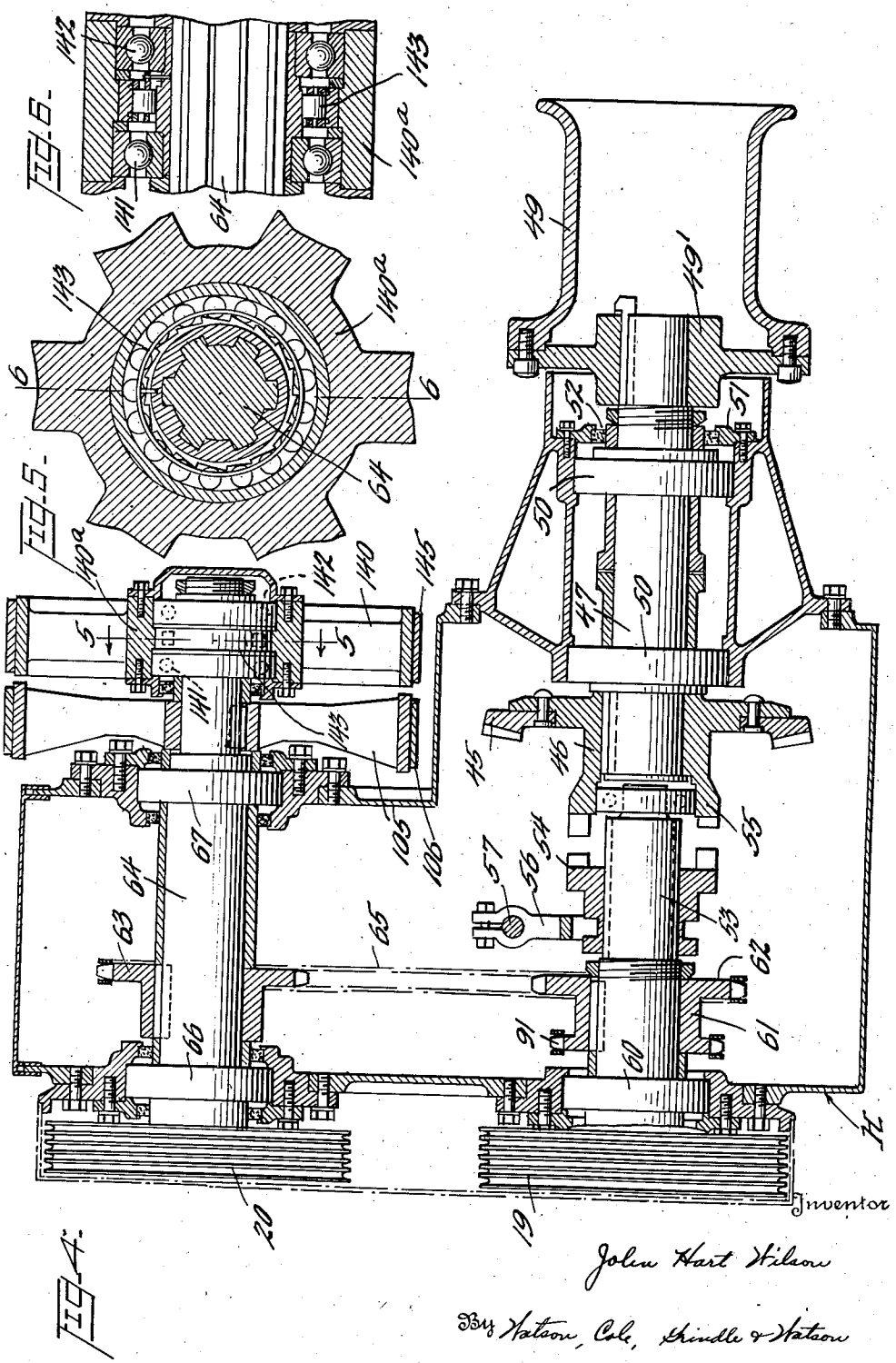


FIG. 4.

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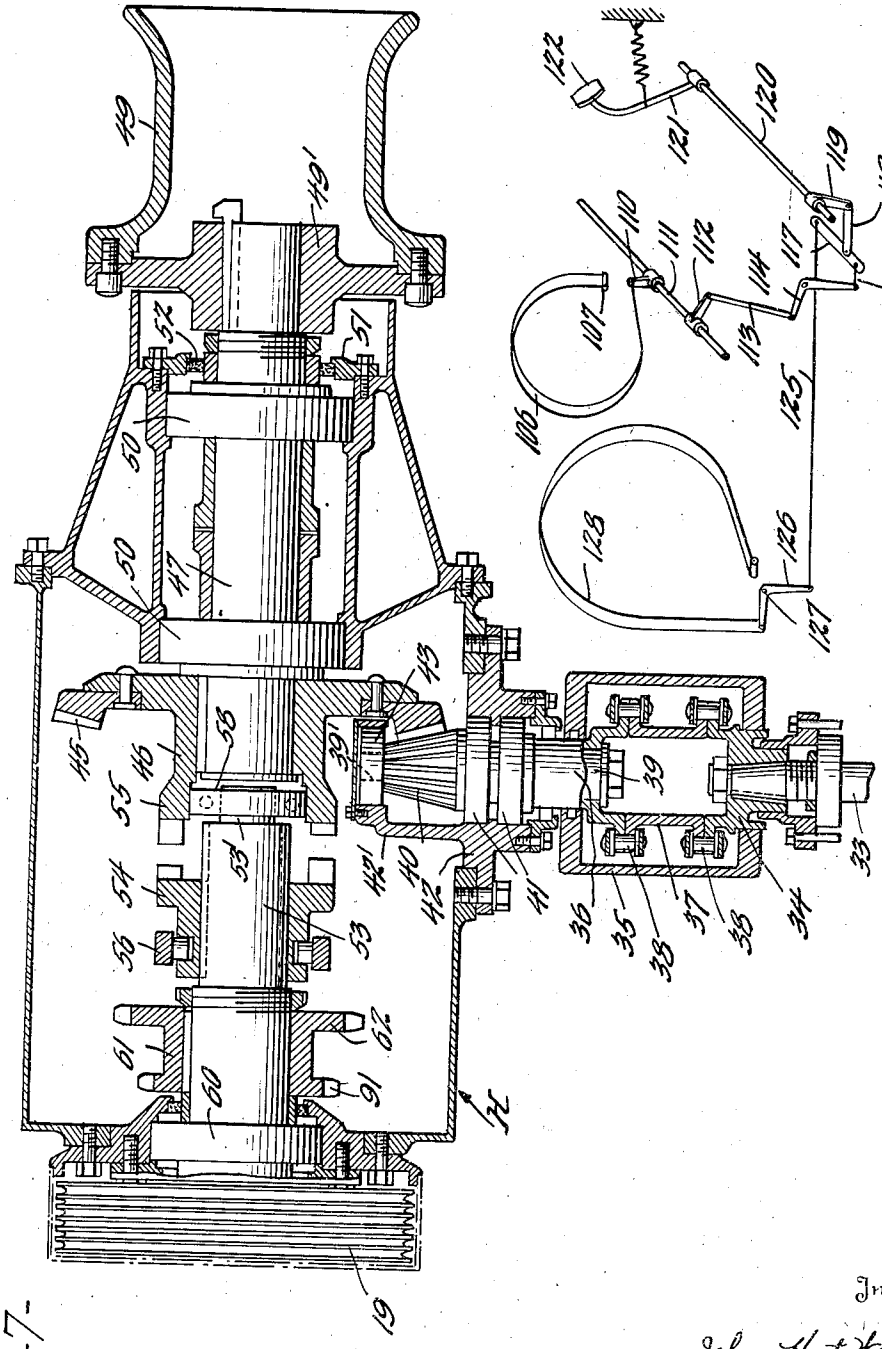


FIG. 7.

FIG. 23.

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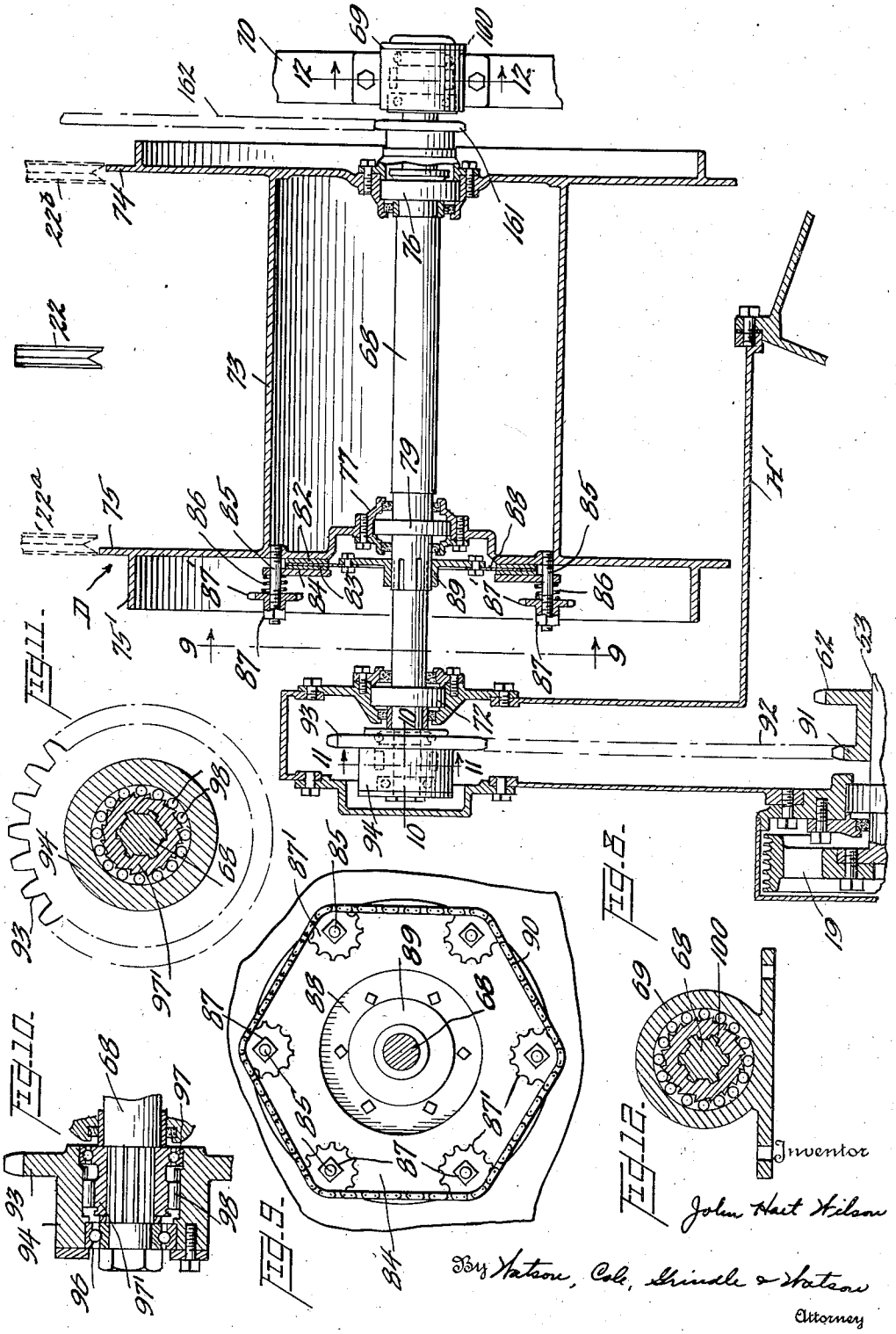


FIG. 11.

FIG. 10.

FIG. 9.

FIG. 8.

FIG. 12.

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FIG. 14.

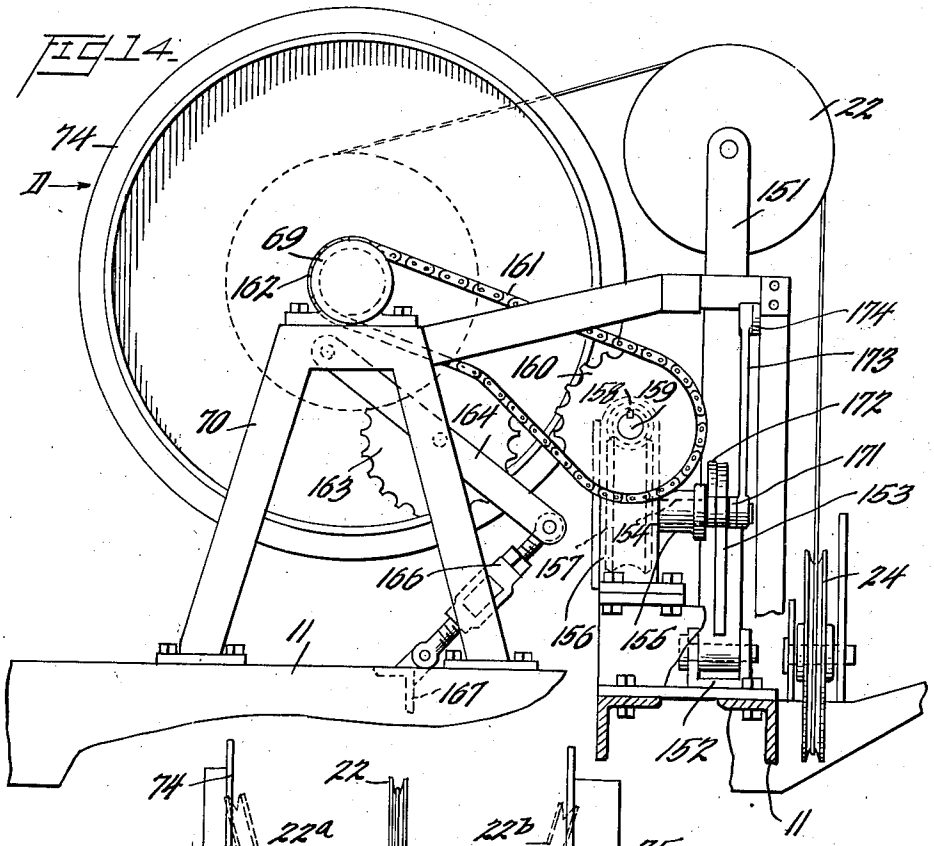


FIG. 15.

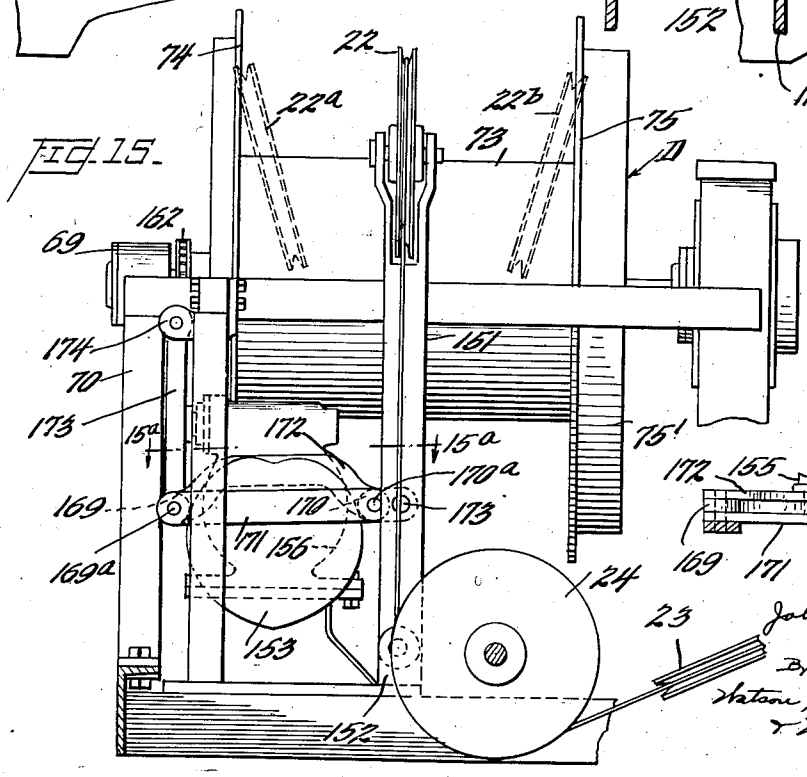
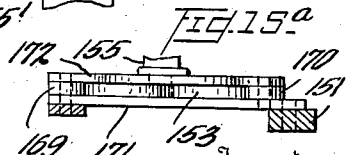


FIG. 15a.

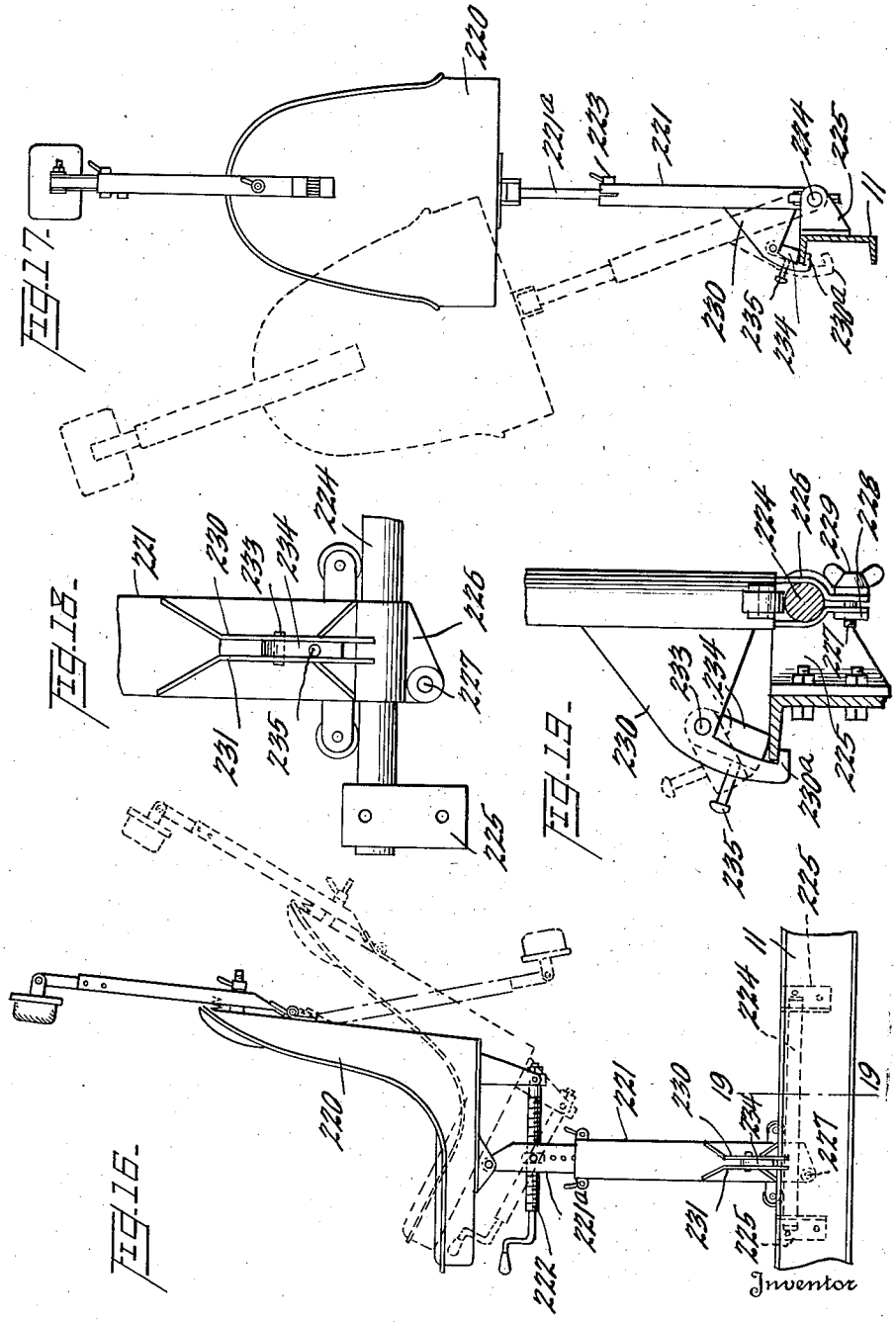


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UNITED STATES PATENT OFFICE

2,422,274

WINCH

John Hart Wilson, Wichita Falls, Tex.

Application July 29, 1942, Serial No. 452,773

5 Claims. (Cl. 254—187)

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This invention relates to winches and more particularly to winches of the type primarily designed and constructed for use in drawing in or paying out of cables of substantial length under conditions which result in widely fluctuating cable tension.

Numerous types of winches and winding and reeling devices have heretofore been designed and actually placed in use, for the accomplishment of widely varying tasks. In the usual case, however, the winch need only be designed to successfully raise and lower a weight which does not vary greatly and to reel in and pay out a rope or cable which extends outwardly from the winch at an unvarying angle. The problems involved in the design of winches of this general type are relatively simple and a satisfactory design may be arrived at by conventional formulae.

Where the rope or cable which stretches from a winch to an object to be controlled or manipulated, however, is subject to rapid changes in the magnitude and direction of the pulling force which it must at all times resist, the problem of winch design becomes one of greater difficulty. This is particularly true in the case of the balloon winch, i. e., a winch the primary function of which is to manipulate a cable to the end of which a captive balloon is secured. The captive balloon is frequently allowed to rise to a relatively great height and is, of course, of such character that it has no ability to resist rapid changes of position due to the action of air currents, the cable itself being the only element restraining the free movement of the balloon under the influence of such currents. Naturally, as the winds or air currents vary in direction, the balloon varies its angular or compass position with respect to the winch to which it is tethered and, necessarily also, the balloon must move downwardly when subjected to the action of a downwardly directed current of air. An upwardly directed current of air will tend to carry the balloon with it and impose a great strain upon the cable to which it is attached.

Under conditions of violent air turbulence, which not infrequently occur, the balloon may tend to change rapidly not only its compass position with respect to the winch to which it is attached, but may be violently agitated vertically, alternately being driven downwardly and rising at relatively high velocity. As a relatively light cable must be used in order that the balloon shall have the ability to rise to the desired height, it is clear that a problem of real difficulty in winch construction is presented. The cable must be protected against sudden shock which, unless

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cushioned in some manner, would cause it to immediately snap and hence the winch to which the lower end of the cable is secured must be provided with means which will quickly and automatically function when the cable tension threatens to suddenly increase to an excessive amount, to prevent damage. Manually operable means for controlling the cable under more normal conditions, is also necessarily provided it being clear that no completely automatic mechanism can be relied upon to properly manipulate the cable under all weather conditions and also apparent that the judgment of an operator must be exercised at all times in the control of a balloon winch in a combat zone. Likewise the cable, being of comparatively fragile type, may too quickly become frayed, and may break, unless the winch mechanism with which it comes in contact is designed in such manner as to prevent premature or excessive wear, to the greatest extent possible. One difficulty heretofore commonly met with in the operation of balloon winches of previously known types has arisen in connection with the operation of the storage drum upon which the cable is wound, the cable having a tendency to wind unevenly and to pile up at the ends of the drum, greatly increasing the wear incident to winding and unwinding. Numerous other problems of design are peculiarly associated with the balloon winch and it is the general purpose of the present invention to provide an improved winch mechanism which is particularly suited for use as a means to which a balloon, such as a barrage balloon, may be tethered and by means of which the movements of the balloon may be controlled in an improved manner at all times with minimum care on the part of the operator and minimum wear of both cable and winch mechanism.

In order that the possibility of cable breakage shall be rendered practically negligible, the improved winch is equipped with novel automatically acting mechanisms by means of which possible damage due to sudden variations in cable tension can be adequately taken care of. Means under the control of an operator is provided for adequately manipulating the cable quite regardless of the compass direction in which the cable extends from the winch, this means including a novel cable guide which not only facilitates free swinging movement of the cable with respect to the winch, about a vertical axis, but also permits the angularity of the cable with respect to the horizontal to vary greatly, from a position in which the cable extends approximately vertically upwardly to a position in which it extends down-

wardly, except insofar as the angularity of the cable with respect to the vertical is limited in one direction by the presence of the winch itself and in other directions by the ground surface or the presence of objects on the ground. With a cable guiding means of this type the use of a snatchblock or auxiliary cable guiding sheave, located at any suitable point adjacent the winch, is made possible

An important consideration in the design of a balloon winch intended for military use is portability and in accordance with the present invention a winch is provided which is compactly designed, of relatively light weight, and readily transportable from point to point upon motorized equipment. It is furthermore so designed that the efficiency of the operator, who must remain on duty under the most adverse weather conditions and for long periods of time, is promoted, a seat being provided upon which the operator can position himself in such manner as to keep the balloon within his field of vision at all times with minimum physical discomfort, the several controls of the mechanism being so disposed as to be within the immediate reach of the operator when so positioned, thus facilitating proper and efficient manipulation of the balloon with the expenditure of the least effort. The operator's seat is constructed and adjustably mounted in a novel manner and likewise a protective canopy support is so arranged that it may be quickly adjusted to an operative position when the seat is moved to such position, and returned to inoperative position quite as readily when the seat is returned to its inoperative position. In their inoperative positions the seat and protective canopy are compactly disposed with respect to the supporting frame and other elements of the winch, so that the entire winch occupies a minimum space for transportation. In their operative positions both chair and protecting canopy frame are extended so as to position the operator most advantageously for the work in hand. All cable contacting portions of the winch are designed and positioned so as to subject the cable to the least possible amount of bending, particularly about curves of short radius, and the spooling mechanism associated with the storage drum causes the laying on to the drum of successive layers of cable in such manner that these layers are continuous and smooth, all possibility of piling up of the cable being completely avoided.

The winch mechanism includes numerous additional improved details of design, which will hereafter be fully described. It may be said that certain features of the winch may be advantageously used in the construction of winches of other types although the primary objective of the invention is to provide a special purpose winch of outstanding utility. Likewise the invention contemplates certain changes in the design and arrangement of its component elements, in adapting the winch for the accomplishment of tasks of somewhat different nature from that of balloon cable control. That form of the winch, therefore, which is illustrated in the accompanying drawings, is set forth by way of example only and it is contemplated that, without departure from the invention, various changes and rearrangements of the various elements and subcombinations may readily be effected.

In the drawings:

Figure 1 is a schematic view in which are illustrated those elements of the winch mechanism which are actually contacted by the cable, the manner in which the cable is threaded through the machine being readily perceptible;

Figure 2 is a top plan view of the winch, the operator's seat and protective canopy support being shown in extended position;

Figure 3 is a side elevation of the winch;

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 is a section on line 5—5 of Figure 4;

Figure 6 is a section on line 6—6 of Figure 5;

Figure 7 is a section on line 7—7 of Figure 3;

Figure 8 is a section on line 8—8 of Figure 3;

Figure 9 is a section on line 9—9 of Figure 8;

Figure 10 is a section on line 10—10 of Figure 8;

Figure 11 is a section on line 11—11 of Figure 8;

Figure 12 is a section on line 12—12 of Figure 8;

Figure 13 is a section on line 13—13 of Figure 2;

Figure 14 is a side elevation of portion of the machine as viewed from a point on the opposite side of the machine from that occupied by the observer who perceives the machine as it is illustrated in Figure 3;

Figure 15 is a front elevation of the mechanism shown in Figure 14;

Figure 15*a* is a section on line 15*a*—15*a* of Figure 15;

Figure 16 is a side elevation of the operator's chair showing, by the use of full and dotted lines, the chair in two positions of adjustment;

Figure 17 is a rear elevation of the chair showing it, in full lines, in operative position, and in dotted lines in inoperative position;

Figure 18 is an enlarged side view of a portion of the chair support;

Figure 19 is a section on line 19—19 of Figure 16;

Figure 20 is a section through portion of the cable guide over which the cable first passes as it passes into the winch;

Figure 21 is a plan view of the portion of the cable guide shown in Figure 20;

Figure 22 is a section on line 22—22 of Figure 20;

Figure 23 is a schematic view of the mechanism for braking certain operative parts of the winch;

Figure 24 is a side elevation of the cable guide over which the cable first passes as it goes into the winch and with which it last contacts as it leaves the winch;

Figure 25 is a front elevation of the same, partly broken away;

Figure 26 is generally similar to Figure 24, but shows certain portions of the guide broken away in order that interior details may be observed; and

Figure 27 is a section on line 27—27 of Figure 2.

Inasmuch as it is desirable to transport balloon winches from place to place under varying conditions of warfare it is preferred that all of the essential elements of the winch be compactly arranged with respect to each other within a space which may be said to be based upon a horizontal rectangular area, preferably an elongated rectangular area of such length and width that the entire winch, including any supporting frame, may be placed in or on a truck body of no great size. The winch which comprises the subject matter of the present invention has been designed so that this is easily possible, the various operating units being compactly arranged with respect to each other and disposed upon a rectangular frame which is generally indicated by the numeral 10 in Figures 2 and 3. The details of construction of frame 10 may be varied widely but advanta-

geously it may comprise side members 11 the undersurfaces of which, at the ends thereof, are upwardly inclined to facilitate movement of the winch onto and off of the truck body. Side frame members 11 will be suitably connected by bracing members so that the entire frame will comprise one rigid rectangular supporting means.

By reference to the schematic view, Figure 1, the relative relationships of the several principal functioning elements of the winch may be readily perceived. A power plant such as an internal combustion engine is diagrammatically illustrated at 12, this power plant or prime mover being located at one end of frame 11. At the other end of frame 11 is a cable guide 13 through or over which the cable passes as it leaves the winch, a short length of that portion of the cable which extends from the winch to a balloon being indicated at C in Figures 1 and 3. Intermediate the prime mover 12 and the cable guide 13 are positioned the various instrumentalities found essential for the adequate control and manipulation of the cable. The first of these instrumentalities is indicated diagrammatically at 14, this being the shock absorber which includes a sheave 15 around which the cable passes and resilient means generally indicated at 16 for supporting the sheave 15 in such manner that it may move toward the cable guide 13 when the tension in the cable increases sharply. It will be observed that, after the cable leaves the cable guide 13 it passes directly to and around the sheave 15, the sheaves 17 and 18 shown being merely provided to deflect the cable laterally, the guide 13 being located centrally of the frame and the cushioning means 14 being located to one side of the prime mover 12. For convenience that reach of the cable intermediate the guide 13 and the shock absorber 14 is indicated by the numeral C'. After passing around the sheave 15 of the shock absorbing mechanism 14 the cable passes forwardly to a traction device or "surge drum" generally indicated at T, that reach of the cable which extends between these two portions of the winch mechanism being indicated at C^2. The traction device T is provided, comprising essentially two drums or multi-grooved sheaves 19 and 20, disposed one above the other and supported for rotation about parallel axes, the cable first passing beneath sheave 19 and upwardly to and around sheave 20, then downwardly around sheave 19, and so on until it engages each sheave a plurality of times, the various wraps of the cable lying in spaced grooves formed in the cable receiving surfaces of the respective sheaves and the length of contact between the cable and the two sheaves being, in the aggregate, so great that slippage between the sheaves and cable may not occur, regardless of the magnitude of the tension exerted on the cable by the balloon attached thereto, and in particular regardless of the tension in the reach C^2 of the cable. The sheave 19 is arranged to be driven in either direction of rotation by power developed in the prime mover 12 and transmitted by means to be later described, and the rotation of sheave 20 may be opposed by braking means generally indicated at B so that, by means of the traction device T, the movements of the cable may be positively controlled, the operator, by manipulating suitable control elements, either driving sheave 19 (in either direction of rotation) or disconnecting this sheave from the power source and controlling the paying out of the cable by suitably manipulating the friction applying means B.

From the lower sheave 19 of the traction device T the cable passes forwardly to a level winding or spooling device generally indicated at S, passing over a guide sheave 22 and finally on to a cable storage drum generally indicated at D, that reach of the cable intermediate the traction device and the spooling mechanism being indicated at C^3, this reach passing over two direction changing sheaves 23 and 24, respectively, and that reach of the cable which lies intermediate the spooling device S and the storage drum D being indicated at C^4.

The storage drum D is driven by power derived from the prime mover 12 and in the normal operation of the winch the reach C^4 of the cable will at all times be maintained under tension, whether the cable is being drawn in or paid out but, by reason of the presence of frictionally driven elements in the operative connection between the storage drum D and the prime mover the tension of reach C^4 of the cable is maintained relatively low at all times, only sufficient in magnitude to insure a tight wrap of the cable on the storage drum. Only that portion of the cable extending from the traction device T to the balloon will be under substantial tension and this tension is kept below a desired maximum at all times, to avoid cable breakage. The details of the several instrumentalities which together comprise the winch will now be described.

The internal combustion engine diagrammatically illustrated at 12 may be of any type found to be suitable, and may even be replaced by an electric motor in localities where electric power is always available. Preferably, however, an internal combustion engine is employed and with it are associated a conventional clutch, located preferably within a housing indicated at 30, and a conventional change-speed gearing contained within housing 31, several speeds of forward drive being provided, and at least one speed of reverse drive, the direction of drive being controlled by the manipulation of a conventional hand lever such as indicated at 32. The drive shaft 33 of the prime mover projects toward the traction device T and has keyed to its outer end a hub 34 rotatably supported within the end wall of a housing 35 rigidly supported by the frame of the winch. Rotatably supported within an aligned aperture in the opposite end wall of the housing 35 is a generally similar hub 36, hubs 34 and 36 being connected by a flanged cylindrical coupling member 37 and circumferentially extending chains, of which portions are indicated at 38. The arrangement is such that, by removing the chains 38, the engine shaft 33 may be disconnected from the power transmission mechanism by means of which the rotary motion of the shaft is communicated to the traction device and cable storage drum. This permits removal of the transmission from the unit, for the purpose of overhauling or replacement, quickly, easily and without disturbing the engine or traction device casing H.

The hub 36 encircles and is non-rotatably secured to short shaft 39 upon that end of which, remote from coupling 37, there is formed as an integral part the bevel pinion 40. Roller bearings 41 support shaft 36 for free rotation, these bearings being supported in turn within apertures formed in member 42 which comprises a portion of the housing for the traction device driving mechanism, this housing being generally indicated at H. An extension 42' of member 42 has at its end a portion which extends transversely of the axis of shaft 36, which portion is provided

with a cylindrical aperture within which there is closely fitted the outer race of a roller bearing 43, this roller bearing supporting for free rotation the reduced end portion 39' of shaft 39, the pinion 40 being thus supported at both ends in anti-friction bearings.

The teeth of the pinion 40 mesh with the teeth of a bevel gear 45 which gear is secured to a hub 46 keyed upon a shaft 47 disposed at right angles to the power shaft 33 and the pinion shaft 39 and extending horizontally, with its outer end projecting without the housing H and supporting a windlass 49, commonly called a cathead. Shaft 47 is supported, intermediate the hub 49' of the windlass and the bevel gear 45 by spaced roller or ball bearings indicated at 50 and an oil retaining ring and washer are indicated at 51 and 52, respectively. It is clear that, when the motor shaft 33 is driven, the windlass 49 will be revolved and that the direction of rotation of the windlass depends upon the direction of rotation of the shaft 33. The windlass 49 is of general utility and may be utilized whenever the cable or rope is to be utilized in pulling, in the ordinary manner. In axial alignment with shaft 47 is a shaft 53. Shaft 53 is coaxial with and rigidly secured to the lower sheave 19 of the traction device T.

Generally, in the operation of the winch, the aligned shafts 47 and 53 are coupled together for simultaneous rotation by means of a jaw clutch, the longitudinally sliding member of which is indicated at 54 and the longitudinally fixed member of which is indicated at 55. Slide clutch member 54 is splined to shaft 53 in the customary manner and may be moved longitudinally upon this shaft by means of a shifter yoke of ordinary construction, portion of which is indicated at 56 and which is rigid with a horizontally extending rock shaft 57 supported in a bearing mounted on the wall of housing H and to the exposed outer end of which there is rigidly affixed the operating lever 58. By moving lever 58 transversely of the machine, thus rocking shaft 57, the shifter yoke 56 may be caused to engage the jaw clutch elements or to effect their separation as may be desired. It will be observed that the reduced end portion 53' of shaft 53 is supported in a bearing 58 located in a cylindrical recess formed within the hub 43, the two shafts 53, 47 being thus maintained in alignment at all times.

An anti-friction bearing of relatively large size is indicated at 60, this bearing supporting shaft 53 where it passes through the end of housing H. Keyed upon shaft 53 is the hub 61 of a double sprocket, the larger sprocket 62 being positioned directly below a similar sprocket 63 keyed upon shaft 64 upon the outer end of which the upper sheave 20 of the traction device is rigidly mounted. The axis of shaft 64 is parallel to the axis of the lower shaft 53 and the shafts are interconnected for simultaneous movement by means of a chain 65 which passes over and operatively connects sprockets 62 and 63. The shafts 53 and 64 must, therefore, necessarily rotate simultaneously, in the same direction of rotation, and at equal angular velocities when shaft 53 is operatively connected to the prime mover. Anti-friction bearings 66 and 67 of rugged nature support shaft 64 for free rotation.

In Figure 4 sheaves 19 and 20 of the traction device are illustrated in elevation, the cable receiving grooves being clearly shown. Each cable receiving surface of each of these sheaves is provided with a plurality of grooves, six grooves being

provided upon the thread receiving cylindrical face of the lower sheave and five grooves upon the face of the upper sheave or drum. The number of grooves may be varied as may be found necessary in the handling of cables having different characteriscs and the sheaves of the grooves may be varied if desired to bring about increased or decreased intensity of frictional engagement between cable and sheave. In any event, however, the cable receiving surfaces of the sheaves of the traction device or surge drum are so designed that, with the cable wrapped about these surfaces a desired number of times, slipping of the cable circumferentially of the sheaves becomes impossible so long as the reaches of the cable passing to and from the traction device, respectively, are in tension. The traction device, therefore, is an instrumentality for positively pulling in or paying out the cable, although the engagement of the cable with the traction device is not positive, but is frictional only.

The cable storage drum D is in advance of the traction device T and is supported for rotation about an axis parallel to the shafts 53 and 64 of the traction device T, previously referred to. The storage drum supporting shaft is indicated at 68, one end of this shaft being mounted in a bearing 69 fixed upon a pedestal 70 and the other end being supported in an anti-friction bearing 72 mounted in the inner wall of a forward extension H' of the housing H which encloses the shafts and driving gear of the traction device. The cable receiving cylindrical portion of the drum is indicated at 73 and its disc-like ends at 74 and 75, respectively, the end 74 being provided with a central aperture through which shaft 68 passes, an annular anti-friction bearing 76 encircling the shaft at this point and being snugly housed within the hub-like central portion of member 74. The annular end 75 of the drum is provided with a similar hub-like portion 77 encircling shaft 68, and which also houses an anti-friction bearing, this bearing being indicated at 79.

The storage drum is, therefore, freely rotatable upon shaft 68 insofar as the drum supporting means just described is concerned. It is, however, frictionally connected to the shaft 68 so as to tend to rotate therewith at all times and this frictional connection may be most clearly perceived from an inspection of Figures 8 and 9. Disposed in a plane parallel to the outer face of the end 75 of the drum, and so as to be concentric with the axis of shaft 68, is an annular member or face 82 of friction material, such as may be used in the conventional automotive "disc type" clutch, and spaced slightly away from the annular member 82 is a second similar member 83 positioned to engage the inner face of a member 84 formed as an annular plate concentric with the axis of shaft 68. Member 84 is provided with a plurality of perforations through each of which projects a rigid pin 85 the inner end of each of which is received and securely held within a cylindrical aperture formed in the end 75 of the storage drum. Annular member 84 is freely slidable upon its supporting pins 85 and resilient means is provided, comprising a coil spring 86 encircling each pin 85, and an abutment nut 87 having a threaded connection with the outer end of the pin, for constantly urging disc 84 toward the end 75 of the drum. A friction disc 88 which is rigidly secured to a hub 89 which may in turn be keyed or splined upon shaft 68, and to which disc the annular friction members 82 and 83 are secured, is interposed between the drum and

annular plate 84. Disc 88 is formed in two half-portions to facilitate its assembly, and removal for replacement purposes. The members 82 and 83 are constantly clamped between the drum and plate 84, the degree of frictional engagement between the several parts depending upon the intensities of the forces exerted by the compression springs 86.

It will be observed that each of the threaded abutment members 87 is provided with an integral sprocket 87' and a single sprocket chain 90 passes over all of these sprockets as clearly illustrated in Figure 9. At least the outer end of each spring abutment nut 87 is polygonal and adapted to receive a wrench by means of which it may be rotated to increase or decrease the pressure of the associated spring upon the annular member 84. Naturally, by reason of the fact that the several abutment nuts 87 are interconnected by the chain 90 the adjustment of one nut will result in the simultaneous adjustment of all others so that the degree of friction between the friction disc 88 and the friction members 82 and 83 may be varied at any time, quickly and easily and with assurance that the springs will continue at all times to act with equal pressures against the clutch member 84.

The storage drum shaft 68 is driven by power from the prime mover, taken from the shaft 53 of the traction device T, hub 61 which is keyed to that shaft having formed thereon a second sprocket 91 which is operatively connected by means of a chain 92 to a sprocket 93 which is integral with a sleeve 94 encircling that end of the drum shaft 68 which lies within the extension H' of the housing H. Anti-friction annular bearings intermediate shaft 68 and sleeve 94 are indicated at 96 and 97, respectively, bearing 96 being of conventional type, but bearing 97 having an elongated sleeve-like inner race 97', the outer surface of which is provided with a plurality of inclined faces, as shown in Figure 11, each such face having associated therewith a roller 98 which at all times lies between that face and the encircling cylindrical inner face of sleeve 94. The parts just described, i. e., the sleeve 97' with its inclined faces, the rollers 98, and the cylindrical inner face of the outer sleeve 94, together comprise an overrunning or one-way clutch the effect of which is to clutch or couple together the sleeve 94 and the shaft 68 when the sprocket 93 is driven in one direction by the chain 92, in winding in the cable, but to disconnect the drum shaft 68 and sleeve 94 when the drum shaft is stationary and sprocket 93 is driven in the opposite direction.

The bearings 69 previously referred to as providing a support for the opposite end of the drum shaft 68 are likewise formed so as to include one anti-friction bearing which has a similarly extended inner race which forms the inner member of a one-way brake, shown in section in Figure 12. The one-way brake at this end of shaft 68, which brake is generally indicated by the numeral 100 is, however, reversed as compared with the one-way or overrunning clutch at the opposite end of the shaft. It functions to hold the shaft 68 stationary when that shaft is completely disconnected from its driving means by reason of the functioning of the overrunning clutch within the sleeve 94, thus preventing rotation of the cable storage drum 73 unless the pull of the cable in the unwinding direction is sufficiently great to overcome the frictional force developed between the friction members 82 and 83 and the drum and plate 84. It is the function of the one-way brake 100, therefore, to prevent free rotation of the cable storage drum under the pull of the cable and to insure that the upward movement of the balloon to which the cable is attached is never at any time a free or unopposed motion, even though the traction device itself may be revolving freely, those reaches of the cable indicated by the letters C^3 and C^4 being maintained under tension at all times so that the wrapping frictional engagement of the cable on the traction device will always be maintained.

The overrunning clutch at the opposite end of the shaft, which includes the rollers 93, automatically functions to operatively connect the driving chain 92 to the drum shaft 68 when the traction device is operated in the direction to wind in the cable onto the storage drum. When the traction device T is in operation to draw in the cable the drum shaft 68 will likewise be in operation and will drive the drum through the friction device previously described. The cable receiving drum 73 is of relatively large diameter and will tend to move at a relatively high circumferential speed, having the effect of attempting to wind onto the drum a greater length of cable than the traction device T is capable of winding in and paying out toward the storage drum. During the time, therefore, that the cable is thus being drawn in and is passing to the storage drum there will be a substantial amount of slip between the friction disc 88 and the friction members 82 and 83, the amount of slip increasing as the diameter of the package of cable on the storage drum increases. When the initial winding of cable is being placed on the drum the slip will preferably be about eight per cent, whereas when the drum is full the slippage may be as great as fifty per cent or even slightly more. By the mechanism described, however, the cable tension between the storage drum and the traction device may not only be maintained at all times, which is essential, but may be maintained within predetermined limits with considerable accuracy. The mechanism employed for accomplishing this is of rugged construction and of simple and inexpensive nature, easily repaired when worn and accessible for quick adjustment at all times.

It is, of course, essential that manually operable braking means be provided in association with the traction device so that this device may be locked against movement when desired or frictionally retarded when paying out cable. Such braking means includes a brake drum 105 keyed upon the end of shaft 64 and a brake band of the external contracting type, indicated at 106. One end of this brake band is fixed, being attached by a pin 107 to a rigid stationary bracket 108 while the other end of the band is attached by a pin 109 to the free end of the upwardly extending arm 110 of a bell crank lever mounted for rocking movement upon an arbor 111, the other arm of this bell crank lever, indicated at 112, being connected by a link 113 to one end of a bell crank lever 114 pivotally supported upon the frame of the machine. The lower end of the bell crank 114 is pivotally connected to a short link 116 extending longitudinally of the frame, link 116 having its opposite end pivoted to a cross rod 117 which in turn is connected by a link 118 to the lower end of an arm 119 the upper end of which is rigidly fixed upon rock shaft 120 extending transversely of the machine and the ends of which are rotatably supported in bearings mounted upon the side frame mem-

bers. Connected to the end of rock shaft 120 is a brake pedal 121 placed so that the foot rest 122 thereof may be conveniently engaged by the foot of an operator.

To the opposite end of cross rod 117 there is pivotally connected the end of an elongated link 125 which extends forwardly and the opposite end of which is connected to the lower end of a bell crank lever 126 mounted for supported movement upon the frame by a pin 127. The free end of the other arm of the bell crank 126 has pivotally connected thereto the free end of a brake band 128 of the external contracting type which band encircles a cylindrical flange 75' integral with the head 75 of the cable storage drum 73, the opposite end of the brake band 128 being connected at 130 to a fixed bracket 131, so as to be immovable. It will be apparent that, when pressure is applied upon the brake pedal 121 by the operator the link 118 will be drawn to the right (Figure 2) thus drawing the cross rod 117 and the links 116 and 125. The brake bands 106 and 125 will be simultaneously contracted and retarding forces exerted which tend to stop both the traction device and the storage drum, the braking force applied to the traction device, however, being very much greater than that applied to the storage drum by reason of the action of the cross rod 117, which has a differential effect as will be apparent, the point of application of the braking force to this cross link being much closer to the link 125 than to the link 116.

For the convenience of the operator a hand lever 133 is provided, the lower end of this lever being fixed on the rock shaft 111. Any convenient means may be associated with the end lever for locking it in position after it has been moved to brake applying position, such for instance as a pawl and segment and by this means the traction device may be permanently locked against rotation when it is disconnected from the prime mover. The second pedal which is shown to be mounted upon the rock shaft 120, and which is indicated by the numeral 135 is a clutch operating lever, the hub 136 to which the lower end of the clutch pedal 135 is affixed, being freely rotatable upon rock shaft 120 and also being connected by an arm and link 137 to the clutch operating shaft 138. Any suitable type of clutch and clutch operating mechanism may be employed and by means of which the driving connection between the prime mover and the other mechanism of the winch may be readily established or broken.

The traction device T is provided with an automatically acting braking means in addition to the manually operable braking means which has been described, which automatically operating brake can be most clearly perceived in Figures 2, 4, 5, and 6. Supported upon the end of the upper shaft 64 of the traction device, beyond or outside of the brake drum 105 is a second brake drum 140 the cylindrical outer surface of which comprises a braking surface. The drum or wheel 140 has a hub portion 140a of relatively large diameter and intermediate the hub and shaft 64 are positioned roller bearings 141 and 142 and an overrunning or one-way clutch 143, the clutch being disposed intermediate the bearings. The clutch details may be conventional and its function is to positively connect the brake drum 140 to shaft 64 when shaft 64 rotates in the direction in which it must necessarily rotate when cable is being payed out but to operatively disconnect the drum 140 and shaft 64 when the traction device is operating to draw in the cable. The outer cylindrical friction surface of drum 140 is engaged by a band 145 which almost completely encircles the one end of this band being securely attached to an anchoring member, which may conveniently be a bracket rigid with the frame of the winch and the other end being preferably attached to an operating member (not illustrated) by means of which the pressure of the band on the drum may be controlled. While the pressure of the band on the drum may be adjusted from time to time as may be desired it exerts, between adjustments, an even constant pressure on the drum which tends to prevent the drum from rotating. The arrangement is such that, when the traction device is drawing in cable drum 140 will be stationary, shaft 64 having been operatively disconnected from the drum by reason of the action of the overrunning clutch. As soon, however, as the shaft 64 begins to revolve in the opposite direction, i. e., as soon as the traction device moves in a direction which results in the paying out of cable, the overrunning clutch 142 becomes active to clutch the drum 140 to shaft 64 and the shaft is immediately retarded by the action of the brake band 145 on the drum. This braking action is, therefore, automatic and is effective in the event that, for any reason, a sudden tension created in the cable is not opposed sufficiently by the manually operable braking mechanism previously described. It furthermore considerably decreases the manual effort required in the manipulation of the manually operable brakes and renders the operation of the winch considerably smoother than it otherwise would be, particularly when a captive balloon is being subjected to turbulent air currents. Likewise, if the operator is killed or injured, or is forced to leave while the apparatus is in full operation, this brake will restrain the balloon and prevent it from escaping, the brake being normally set.

As previously stated the winch includes a novel form of spooling or "level winding" mechanism for insuring the proper lay of the cable on the storage drum as the cable is drawn in. This spooling device is most clearly illustrated in Figures 14 and 15 where it is shown to comprise essentially the large diameter sheave 22 which is supported for oscillation along a path immediately in advance of the storage drum and substantially parallel to the axis of the drum, the length of such path of movement being coextensive with the distance between the drum heads 74 and 75. The cable guide or sheave 22 is rotatably mounted upon the upper end of a supporting rod 151 mounted for rocking movement upon a supporting bracket 152 rigid with the winch frame about an axis normal to a vertical plane which includes the storage drum axis. The guide sheave 24 previously referred to is so positioned that the reach of cable which is indicated by the numeral C^3 passes off of that sheave approximately at a point intersected by the prolonged axis, about which the member 151 rocks so that the cable reach C^3 at all times is disposed parallel to supporting member 151 regardless of its inclination to the vertical. In the operation of the spooling device the guide sheave 22 will be moved from the position which is approximately indicated in dotted lines at 22a to the approximate position indicated in dotted lines at 22b (in Figures 11 and 15) by forces applied to the sheave support-

ing member 151 by novel mechanism shown in Figures 14 and 15, and which is operatively connected to member 151 a short distance above its point of pivotal attachment to the bracket 152.

This mechanism includes the cam 153 mounted upon the outer end of a shaft 154 disposed parallel to the axis about which member 151 rocks, shaft 154 being rotatably supported in a sleeve 155 which is rigid with a casing 156, this casing housing a worm wheel 157 to which the inner end of shaft 154 is secured and a worm 158 the teeth of which mesh with those of the worm wheel 157. Upon the end of the worm shaft 159 which lies without the housing 156 is mounted a sprocket wheel 160 which is connected by means of a chain 161 with a sprocket wheel 162 mounted upon and rotatable with the storage drum shaft 68. An idler sprocket 163 rotatably mounted upon a swinging bar 164 engages the lower reach of the chain 161 and serves to maintain the chain tight at all times, bar 164 which supports sprocket 163 being pivotally attached at its upper end to bracket 70 and its lower end being adjustably attached to a turn buckle 166 to an angle member 167 rigid with the winch frame. It will be clear that the heart-shaped cam 153 will be revolved about the axis of rotation of its supporting shaft 154 whenever the storage drum rotates and that the movements of the cam will be synchronized with those of the drum although, by reason of the speed reducing effect of the worm and worm wheel the cam will revolve at a considerably reduced angular velocity than that of the storage drum. Opposed cam followers are indicated at 169 and 170 these cam followers comprising rollers mounted for free rotation about the pins 169a and 170a, pins 169a and 170a connecting the links 171 and 172 which are, respectively, parallel to and on opposite sides of cam 153. Link 171 is a straight link and is extended so that its end lies directly opposite rocking support 151, being pivotally connected to that member by pivot element 173. Link 172 is centrally offset in an upward direction as shown in order to bridge the cam shaft 154.

A vertical link 173 has at its lower end an aperture through which the outer end of pin 169a extends and the link is likewise pivotally connected at its upper end to a bracket 174 so that it is free to swing in a plane parallel to the plane of the cam 153. As the cam 153 rotates one surface or the other will serve as a thrust surface, applying a force to either the cam follower 169 or the cam follower 170 and thus effecting annular rocking movement of the support 151 for the cable guide 150. As the sheave 22 reaches the end of its stroke the peak of the cam 153 passes the cam follower against which the cam has been active and movement of the rope guide 22 in the reverse direction is immediately commenced. By reason of the fact that that cam is shaped as shown there is no appreciable "dwell" of the rope guide 22 at the point where it reverses its move and hence piling up of cable at the ends of the drum, a difficulty commonly met with in prior winches of this general class. It is, of course, important that, at the instant of reversal, lost motion in the operating mechanism may not result in the undesirable "dwell" and it is, therefore, essential that the two cam followers be in close contact with the periphery of the cam at the instant of reversal, when one follower becomes inactive and the other becomes active.

The possibility of lost motion is eliminated in the mechanism described, the cam follower supporting means including the links 173, 171 and 172 maintaining the axes of rotation of the cam followers at all times upon diametrically opposed sides of the cam, i. e., maintaining the cam followers so positioned at all times that a line connecting their axes of rotation will also pass through, or approximately through, the axis of rotation of shaft 154 and cam 153. It will be clear that, as cam follower 170 moves downwardly from its point of maximum height, which is when the sheave 22 is midway between the drum heads, the cam follower 169 will be lifted through practically the same distance by the action of the swinging link 173 so that a line connecting the axes of the cam followers will always approximately pass through the axis of shaft 154. In the operation of the mechanism described there is little possibility of wear and accuracy of traverse of the cable guide 22 for long periods of time is assured. The mechanism is furthermore of great simplicity, and durable, essential features in a balloon winch. The sheave 22 will, of course, oscillate during the paying out of the cable, as well as during its winding in, and will serve to decrease wear of the cable which is caused by the rubbing of one convolution against the adjacent wrapping or convolution as the cable is unwound from the drum.

The shock absorber positioned intermediate the traction device T and the cable guide 13 has been previously referred to in general terms. It comprises the sheave 15 and a spring mechanism generally indicated at 16. The sheave is supported upon a bracket 180 in such manner that it is rotatable about an axis slightly inclined to the vertical. The bracket 180 is pivotally connected at 181 and 182 to sleeve members 183 and 184, respectively, these sleeve members being slidably mounted upon parallel, pivotally extending rods 185 and 186 the ends of which are supported in members 187 and 188 which are rigid with the frame of the winch. Encircling each of these guide rods are two helical compression springs one of relatively light resistance to compression, indicated at 190, and a second of considerably heavier resistance compression, indicated at 191 the adjacent ends aligned springs abutting against an intermediate slidable division plate or washer member 192.

It will be clear that, in the event that the reach C′ of the cable, and hence the reach C^2 also, are placed in sudden and excessive tension the sheave 15 with its supporting bracket and slides will be drawn to the left (Figures 1 and 3) this movement being opposed immediately by the lighter helical springs 190 and in a secondary manner by the heavier springs 191. If the sudden tension is not excessive the springs 191 will be compressed little if at all and the tension will be relieved by compression of the lighter springs 190 alone. Should the pull of the cable on the sheave 15 be of greater magnitude, however, the lighter springs 190 will first be compressed practically to solid height, followed by partial or full compression of the heavier springs 191. The shock relieving action of the mechanism just described will, of course, be entirely automatic. By reason of the inclination of the axis of sheave 15 a large sheave can be used at this point without making it necessary to widely separate the guide rods 185 and 186 with their associated springs.

At the forward end of the winch a novel cable guide is employed, previously indicated in a general way by the numeral 13. The details of this cable guide may be most clearly perceived in

Figures 24, 25, and 26 of the drawings. The guide sheave 195 over which the cable actually passes is mounted upon a pin or arbor 196 which is supported in aligned apertures formed in the outer ends of the parallel arms 197a and 197b of the sheave support generally indicated at 197. This support includes a cylindrical horizontal portion 197c mounted in spaced anti-friction bearings 198 which are retained within a sleeve 199 which is supported on spaced parallel upstanding bracket members, of which one is indicated at 200 in Figure 24, these bracket members being rigid with the cross member 202 comprising a portion of the rigid frame of the winch. Each bracket 200 is provided with a pin or bolt 203, extending inwardly toward sleeve 199 and entering an aperture formed in the sleeve for its reception; sleeve 199 being thus supported for rocking movement about a horizontal axis coincident with aligned axes of the bolts or pivot pins 203. It may be moved about this axis from the position in which it is shown in full lines in the several figures of the drawings, which is its operative position, to the position in which it is shown in dotted lines in Figure 24, which is its inoperative position and the position which it is moved when the winch is to be transported.

To hold sleeve 199 firmly in position with its axis horizontal and the guide sheave 195 in its forward position, hold-down bolts 205 are provided, each of these bolts having its lower end pivotally connected to ears 206 rigid with the base member 202 and being provided at its upper end with a threaded portion to receive a securing nut 207. The undersurfaces of the securing nuts 197 ordinarily engage the horizontal upper surfaces of the parallel arms 208 extending outwardly from and rigid with the sleeve 199, thus holding down the forward end of the sleeve 199 despite any upward pull of the cable upon sheave 195. In order to move the cable guide from its operative position to its inoperative position it will, of course, be necessary to first release nuts 207 and swing these bolts outwardly and downwardly so that the laterally extending arms 208 of the sleeve are disengaged. A weight 210 rigidly attached to the sheave supporting member normally tends to maintain the sheave 195 in a vertical plane but, in the usual case, the pull of the cable when the winch is in operation is the dominating factor and the sheave 195 will assume a position which is entirely dependent upon the horizontal angle between that reach of the cable which extends to the captive balloon and upon the vertical angle between this portion of the cable and the horizontal, the sheave being adapted to freely swing or revolve about the axis of the cylindrical portion 197c of the sheave support.

A guard to prevent escape of the cable from the groove in the sheave 195 is indicated at 211, this guard comprising two side plates 212 provided with aligned apertures through which the pin 196 extends. The peripheral edges of the two side plates are connected a substantial angular distance around the axis of the guard, but not to such an extent as to interfere with the free movement of the cable into the sheave through the cable entry neck 213 or the passage of the cable from the sheave 195, through the hollow interior of the cylindrical portion 197c of the sheave support, on its way to guide sheave 17. The casing 211 must, of course, be free to rotate about the axis of pin 196 as the angle of the cable with the vertical changes from time to time. The cable entry neck 213 is shown in detail in Figures 20, 21 and 22 and in these figures an insulating sleeve 215 is shown to have a portion extending into and having threaded engagement with the inner surface of the neck. Encircling the outer end of this sleeve 215 of insulating material is a metallic contact member 216 which is connected by a suitable helical conduit 217 to the ignition system of the prime mover 12. Mounted upon the cable C is a metallic disc 218 comprising two one-half portions secured together by screws 219 in such manner that the cable is securely gripped frictionally. The disc 218 is positioned on the cable at a point immediately below the captive balloon and, in the event that the operator neglects to stop the action of the traction device at the proper time when hauling in the balloon, the disc 218 will strike the contact member 216 and thus cut out or ground the ignition system of the internal combustion engine which supplies the power for the operation of the winch, the cable C, of course, being grounded.

In the operation of a barrage balloon winch its operator must remain alert with upwardly directed gaze for long periods of time and it is essential that he be seated comfortably and in such manner that he can operate the winch controls with the least effort. As previously explained also the winch must be compact and have relatively small overall dimensions when arranged for transportation. By the novel seat mechanism which is illustrated in Figures 16 to 19, inclusive, and providing a shifting canopy support, it is possible to meet the requirements in a most effective manner.

The operator's seat 220 is mounted upon a telescoping supporting leg 221, the seat being pivotally connected to the upper member 221a of the telescoping leg so that it may be rocked in a fore and aft direction from the position in which it is shown in dotted lines, a hand screw 222 of suitable type being provided to enable this adjustment to be quickly accomplished. The height of the seat above the winch frame may be adjusted by adjusting the telescoping supporting leg, the details of the means for securing the parts of the leg in different positions of adjustment, portion of which is indicated at 223, being relatively unimportant. The lower end of the supporting leg 221 is slidably supported upon the frame for movement fore and aft of the winch and for rocking movement laterally of the winch. A supporting rod 224 has its ends rigidly mounted in brackets 225 attached by bolts or the like to the adjacent side frame member of the winch. From the lower end of the supporting leg 221 parallel extensions 226 project downwardly upon opposite sides of the supporting rod 224, these flange-like extensions being curved toward each other around the undersurfaces of the rod, as shown in Figure 19, and then projecting in parallelism for a further distance in a downward direction, these lowermost and parallel portions being provided with aligned apertures to receive a threaded bolt 227 provided with a nut 228 and a head 229 having wings by means of which it may be rotated. By the means just described the lower end of the supporting leg 221 may be securely clamped to the supporting rod 224 at any point along the length of the rod. The weight of the chair and occupant are transmitted to rod 224 through anti-friction rollers 221b.

Leg 221 is also provided at its lower end with means for bracing it transversely. This means comprises laterally extending parallel webs 230 and 231, generally triangular in side elevation,

provided with downwardly projecting hook-like portions the terminal end of one of which is indicated at 230*a*, these ends extending toward supporting rod 224 so as to comprise abutment members limiting the outward swinging movement of the web about this rod by contact with the undersurface of the upper horizontal flange of the main winch side frame member, as clearly shown in Figure 19. Intermediate flanges 230 and 231 and supported for swinging movement upon a pivot 233 is a locking dog 234 which automatically falls into the full line position in which it is shown in Figures 17 and 19 when the seat post 221 is moved to a vertical position and which, by reason of the fact that its lower end bears upon the upper surface of the upper flange of the side frame member, prevents movement of the seat toward its dotted line position. The locking dog can be released, however, when it is desired to move the seat to an operative position, quickly and easily, the operator simply gripping the handle member 235 associated with the locking dog in applying the lifting force to this handle.

The protective canopy frame is indicated at 240 and is shaped as indicated in Figures 1 and 2 of the drawings, being rectangular when viewed in plan, and a horizontal and an inclined portion when viewed from the side. Upon it may be placed any suitable protective shield for the winch operator. As shown in full lines in Figure 2 the canopy support is in its operative position and in order that it may occupy this position when the winch is in operation, and be moved inwardly so as not to project beyond the sides of the winch frame when the winch is to be transported, it is mounted for sliding movement upon parallel horizontal rods 241 and 242, these rods being in turn supported upon the upper ends of substantially vertical posts 243 and 244, respectively. Bearing members 245 and 246, at the opposite ends of the sliding canopy supporting frame 240 are rigid with this frame, but are slidable upon the horizontal supporting rods 241 and 242. By the means shown the canopy support 240 is permanently attached to the winch but may be readily adjusted laterally at any time.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a winch, in combination, a shaft supported for rotation about a fixed axis, a power driven element encircling the shaft, an overrunning clutch for transmitting driving torque from said element to said shaft, whereby the shaft will be positively driven in one direction of rotation by said element when said element is rotated about the axis of the shaft in one direction, a one-way brake for acting automatically to grip and hold said shaft against rotation in the direction opposite to that in which the shaft is rotated by the overrunning clutch, a drum mounted on the shaft for rotation relatively thereto in either direction, and means frictionally connecting the shaft and drum at all times.

2. In a winch, in combination, a shaft supported for rotation about a fixed axis, a power driven element encircling the shaft, an overrunning clutch for transmitting driving torque from said element to said shaft, whereby the shaft will be positively driven in one direction of rotation by said element when said element is rotated about the axis of the shaft in one direction, a one-way brake for acting automatically to grip and hold said shaft against rotation in the direction opposite to that in which the shaft is rotated by the overrunning clutch, a drum mounted on the shaft for rotation relatively thereto in either direction, and means frictionally connecting the shaft and drum at all times, said means including a disc mounted on the shaft, annular friction surfaces carried by the drum and disposed concentrically to the axis of the shaft, the outer margin of the disc being intermediate the said friction surfaces, and resilient elements normally urging said friction surfaces toward each other to clamp said disc.

3. In a winch, in combination, a shaft supported for rotation about a fixed axis, a power driven element encircling the shaft, an overrunning clutch for transmitting driving torque from said element to said shaft, whereby the shaft will be positively driven in one direction of rotation by said element when said element is rotated about the axis of the shaft in one direction, a one-way brake for acting automatically to grip and hold said shaft against rotation in the direction opposite to that in which the shaft is rotated by the overrunning clutch, a drum mounted on the shaft for rotation relatively thereto in either direction, and means frictionally connecting the shaft and drum at all times, said means including a disc mounted on the shaft, annular friction surfaces carried by the drum and disposed concentrically to the axis of the shaft, the outer margin of the disc being intermediate the said friction surfaces, a series of springs disposed in a circular series about said shaft, for normally urging said friction surfaces toward each other, and means for simultaneously adjusting the action of said springs.

4. The combination set forth in claim 1 in which the outer member of the torque transmitting clutch comprises a sleeve upon which a driving sprocket is fixed, said sleeve enclosing a sprocket supporting bearing.

5. The combination set forth in claim 1 in which the overrunning clutch and the one-way brake are disposed respectively at the extreme ends of the shaft, and each comprises inner and outer members, portions of said respective inner and outer members comprising cooperating portions of supporting bearings, the one for supporting the said power driven element from the shaft, and the other for supporting the shaft from a relatively stationary part of the winch.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,999,202	Osgood	Apr. 30, 1935
2,017,352	Quick	Oct. 15, 1935
628,977	Wright	July 18, 1899
1,753,950	Sleeper et al.	Apr. 8, 1930
1,060,165	Cole	Apr. 29, 1913
980,220	Eastman	Jan. 3, 1911
1,022,349	Barker	Apr. 2, 1912
2,289,428	Hunt	July 14, 1942
1,313,719	Miller	Aug. 19, 1919
2,297,912	Payson	Oct. 6, 1942
1,112,331	Sessions	Sept. 29, 1914
1,482,924	Hescock	Feb. 5, 1924