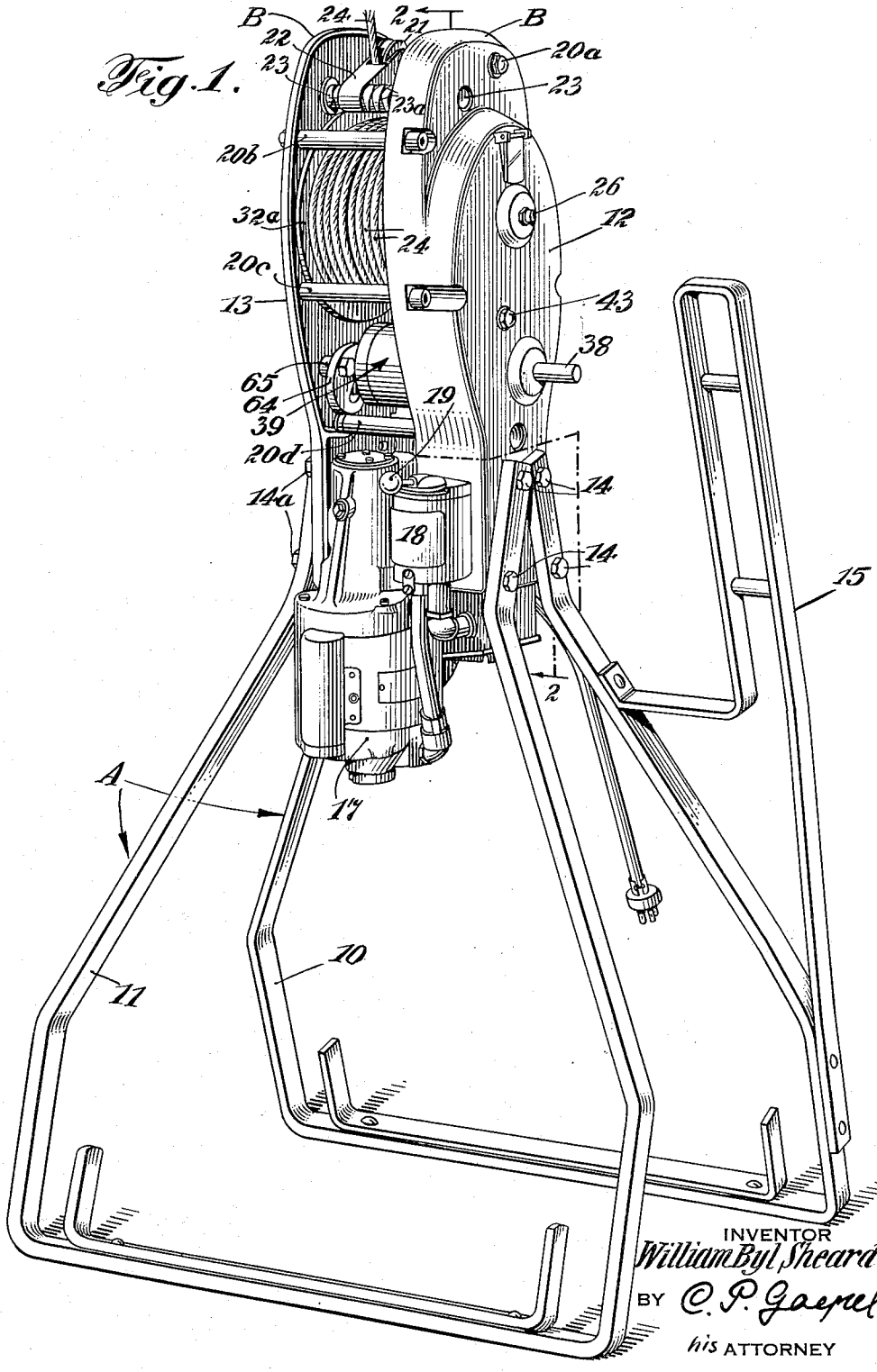
Jan. 8, 1957 W. B. SHEARD 2,776,815

UNIVERSAL SCAFFOLDING MACHINE

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Fig. 1.



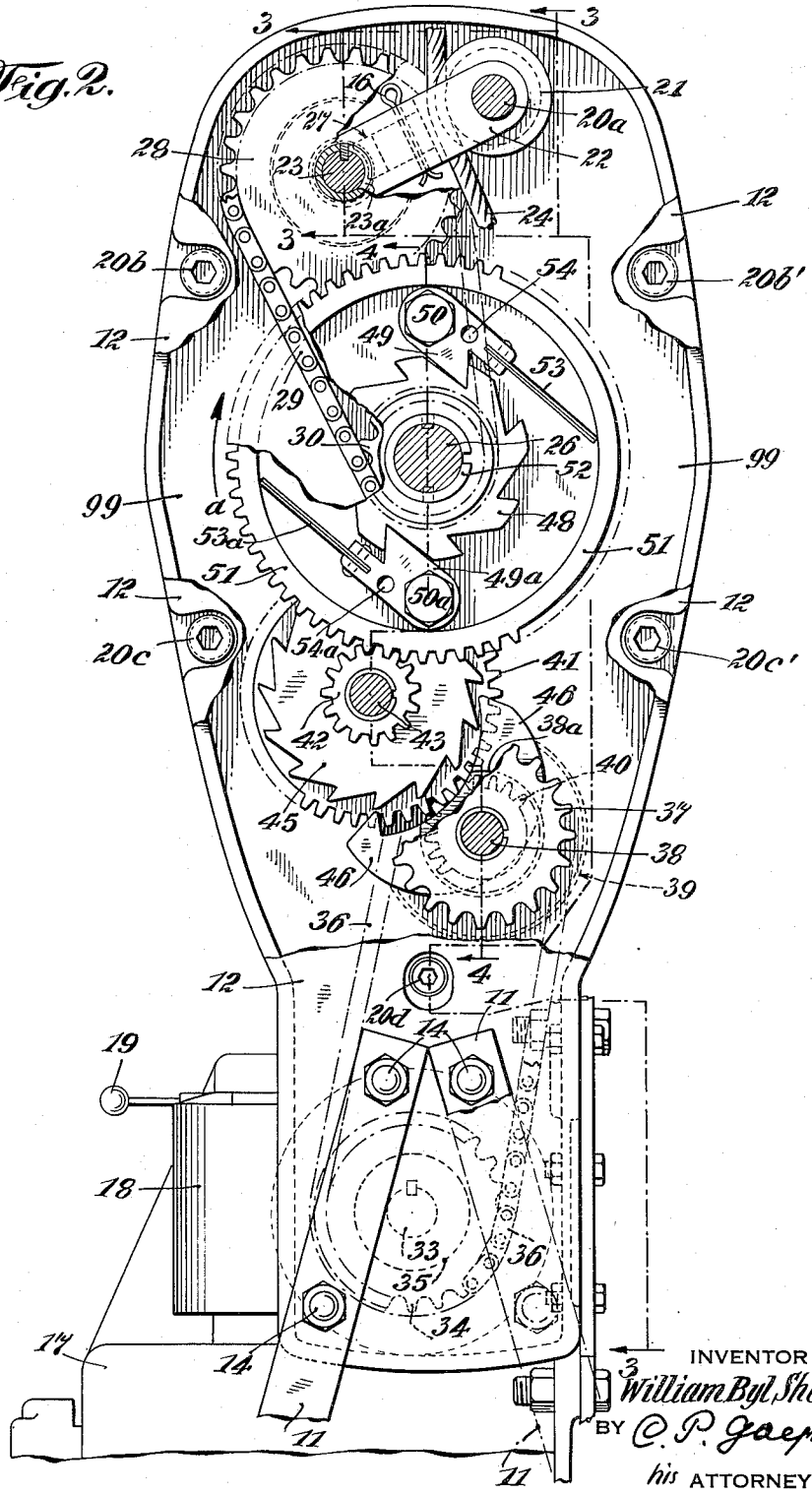

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UNIVERSAL SCAFFOLDING MACHINE

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Fig. 2.



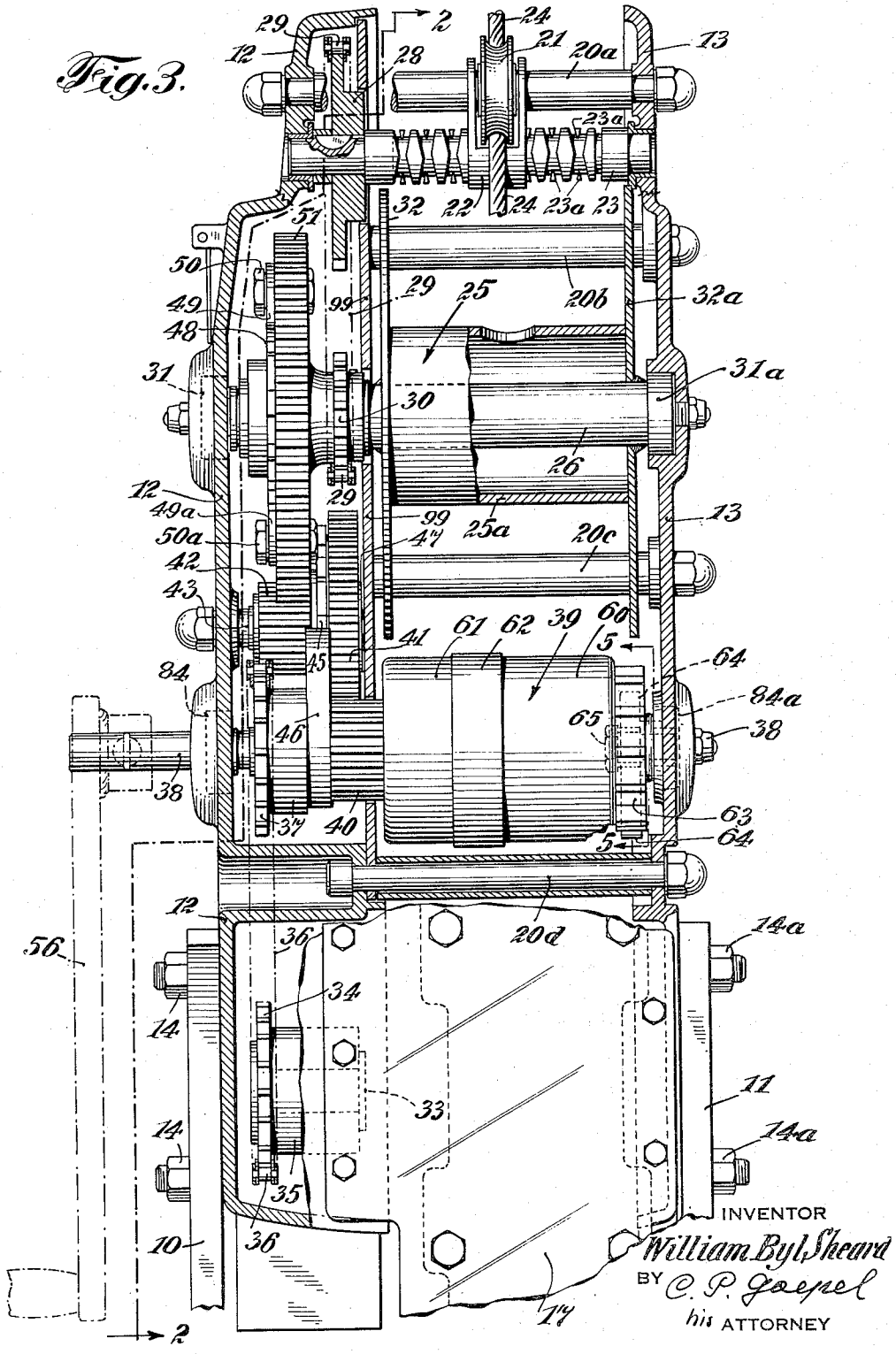

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Fig. 3.




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Fig. 4.

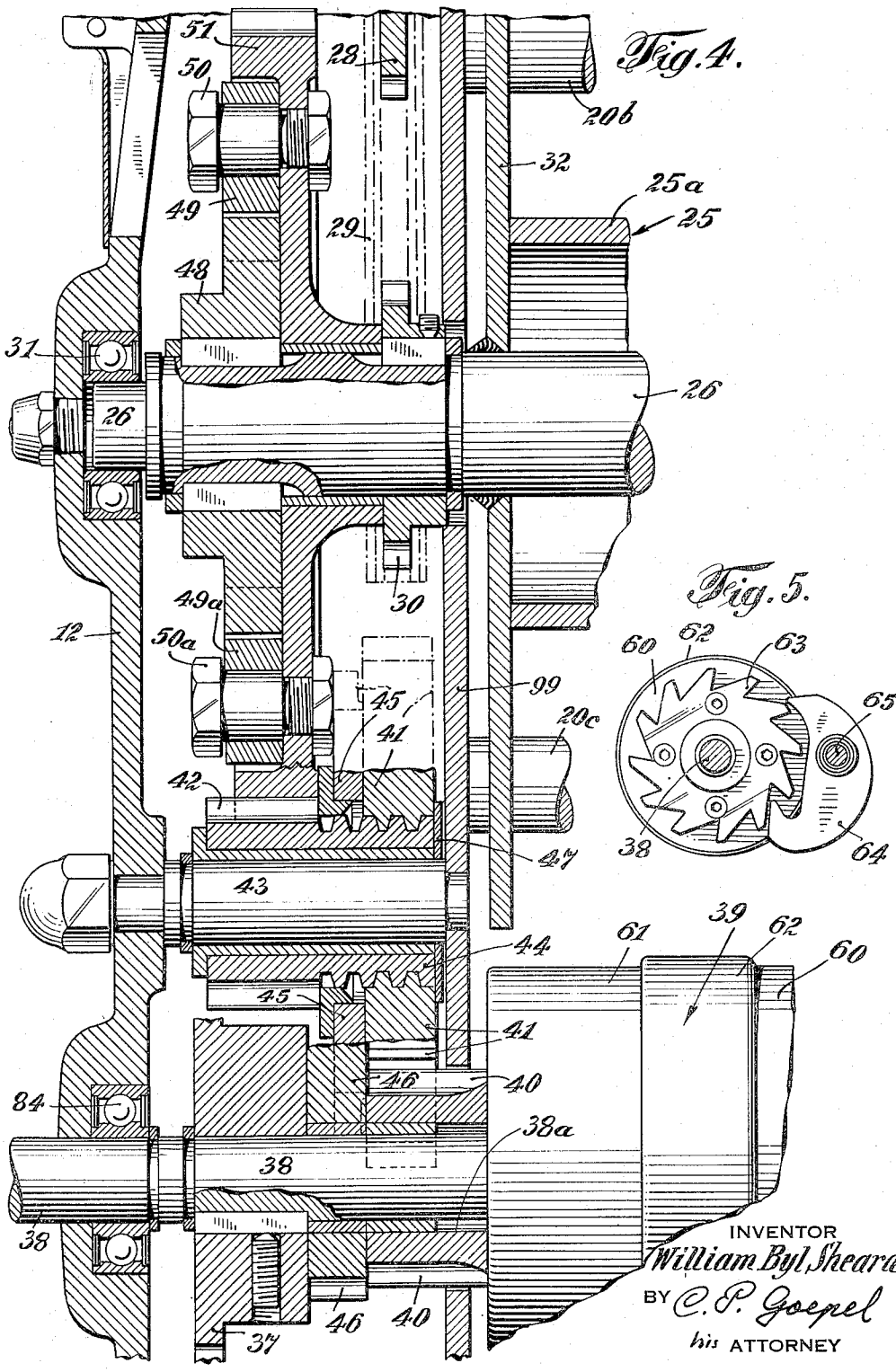



Fig. 5.



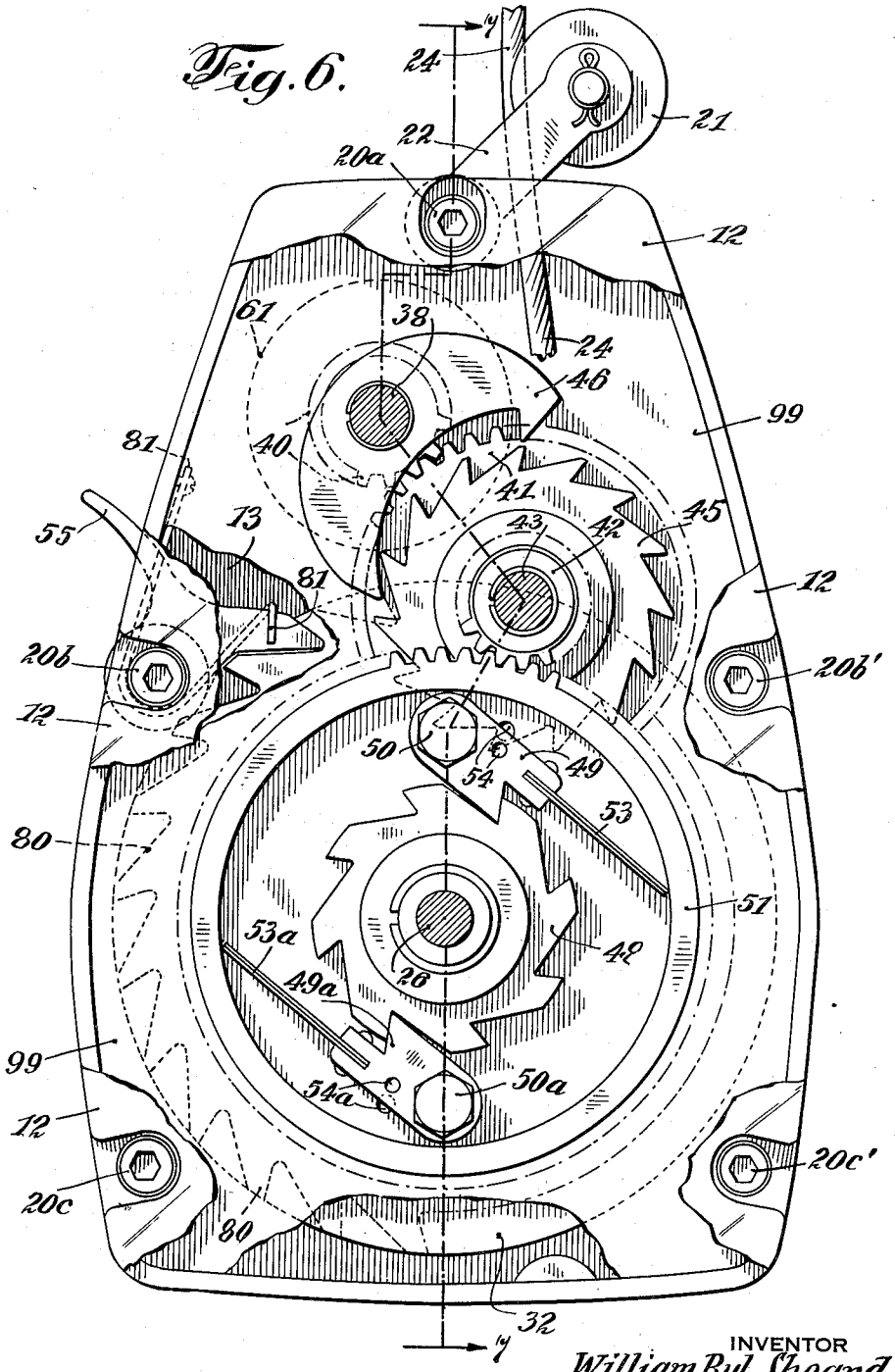

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Fig. 6.

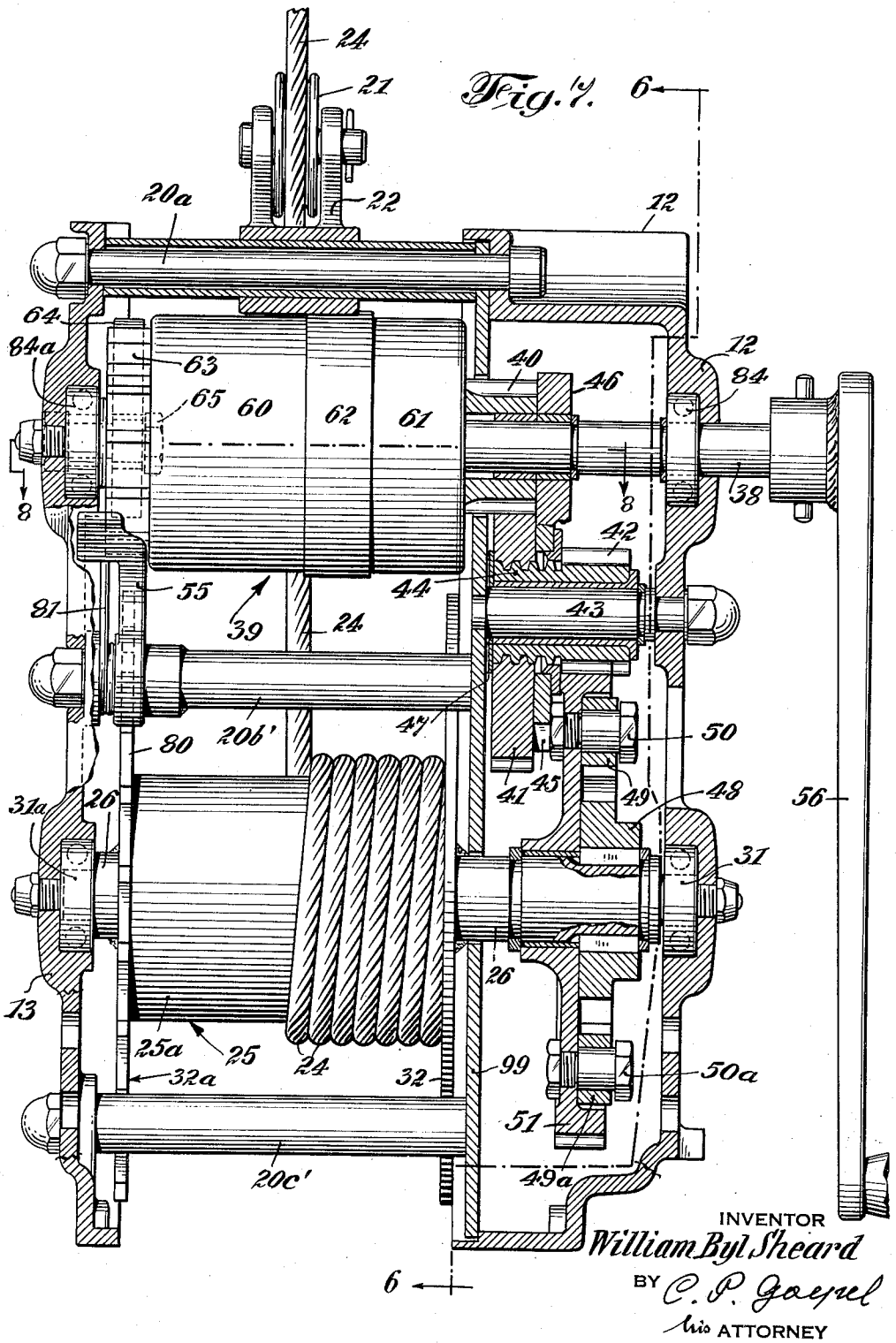



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Fig. 8.

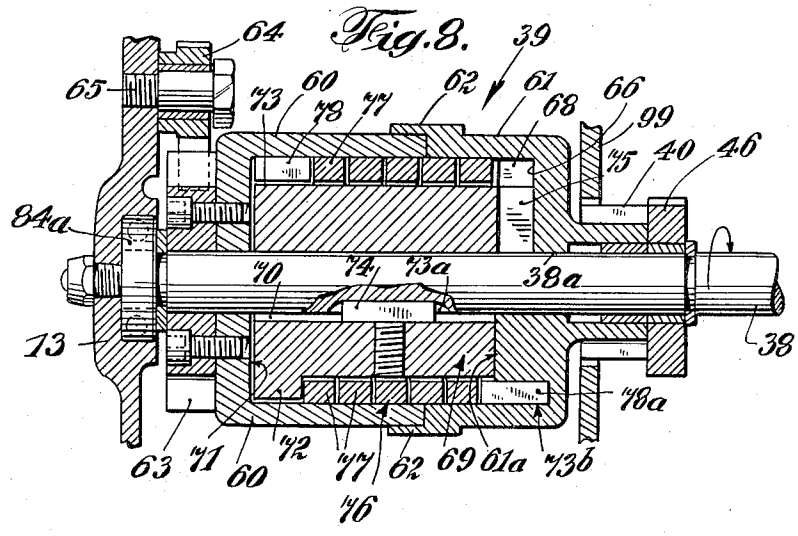
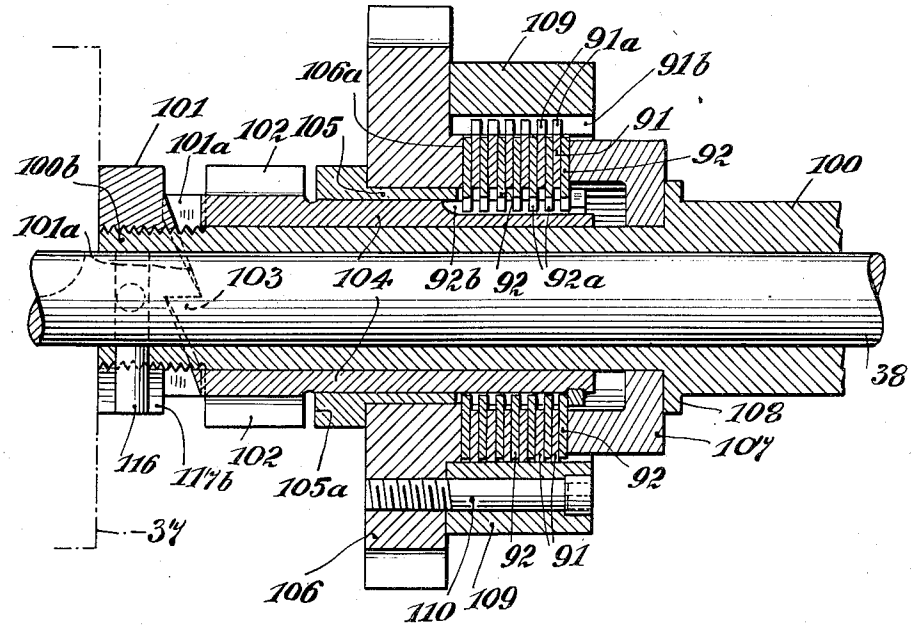



Fig. 10.




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Fig. 9.

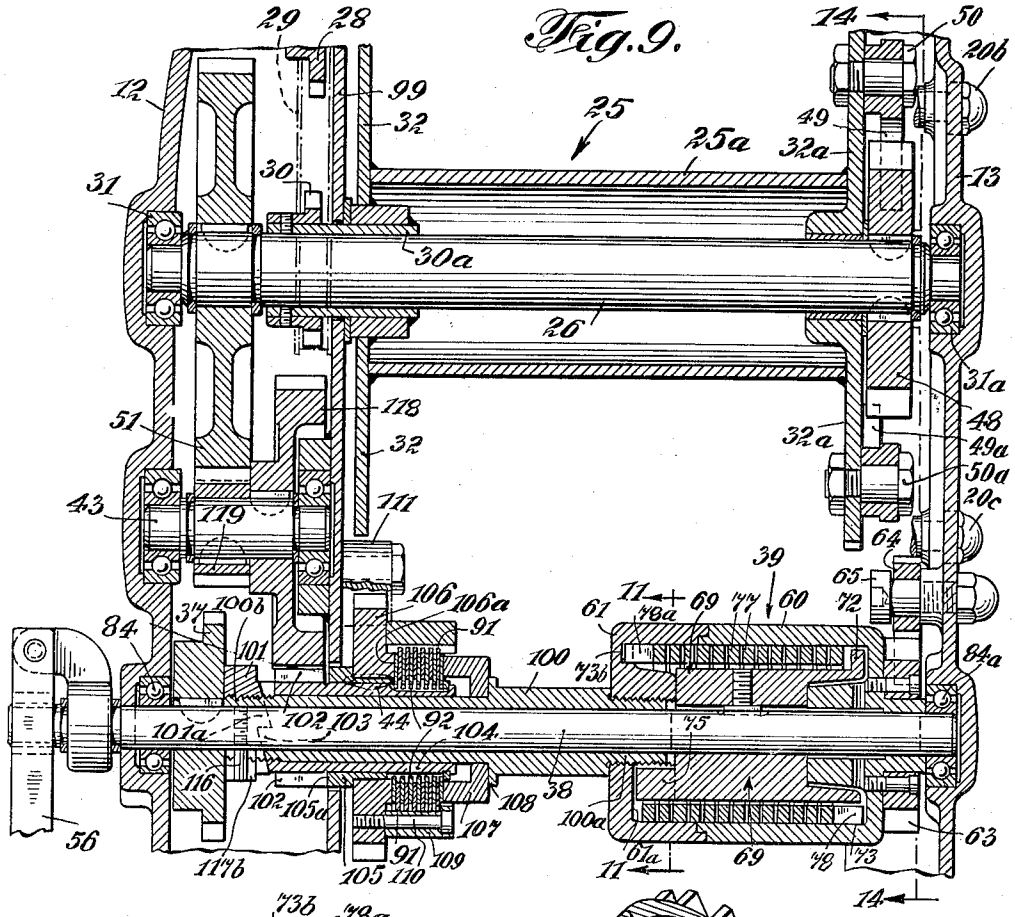



Fig. 11.

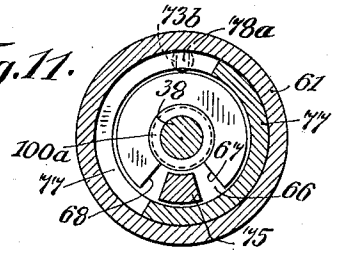



Fig. 12

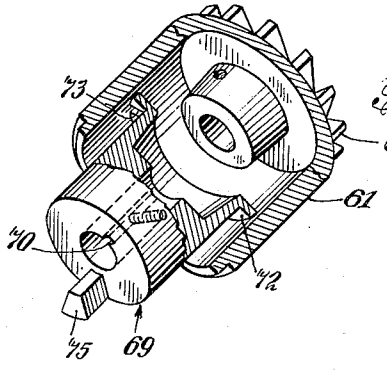
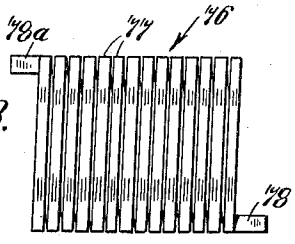



Fig. 13.




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Fig. 14.

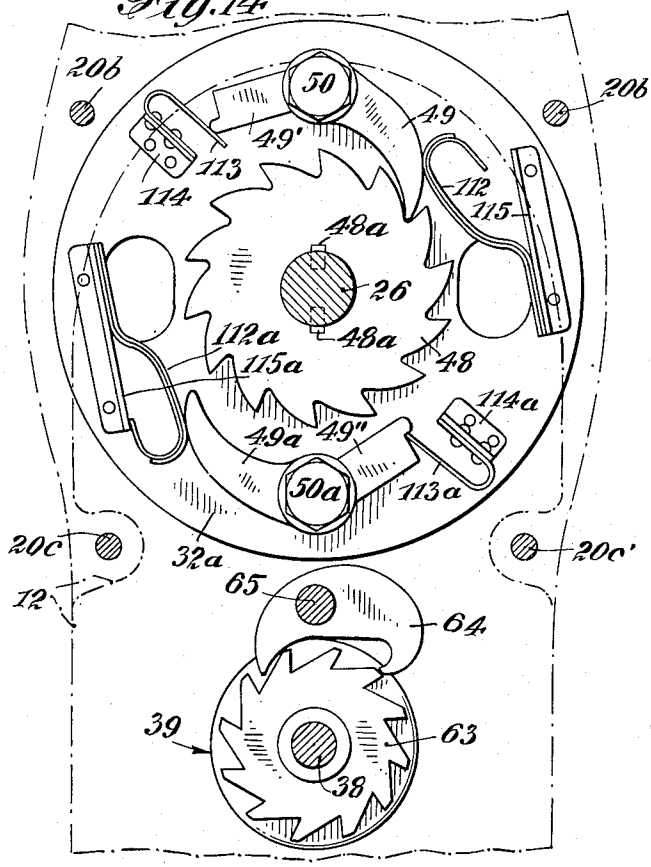



Fig. 15.

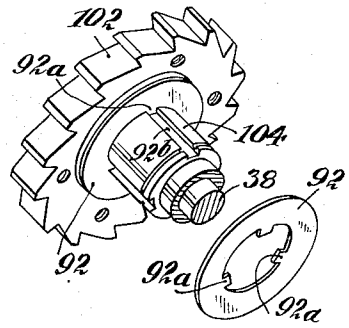



Fig. 16.

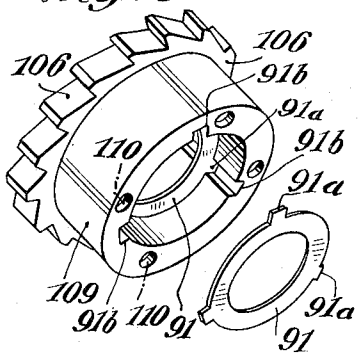



Fig. 17.

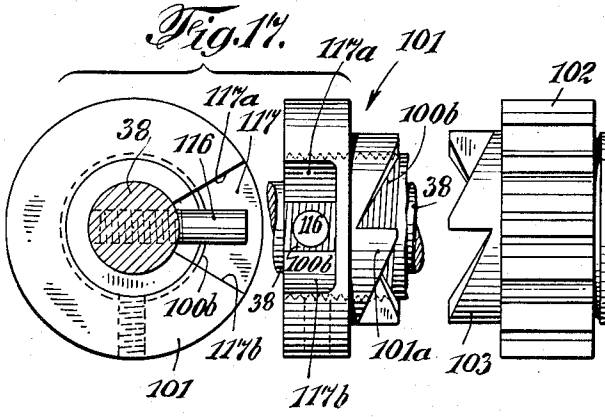
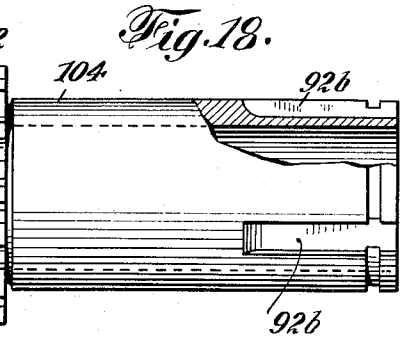



Fig. 18.




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United States Patent Office 2,776,815 Patented Jan. 8, 1957



2,776,815

# UNIVERSAL SCAFFOLDING MACHINE

William Byl Sheard, Pleasantville, N. Y., assignor to The Patent Scaffolding Co., Inc., Long Island City, N. Y., a corporation of New York

Application June 18, 1954, Serial No. 437,733

5 Claims. (Cl. 254—168)

This invention relates to safety scaffolds, and more particularly to a scaffold winch for handling scaffolds such as used by painters, glaziers, pointers, window washers and maintenance crews working on the exterior of the faces of buildings or other elevated structures at some height above the ground.

The universal safety winch of this invention may be either power driven or manually operated, depending upon the circumstances and availability of sources of power, such as electric current, compressed air or combustion motors.

It is often desired to elevate scaffolds with a considerable velocity and hand-operated winches have been found to be limited in this respect. However, it is again desirable to have a machine which may be hand-driven in the event of failure of the power source. My winch, when power driven, raises or lowers the scaffold structure attached thereto by means of a cable at considerable speeds and when idle, the braking mechanism therein prevents downward movement of the structure until the power unit is again operated in either direction. Thus, the winch is particularly adapted for use by window washers on tall buildings, since one operator may control the raising or lowering of the structure by actuating the power unit's starter with one hand.

My winch provides a multiplicity of safety means to prevent accidental unreeling of the cable from the drum when such unreeling is not desired or dangerous to the crew supported by the scaffold structure. The winch combines a friction brake system with a spring clutch in the same scaffolding machine, the latter being connected with a ratchet to form a one-way brake, either brake being adapted to hold the load by itself. Their mode of operation and their arrangement in the winch structure are such that one brake will offset the relatively weaker points of the other.

This novel multiple automatic brake construction in my winch immediately stops any movement of the cable drum when the motor or handle is not operated. The operator is not required to control the action of the braking system since it will act automatically when necessary, i. e. at all times except when the driving shaft of the winch is actually rotated by hand or from the power source. The force exerted by the weight of the load attached to the free end of winch cable automatically operates the braking system and locks the device until intentional rotational movement is imparted to the driving shaft of the winch. The cable drum is also easily disengageable from the driving mechanism in a very simple manner to permit unreeling of the cable independently of the power source.

Since the operation of the friction brake is affected relatively little by wear, or at least less than that of the spring clutch, it is placed closer to the load and is required to do most of the braking work. On the other hand, the spring clutch operates independently of the rest of the system and does not depend on the friction in the driving mechanism to operate automatically, as



the friction brake. Therefore, it acts to hold the driving mechanism stationary and forces the friction brake to operate.

The invention further provides a simple, safe and obvious method of disengaging the driving mechanism when not under load, but being very difficult to disengage when the winch is under load.

The disengaging mechanism also prevents overloading of the winch when the machine is unreeling cable and prevents the winding or spooling in the wrong direction which could jeopardize the operation of the automatic load brakes.

Several preferred embodiments of my invention will be described in more detail in connection with their illustration in the accompanying drawing, and the invention will be finally pointed out in the appended claims.

In the accompanying drawing,

Fig. 1 is a perspective view of the assembled universal scaffolding machine constructed in accordance with one preferred embodiment of my invention;

Fig. 2 is a vertical section taken along line **2—2** in Fig. 1;

Fig. 3 is a section taken along line **3—3** in Fig. 2;

Fig. 4 is a section taken along line **4—4** in Fig. 2;

Fig. 5 is a partial end view of the spring clutch, taken along line **5—5** in Fig. 3;

Fig. 6 shows another embodiment of the invention and is a section along line **6—6** in Fig. 7;

Fig. 7 is a view, partly in section, taken along line **7—7** in Fig. 6;

Fig. 8 is a section through the spring clutch, taken along line **8—8** in Fig. 7;

Fig. 9 is a view, partly in section, of another embodiment of my invention, showing the friction brake and the spring clutch mounted on the same shaft;

Fig. 10 is an enlarged partly sectional view of the friction brake illustrated in Fig. 9;

Fig. 11 is a section through the spring clutch taken along line **11—11** in Fig. 9;

Fig. 12 is a perspective view, partly in section, of two elements within the spring clutch illustrated in Fig. 9;

Fig. 13 illustrates the spring within the spring clutch;

Fig. 14 is a sectional view taken along line **14—14** in Fig. 9 illustrating another cable drum disengaging arrangement;

Figs. 15 and 16 are perspective views illustrating elements of the friction brake shown in Figs. 9 and 10;

Fig. 17 is a combined plan and side view of a clutch nut mounted on the shaft supporting tthe friction brake and the spring clutch; and

Fig. 18 is an illustration of a brake pinion gear cooperating with the clutch nut shown in Fig. 17.

Similar characters of reference refer to identical elements throughout the various views in the drawing.

Referring now in more detail to the illustrated embodiments, and more particularly to Fig. 1, there is shown a support A, consisting of two suitably shaped stirrups **10** and **11**, to which the shells **12** and **13** of winch casing B are secured by bolts **14**, **14*a***. Stirrup **10** carries a guard rail support **15**.

The winch is driven by an electric motor **17**, operable through switch box **18** by lever **19**. However, a crank **56** may be attached to shaft **38** to adapt the winch to manual operation.

The winch mechanism, and more particularly that embodiment thereof wherein the winch may be either power driven or manually operated, is shown in Figs. 2 to 4. Referring first to Fig. 3 which is a longitudinal section through shells **12**, **13** of casing B, there are shown bracing shafts **20*a***, *b*, *c*, *d*, connecting shells **12**, **13** in spaced relationship. A sheave wheel **21** is mounted on shaft **20*a*** for free rotational movement between the two forks

or extensions of a member 22 which is mounted on shaft 23. Cable 24 is secured at its outer free end to cornice hooks, outrigger beams or other appropriate anchorage (not shown) in the usual manner. As the cable 24 enters the winch, it passes over sheave wheel 21 and down to cable drum 25 to which its other end is securely attached. When the cable drum 25, on its shaft 26, is rotated in clockwise direction, as shown by arrow *a* in Fig. 2, the cable will spool on the drum barrel 25*a*, and when rotated in the counterclockwise direction, the cable will unreel from said barrel 25*a*.

Shaft 23 is provided with suitable helical grooves 23*a* adapted to receive a guide pin 27 shown in dotted lines in Fig. 2, which is mounted in a recess in member 22 and secured therein by a cotter pin 16 or the like. One end of guide pin 27 follows the helical grooves 23*a* of shaft 23 and since these grooves are continuous and reverse themselves near the ends of shaft 23, member 22 with sheave wheel 21 travels back and forth between shells 12, 13, thereby evenly distributing the cable convolutions on the drum barrel 25*a*. A sprocket 28 is keyed to shaft 23 and is driven by a roller chain 29, the chain in turn being driven by sprocket 30 keyed to shaft 26. Sprocket 30 thus always rotates in unison with cable drum 25. The drive from shaft 26 to shaft 23 is so proportioned that the sheave wheel 21 traverses back and forth at a rate required to spool cable 24 evenly across barrel 25*a* of drum 25. Bearings 31, 31*a* (Figs. 3 and 4) at both ends of shaft 26 reduce the friction of the shaft 26 during the rotation thereof. Barrel 25*a* is limited at both its ends by flanges 32, 32*a* which prevent cable 24 from slipping off the barrel on either side thereof.

A partition wall 99 encloses with shell 12 the rotation transmitting mechanism and the friction brake.

The winch is driven by an electric or air motor 17 energized by switch 19 or air valves respectively (Fig. 2). Motor 17 drives a sprocket 34 which is rotated clockwise or counterclockwise, depending upon the necessity to cause the scaffold or any other weight attached to cable 24 to ascend or descend. Sprocket 34 is attached to a clutch unit 35 which is driven by the shaft 33 of motor 17. Clutch 35 performs two different functions: (*a*) it serves as a means to disengage the motor 17 from the other elements of the driving mechanism if the winch is desired to be operated manually by handle 56; and (*b*) it is designed in a manner to disengage the motor from the other elements of the driving mechanism in the event that a too heavy load is placed on the scaffold or that the scaffold has been caught by some obstruction on the face of the structure. The rotation of cable drum 25 immediately ceases upon the disengagement of clutch unit 35.

Sprocket 34 drives a roller chain 36 which in turn drives sprocket 37 on shaft 38, sprocket 37 being keyed to the latter. Shaft 38 operates a spring clutch unit 39 which in turn transmits the rotation to gear 41 mounted on shaft 43 by the pinion 40. The manner of operation of this spring clutch unit 39 will be described in more detail hereinafter, in connection with Fig. 8.

As stated, pinion 40 drives gear 41 which is rotatably mounted on the hub extension 44 of a gear 42 mounted on shaft 43 (see Fig. 4). The bore of gear 41 is internally threaded to match the external threads cut on the hub extension 44 of gear 42. Shaft 43 also carries a plain plate ratchet 45 (Figs. 2 and 4) between gears 41 and 42. The bore of ratchet 45 is larger than the outside diameter of threads on the hub 44 of gear 42 and therefore ratchet 45 rotates freely thereon. Pawl 46, mounted on shaft 38, permits the rotation of ratchet 45 in counterclockwise direction only. When gear 41 is rotated in counterclockwise direction by pinion 40, it rotates upon the threaded hub 44 of gear 42 and is thereby forced to move toward gear 42 until stopped by plain plate ratchet 45. As gear 41 is forced to rotate, it tends to clamp ratchet 45 between itself and gear 42 and therefore gear 41, ratchet 45 and gear 42 all rotate in unison and pawl 46 merely rides over the teeth of the ratchet 45, when the ratchet 45 rotates. If gear 41 is rotated in the opposite direction, it backs away from plate ratchet 45 until it hits a stop 47 on the hub extension 44 of gear 42 and thus no longer rotates freely on the threads of hub 44; it forces gear 42 to rotate in unison with it on shaft 43.

The backing away of gear 41 from gear 42 automatically unclamps ratchet 45 which is held stationary by pawl 46. When gear 41 hits the stop 47, it rotates in unison with pinion 42 and the cable may unreel from drum 25. If the rotation of gear 41 is stopped, then the tension in cable 24, working through cable drum 25, shaft 26, ratchet 48, pawls 49, 49*a* (see Fig. 2) and bolts 50, 50*a*, in that order, causes gear 51 to rotate counterclockwise and thereby causes gear 42 to rotate in clockwise direction. This rotation causes gear 41 to move toward gear 42 and to clamp ratchet 45 between them, as previously described. However, since the direction of the teeth of ratchet 45 is opposed to the pawl 46, all motion of pinion gear 42 stops. This action is automatic and therefore the described arrangement constitutes an automatic braking device to restrain the winch from lowering the scaffold or the like, attached to cable 24, under the force of gravity of said scaffold, except when driven by gear 40.

In normal operation, pinion 42 meshes with a gear 51 mounted on shaft 26. Pinion 42 rotates said gear 51 in clockwise direction when the cable 24 is spooled onto cable drum 25, and in counterclockwise direction when cable 24 is being unreeled from the drum. Gear 51 rotates freely on shaft 26. As this gear 51 rotates, it forces pawls 49, 49*a* against the teeth of ratchet 48 which is keyed onto shaft 26 (see Fig. 2). Pawls 49, 49*a* are fastened to gear 51 by means of shouldered cap screws 50, 50*a* and are free to rotate upon the shoulders of the screws. Leaf springs 53, 53*a* are attacehd to pawls 49, 49*a* and bear against the projecting rim of gear 51, thereby keeping pawls 49, 49*a* normally in engagement with the teeth of ratchet 48. Ratchet 48 is keyed nonrotatably to shaft 26 and thus in turn rotates cable drum 25 to reel or unreel cable 24.

The tension in the cable 24 tends to rotate ratchet 48 through cable drum 25 and shaft 26 in counterclockwise direction and thereby keeps the teeth of ratchet 48 in contact with pawls 49, 49*a*.

If the motor 17 drives gears 40, 41, 42, 51 in the lowering direction, pawls 49, 49*a* tend to disengage from the teeth of ratchet 48. However, the tension in cable 24 resulting from the weight of the scaffold attached thereto tends to rotate the ratchet 48 in the same direction and keeps pawls 49, 49*a* in engagement with the teeth of ratchet 48.

The main reason for driving shaft 26 from gear 51 through ratchet 48 and pawls 49, 49*a* is that this manner of driving provides a simple and reliable means of disengaging cable drum 25 from the rest of the driving mechanism by merely prying pawls 49, 49*a* out of engagement and clear of the teeth of ratchet 48 and inserting a pair of pins into holes 54, 54*a* and letting part of these pins to project into similar aligned holes in gear 51. The pins hold pawls 49, 49*a* clear of the teeth of ratchet 48 and thus ratchet 48, shaft 26 and cable drum 25 are free to rotate independently of the driving mechanism. The cable 24 can be readily unreeled from drum 25 when, for example, rigging the winch for operation. Other advantage of this ratchet and pawl combination is in that it prevents cable 24 from being wound on the drum 25 in the wrong direction, and should cable 24 jam while it is being unreeled, the drive will merely ratchet. This combination also permits the use of a locking or safety pawl 55, as shown in Fig. 6, without any danger of overloading the driving mechanism. This pawl 55 ratchets on ratchet 80 of disc 32*a* shown in Fig. 3.

The main feature of my novel winch is the use of the friction brake in combination with a one-way brake, consisting of a spring clutch and a ratchet, in the same

scaffolding machine, either of which can hold the load by itself. However, by the novel way of combining both brakes in a single winch, each brake is capable of offsetting the weak points of the other brake by its own strong points.

The spring clutch 39, shown in more detail in Fig. 8, is mounted on shaft 38. This clutch, which works independently of the rest of the system, does not depend on the friction of the driving mechanism as the above-described friction brake. It is housed in an elongated cylindrical shell 60 and a cylindrical sleeve 61 abutting said shell 60 and having a reinforcing ring 62 which partly fits over shell 60 to prevent entry of foreign material into the spring clutch. Shell 60 carries a ratchet wheel 63 cooperating with pawl 64 mounted on bolt 65, as seen in Fig. 1 and in more detail in Fig. 5. Bearings 84 and 84*a* reduce the friction of shaft 38 within shells 12, 13.

Sleeve 61 is either integral or firmly connected to pinion 40, the pinion having a bore 38*a* for the passage of shaft 38. Sleeve 61 has a segmental cutout 66 limited by walls 67 and 68. Within sleeve 61 and shell 60 is a cylindrical member 69 which is keyed to shaft 38, the slot to receive key 74 being shown at 70. One end of the cylindrical member 69 which is adjacent the closing wall 71 of shell 60 has a collar 72 which is interrupted at 73 to form a slot therein into which one end of spring 76 fits, as will be explained in more detail hereinafter. The other end of cylindrical member 69 which is within sleeve 61 is provided with a projection 75 to loosely fit into the segmental cutout 66. This segmental cutout 66 prevents independent rotation of member 69 with respect to sleeve 61 in case that the spring 76 should break or become displaced, or excessively worn.

The spring 76 consists of a cylindrically wound band 77 with both ends 78 and 78*a* bent in a direction parallel to the axis of the spring. End 78 fits into the slot 73 of collar 72 in cylindrical member 69, and end 78*a* fits into a hole 73*b* bored into the wall 61*a* of sleeve 61. When inserted into the spring clutch 39, the spring 76 surrounds with its convolutions 77 the cylindrical member 69 within shell 60 and sleeve 61. The diameter of spring 76 is slightly larger than the diameter of the bores of shell 60 and sleeve 61; therefore, its convolutions must be slightly compressed when inserted into shell 60 and sleeve 61 of the spring clutch.

The operation of the clutch 39 is as follows:

When shaft 38 is rotated in clockwise direction, either by chain 36 from clutch 35, or by handle 56, it rotates the cylindrical member 69 which is keyed to shaft 38 by key 74 insertable into slot 70 of member 69 and slot 73*a* of shaft 38. The wall of the slot 73 in collar 72 of member 69 bears against end 78 of spring 76. This causes the convolutions 77 to expand radially and to press more tightly against the inner surfaces of shell 60 and sleeve 61, thus rotating both shell 60 and sleeve 61 in clockwise direction, pawl 64 riding loosely over the teeth of ratchet 63. The end 78*a* of spring 76 is forced against the wall of bore 73*b* and thus additionally causes sleeve 61 with pinion 40 to rotate in the clockwise direction. The rotation of pinion 40 causes gear 41 and pinion 42 on shaft 43 to rotate counterclockwise and the gear 51 on shaft 26 to rotate clockwise and to reel the cable 24 onto cable drum 25.

When motor 17 is stopped, or the rotation of shaft 38 by crank 56 is ceased, the tension in cable 24 tends to rotate gear 51 in counterclockwise direction, this in turn tending to rotate pinion 42 and gear 41 in clockwise and pinion 40 with sleeve 61 in counterclockwise direction. The wall of the hole 73*b* is then forced against the end 78*a* of spring 76 and tends to expand the spring 76 which in turn causes the spring to more firmly adhere to the inner surfaces of shell 60 and sleeve 61 and tends to rotate the same in counterclockwise direction. However, ratchet 63 which is secured to or integral with shell 60, is prevented from rotation in the counterclockwise direction by pawl 64 and thus any rotation in counterclockwise direction of shaft 38 is prevented.

If it is desired to unreel cable 24 from drum 25, shaft 38 is rotated in counterclockwise direction. Then, cylindrical member 69 which is keyed to shaft 38, also rotates in counterclockwise direction and causes wall of slot 73 in cylindrical member 69 to press against end 78 of spring 76 in counterclockwise direction thus tending to radially compress its convolutions and disengaging spring 76 from the inside surface of shell 60 and allowing the outer surface of spring 76 to slide within the bore of shell 60 which is held stationary by pawl 64 in engagement with ratchet 63. As the spring 76 slides, the tension of cable 24 then causes the pinion 40 and sleeve 61 to follow the rotation in counterclockwise direction through gear 51, pinion 42 and gear 41.

It may be seen from the above that the cable 24 can be unreeled from drum 25 only when the shaft 38 is actually rotated in counterclockwise direction. When the handle is simply released or the motor stopped, the spring 76 will expand radially against the inner surface of shell 60 and enough friction will develop between these two members to cause rotation of spring 76 with respect to shell 60 to cease. Shell 60 is prevented from rotation in the lowering direction by ratchet 63 and pawl 64. The spring clutch will prevent any unreeling of the cable until the shaft 38 is actually rotated anticlockwise by the motor 17 or crank 56. Projection 75 of cylindrical member 69 has freedom of movement in the segmental cutout 66 within sleeve 61 and does not touch the walls of sleeve 61 at any time unless the spring 76 should break or wear out. In other words, the angle of the segmental cutout is so proportioned that the spring 76, when in operative condition, bears the load through ends 78 and 78*a*, and does not let projection 75 touch the walls of cutout 66 in sleeve 61 at any point.

Should the spring 76 break or become displaced, then this projection 75 comes into contact with either wall 67 or wall 68 of cutout 66 and transmits the load directly from pinion 40 to cylindrical member 69 and thus to shaft 38, instead through spring 76 which has been displaced or had broken down. This is an additional safety measure in the spring clutch arrangement.

Figs. 6 and 7 show that embodiment of the novel winch wherein the device is operated only manually by crank 56. This structure is essentially the same as the previously described power-driven winch, except that the arrangement of the brakes has been changed and the sheave wheel 21 within member 22 slides along the outer surface of bracing bolt 20*a* without guide pin 27 and grooves 23*a*; thus, the tension of cable 24 causes its convolutions to arrange themselves around the barrel of cable drum 25 on shaft 26. These two figures also show a ratchet 80 formed on the flange 32*a* of cable drum barrel 25*a*, which cooperates with pawl 55 held against the teeth of ratchet 80 by spring 81. This is an additional safety measure and any unwinding of cable 24 from drum 25 is impossible unless pawl 55 is disengaged from the teeth of ratchet 80; when the cable 24 is reeled onto drum 25, the pawl 55 merely rides over the teeth of ratchet 80.

It is evident from the above description of the friction brake and the spring clutch that either of these alone can prevent the unreeling of cable 24 when such unreeling is not desired or is dangerous. As mentiond above, it is preferable to place the friction brake closer to the load and the spring clutch closer to the driving mechanism. However, their relative arrangement is such that the load is directly transmitted from the one to the other, which considerably increases the safety of the winch structure since, should the friction brake break or otherwise fail to operate, the spring clutch with ratchet 63 will immediately take up the load and prevent any undesired unreeling of the cable or vice versa. This relative interconnection is shown in the figures of the drawing by the arrangement of pinion 40 and gear 41. Gear 41 on shaft 43, which together with pinion 42 and its integral

hub extension 44, ratchet 45, pawl 46 and stop 47 forms the friction brake, directly transmits the load from gear 51 and thus from cable 24 to pinion 40 and therethrough to the spring clutch. On the other hand, this pinion 40 of spring clutch 39 directly transmits the rotational movement of shaft 38 from either crank 56 or from motor 17 to gear 41 and thus to the friction brake, and through gear 51 to cable drum 25.

Fig. 9 shows another preferred relative arrangement of the friction brake and the spring clutch. This embodiment shows both devices mounted on the same shaft 38, which is partly done for space considerations.

The spring clutch pinion 40 shown in Fig. 8 has been extended into a hollow connecting shaft 100 screwed into a clutch nut 101; brake pinion 102 is rotatably mounted on this shaft 100. This new brake pinion 102 combines the functions of pinions 40 and 42. One end of shaft 100 is threaded into sleeve 61 of the spring clutch 39, as shown at 100*a*, with a left-hand thread, which tends to tighten under the action of the load on the scaffold winch. The other end 100*b* of shaft 100 is also provided with a left-hand thread to take the clutch nut 101. This thread also tightens under load. Hollow shaft 100 is free to rotate on shaft 38.

The description of the embodiment of friction brake shown in Fig. 9 will be made partly in connection with the explanation of its operation and partly in connection with Fig. 10 which is an enlarged illustration of the friction brake. Some elements of the friction brake are also shown in Figs. 15 to 18.

The load on the winch tends to rotate pinion 102 in counterclockwise direction. As pinion 102 rotates, its jaws forming the spiral clutch 103 work against the jaws 101*a* of the clutch nut 101. Pinion 102 rotates and slides freely on shaft 100, together with its integral hub 104. The pressure of clutch jaws 101*a* against jaws 103 causes pinion 102 to move toward the spring clutch 39 and to thereby exert pressure against shoulder 105*a* of collar 105; this shoulder 105*a* in turn transmits the pressure to the friction brake ratchet 106. The wall 106*a* of ratchet 106 further transmits the pressure to discs 91 and 92. However, since discs 91 and 92 are restrained from axial movement by pressure cup 107 which bears against shoulder 108 of hollow shaft 100, the axial movement of pinion 102 forces outer discs 91 into tight frictional contact with inner discs 92. The resulting frictional force tends to lock discs 91 and 92 together and causes their rotation in the same direction. Discs 92 are keyed non-rotatably to the hub 104 of pinion 102 by means of projections 92*a* which fit into slots 92*b* in hub 104, as may be seen in Figs. 10 and 15.

The outer discs 91 are keyed in a similar manner to the ring-shaped driving cup 109 which is secured to ratchet 106 by means of cap screws 110. This is illustrated in Figs. 10 and 16.

Ratchet 106 rotates freely on sleeve 105 having a shoulder 105*a*, but pawl 111 permits it to rotate in the clockwise direction only. Thus, when the load creates axial pressure by the action of clutch jaws 103 and 101*a* against each other and locks discs 91 and 92 together, the whole assembly of parts 102, 100, 106, 109, 107, 91 and 92 will tend to rotate together in the counterclockwise direction because of the action of the load on pinion 102. However, pawl 111 prevents this assembly from rotating counterclockwise and therefore prevents the friction brake from rotating in this direction. Clutch nut 101 is prevented from rotation by shaft 100 to which it is attached, and the shaft 100 in turn is prevented from rotation by the normal action of the spring clutch 39, as described in connection with Fig. 8.

To lower the load, it is necessary to bypass both ratchets, i. e. ratchet 106 of the friction brake and ratchet 63 associated with the spring clutch. This is accomplished in the following manner:

When shaft 38 is rotated in the counterclockwise direction, either by handle 56 or by sprocket 37, it rotates the cylindrical member 69 within the spring clutch 39 in the same direction. Member 69 acts on the end 78 of spring 76 received in slot or notch 73 thereof. Since the spring has its convolutions wound left-hand, the action tends to coil up the spring and to thereby decrease the diameter thereof. As its diameter decreases, the friction between the wall of bore in shell 60 and the spring 76 also decreases until the spring 76 slides freely in said bore, and thus bypasses the restraining influence of ratchet 63 and pawl 64. When the spring 76 is released from its frictional engagement with shell 60, then the sleeve 61 rotates counterclockwise and in turn rotates shaft 100 and clutch nut 101 in the same counterclockwise direction. As the clutch nut 101 rotates, it permits brake pinion 102 to move in the direction away from the spring clutch 39 because of the action of clutch jaws 101*a* on jaws 103. As soon as the pressure is released, discs 91 and 92 move apart and no longer are locked by their mutual friction. Therefore, discs 92 rotate independently of discs 91 and are consequently free of ratchet 106 and pawl 111. The pinion 102 is now free to rotate in counterclockwise direction and to lower the load through gear 51.

However, when the rotation of shaft 38 ceases, spring 76 within spring clutch 39 automatically expands and again frictionally engages with its circumference the wall of bore in shell 60. Shell 60 is prevented from rotation in counterclockwise direction by ratchet 63 and pawl 64. The rotation of parts 61, 100, and 101 also ceases and causes the action of spiral clutch jaws 103 against 101*a*. This induces brake pinion 102 to move toward the spring clutch and to again frictionally lock discs 91 and 92, as previously described. The pinion 102 is then locked against rotation through parts 92, 91 and 109. Since ratchet 106 is prevented from counterclockwise rotation by pawl 111, a double braking action is obtained.

In raising the load, handle 56 or sprocket 37 is rotated in clockwise direction. The locked assemblies of both brakes rotate in unison, since pawls 64 and 111 merely ride over their corresponding ratchets 63 and 106. When the motion of handle 56 or of sprocket 37 ceases, the pawls again engage the teeth of their respective ratchets and prevent counterclockwise rotation and unreeling of the cable 24 from drum 25.

Figs. 9 and 14 show a different arrangement for releasing the brake drum 25 from the driving mechanism. As illustrated, ratchet 48 is moved to the opposite side of drum 25 and the shape of pawls 49 and 49*a* has been changed permitting leaf springs 112, 112*a* to act on those portions thereof which engage the teeth of ratchet 48 and to permit leaf springs 113, 113*a* to retain these pawls away and clear of the ratchet's teeth when engaging portions 49', 49'' of the pawls. Ratchet 48 is keyed to shaft 26 at 48*a* and the pawls 49, 49*a* are rotatably supported on flange 32*a* of cable drum 25 by means of bolts 50, 50*a*. Members 114, 114*a* and 115, 115*a* support leaf springs 112, 112*a* and 113, 113*a* on the flange 32*a*. Gear 51 is also keyed to shaft 26 on the opposite side of drum 25. Drum 25 is free to rotate on shaft 26 and has welded or otherwise secured thereto sprocket 30 through sleeve 30*a* and therefore always rotates in unison with the sprocket.

When gear 51 rotates in either direction, together with shaft 26, ratchet 48 follows their rotation at all times unless disengaged by leaf springs 113, 113*a*. In that case, the cable drum rotates independently together with sprocket 30. In Fig. 14, one pawl 49 is shown in engagement with ratchet 48 due to the action of leaf spring 112, whereas the other pawl 49*a* is disengaged and held clear of the teeth of ratchet 48 by leaf spring 113*a*.

Figs. 17 and 18 illustrate on an enlarged scale the clutch nut 101 and the brake pinion gear 102 with its hub 104. As an additional safety measure in case of a breakdown of spring clutch 39, a pin 116 is screwed into shaft 38 within cutout 117. The purpose of this pin 116

is identical with that of projection **75** within segmental cutout **66** with its walls **67** and **68** in the spring clutch, described in more detail in connection with Fig. 8. In case of a breakdown, pin **116** acts against the walls **117***a*, *b* of segmental cutout **117** and thus directly transmits the load from shaft **38** to the pinion **102** and the friction brake without requiring operation of the spring clutch. Gears **118** and **119** on shaft **43** transmit the rotational movement to gear **51** and the cable drum **25**, and to obtain the desired relative rotational speed of the cable drum.

I claim:

1. In a scaffolding machine having a support, a casing connected with said support, a first shaft in said casing and a winding drum on said first shaft for reception of a length of cable, one end of said cable being anchored in said drum, the combination of driving means for imparting rotational movement to said drum in clockwise and counterclockwise direction, means rotatable with said drum for distributing said cable on the periphery of said drum when said drum is rotated in a direction to wind said cable thereon, means for disengaging said drum from said driving means, a friction brake between said driving means and said drum for preventing rotation of said drum while said driving means is not actuated, a second brake including a spring clutch, a ratchet and a pawl, operatively connected between said friction brake and said driving means for preventing rotation of said drum while said driving means is not actuated, and a clutch member between said second brake and said driving means for disengaging said driving means at a predetermined tension in said cable.

2. The structure of claim 1, wherein said drum is rotatable on said first shaft and said means for disengaging said drum from said driving means consists of a ratchet non-rotatably attached to said first shaft, a plurality of pawls rockably supported by said drum, resilient members for urging said pawls into engagement with the teeth of said ratchet, and means for retaining said pawls disengaged from the teeth of said ratchet on a predetermined rocking of said pawls away from the teeth of said ratchet.

3. The structure of claim 1, wherein said winding drum consists of a substantially cylindrical barrel and a flange at each extremity of said barrel, said barrel with said flanges being rotatably attached to said first shaft, said driving means including a gear rotatable with said first shaft, said means for disengaging said drum from said first shaft consisting of a plurality of pawls rockably supported on one of said flanges of said drum, resilient members for urging said pawls into engagement with said ratchet, and means for retaining said pawls away from said ratchet while said pawls are disengaged therefrom, and a second shaft is provided in said casing for said second brake and said friction brake, said second shaft being operatively connected with said driving means, and an operative connection between said friction brake and said gear on said first shaft.

4. In a scaffolding machine having a casing, a support connected with said casing, a first shaft in said casing, a winding drum on said first shaft, and a length of cable having one end thereof anchored in said drum, the combination of means for releasably connecting said drum with said first shaft for rotation therewith, means for distributing said length of cable on the periphery of said drum when said first shaft with said drum is rotated in a direction to wind said length of cable thereon, a second shaft in said casing, a spring clutch mounted on said second shaft, said spring clutch having a cylindrical housing consisting of two cupped portions having an open and a closed end and abutting each other with said open ends thereof, the first of said portions having a ratchet secured thereto at its closed end and having an interior recess in said closed end, a pawl for engaging said ratchet to permit rotation thereof with the first of said portions in a direction to wind said cable onto said drum only, an elongated sleeve surrounding said second shaft and connected at one extremity thereof to said closed end of said second portion, a nut having annularly disposed jaws with the other extremity of said sleeve secured to said nut, a cylindrical member fixedly connected to said second shaft in said spring clutch housing, said cylindrical member having a slot in one extremity thereof within said first portion of said housing, a coil spring surrounding with a plurality of its convolutions said cylindrical member in said housing, one end of said spring being held in said slot in said cylindrical member and the other end of said spring being insertable into said interior recess in said closed end of said first cupped portion, the rotation of said sleeve in one direction expanding the convlutions of said spring to engage said first portion for rotational movement with said second portion of said housing, and the rotation of said sleeve in the opposite direction contracting the convolutions of said spring to disengage said first portion from said second portion of said housing, a friction brake mounted on said sleeve between said spring clutch and said nut, said friction brake having a pinion, said pinion having a hub slidably surrounding said sleeve, and annularly disposed jaws for engaging said nut, a hollow ratchet slidably mounted on said hub, a plurality of first discs axially movably and non-rotatably inserted into said hollow ratchet, a plurality of second discs axially movably and non-rotatably surrounding said hub, said first and said second discs alternately contacting each other, a shoulder on said sleeve for limiting axial movement of said hollow ratchet and a pawl for engaging said hollow ratchet to limit its rotational movement to one direction only, the rotation of said sleeve and of said nut in one direction urging said pinion with said hub away from said nut by the action of said jaws whereby said pinion moves said hollow ratchet toward said shoulder to frictionally engage said first discs by said second discs and to actuate said friction brake, and rotation of said sleeve in the opposite direction releasing said frictionally engaged first discs from said second discs to release said hollow ratchet, said nut at the other end of said sleeve embodying a safety device, power driven means operatively connected with said second shaft, and a clutch member between said power driven means and said second shaft for disengaging said power driven means on a predetermined tension in said cable.

5. The structure of claim 4, wherein said safety device in said nut comprises a pin radially extending from said second shaft, said nut having a segmental cutout with radial walls for engaging said pin to rotate said nut with said axle when said friction brake is inoperative.

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