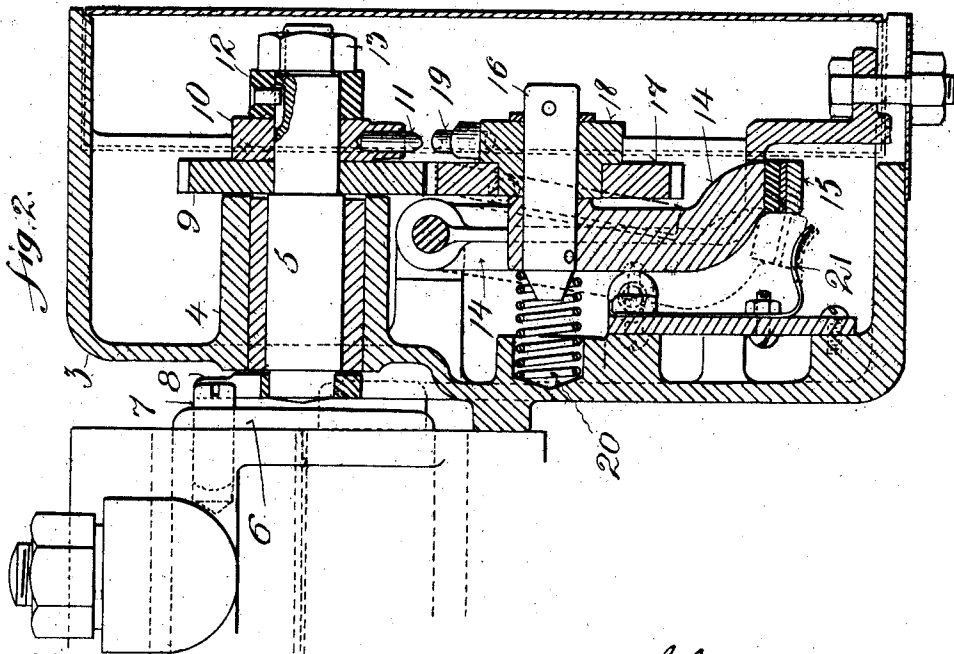
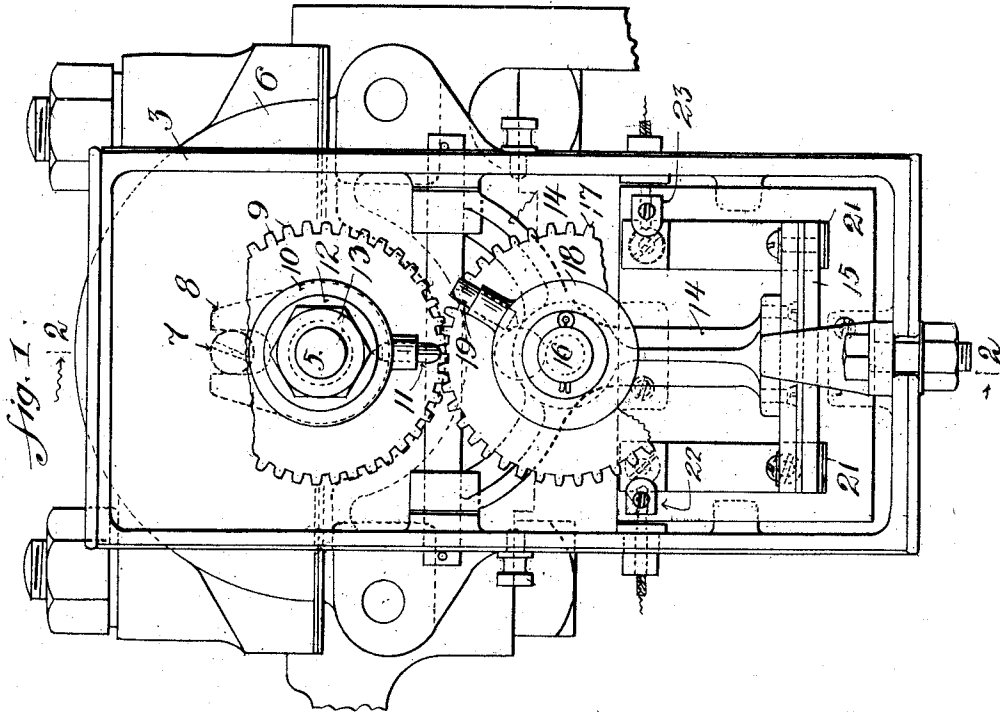


C. W. SPEAR.  
 AUTOMATIC LIMIT STOP MECHANISM.  
 APPLICATION FILED JUNE 17, 1909.

985,221.

Patented Feb. 28, 1911

3 SHEETS—SHEET 1.



Witnesses:  
 W. Benjamin  
 J. Klein.

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 Inventor  
 By his attorney  
 Daniel C. Clark

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3 SHEETS-SHEET 2.

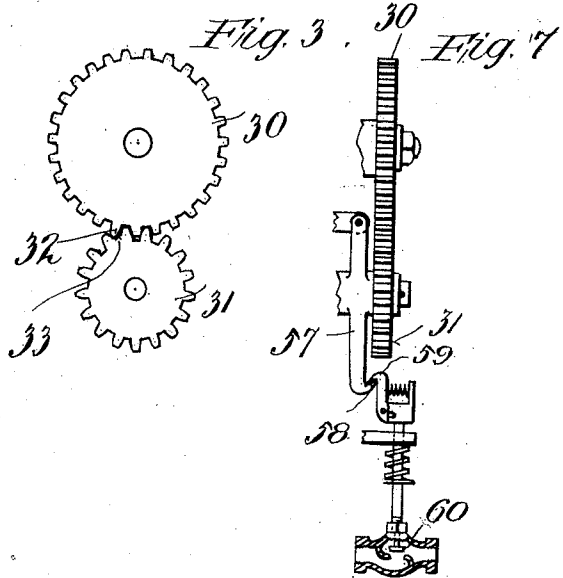
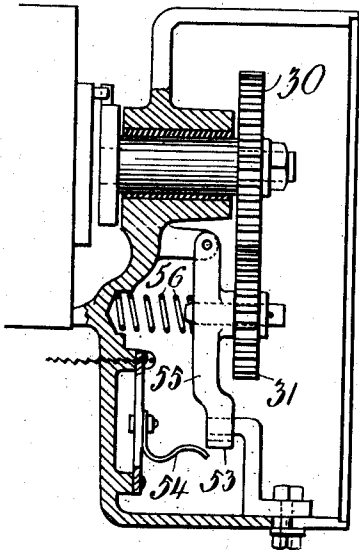
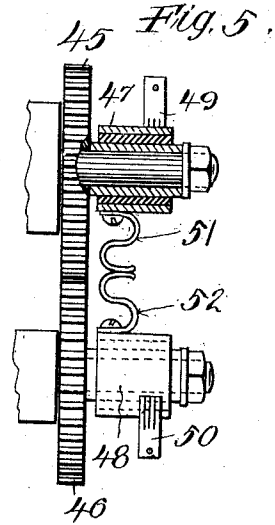
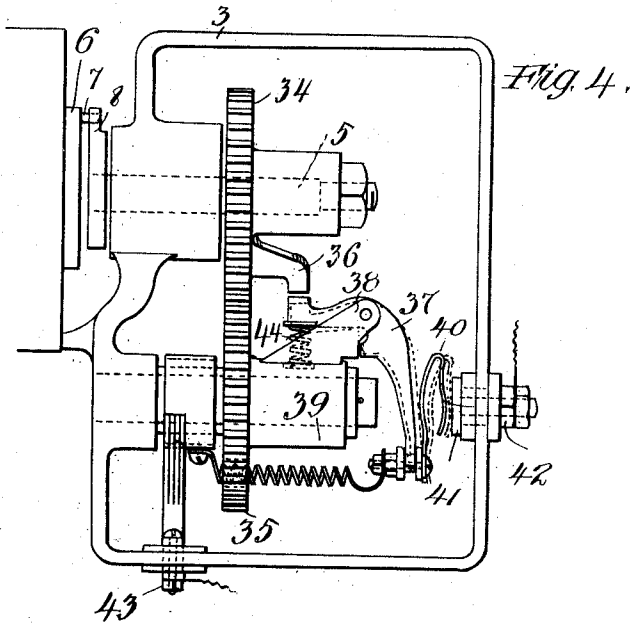


Fig. 6

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3 SHEETS—SHEET 3.

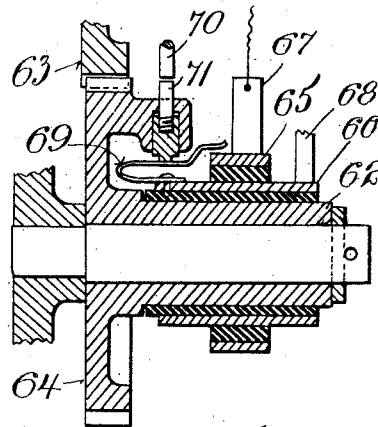
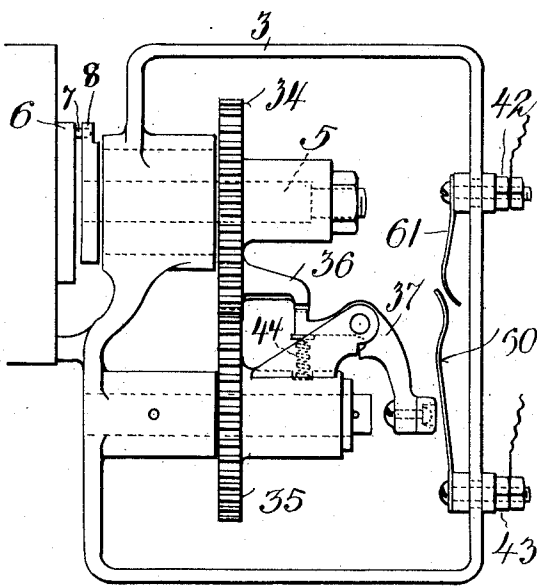
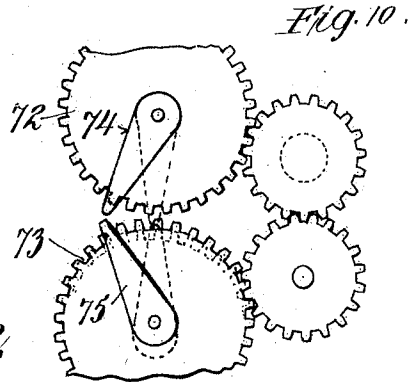
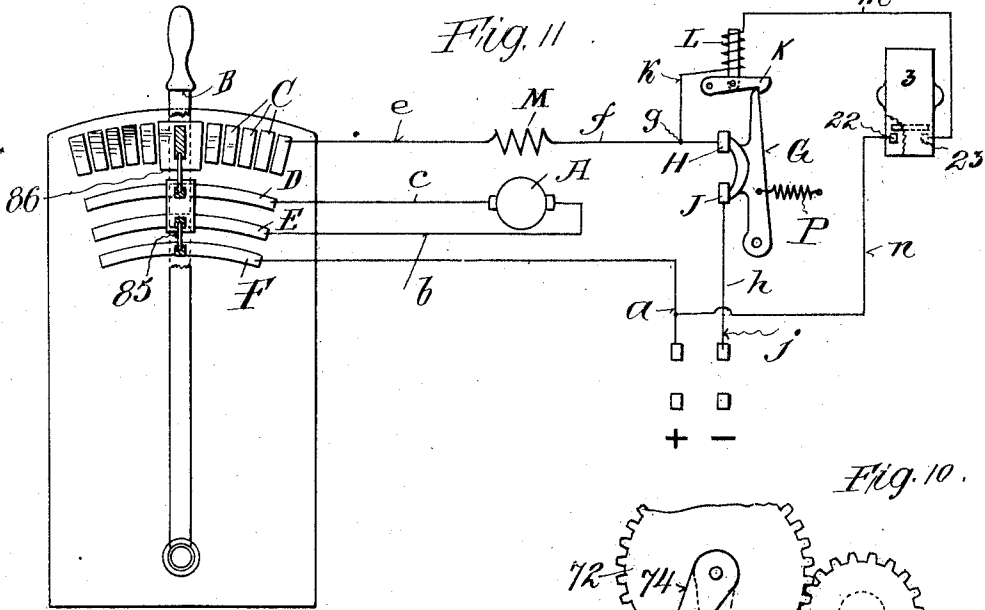


Fig. 8

Fig. 9

Witnesses:  
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Charles W. Spear  
 Inventor  
 By his Attorney  
 Samuel C. Barby

# UNITED STATES PATENT OFFICE.

CHARLES W. SPEAR, OF MUSKEGON, MICHIGAN.

## AUTOMATIC LIMIT-STOP MECHANISM.

985,221.

Specification of Letters Patent.

Patented Feb. 28, 1911.

Application filed June 17, 1909. Serial No. 502,721.

*To all whom it may concern:*

Be it known that I, CHARLES W. SPEAR, a citizen of the United States, residing at Muskegon, in the county of Muskegon and State of Michigan, have made a certain new and useful Invention in Automatic Limit-Stop Mechanism, of which the following is a specification.

This invention relates to automatic limit stop mechanism.

The object of the invention is to provide an automatic limit stop mechanism which is simple and efficient, which effects a quick action of the stop at the desired point in the operation, and which avoids the danger of breakage or derangement in case of accident.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference signs appearing thereon Figure 1 is a view in front elevation of one form of mechanism adapted for controlling an electric circuit and embodying the principles of my invention, the front plate of the box or casing containing the mechanism being removed. Fig. 2 is a view in section on the line 2, 2, Fig. 1, looking in the direction of the arrows. Fig. 3 is a view illustrating the elementary idea of two adjacent members so arranged as to move at relatively different angular velocities, and having cooperating parts adapted to engage each other at the desired intervals to effect a relative movement of said parts. Fig. 4 shows in elevation another arrangement embodying the fundamental principle of the invention, the side of the inclosing casing being omitted, this form of apparatus being shown for use in connection with electric switch mechanism wherein the relative movement of the adjacent members closes the circuit through a contact block carried by the case. Fig. 5 is a view, partly in section, of an arrangement wherein the cooperating parts operated by the two adjacent members, themselves constitute contacts to open and close an electric circuit. Fig. 6 is a similar view of another modification wherein the adjacent members embody the elementary features shown in Fig. 3 for ef-

fecting the relative movements to open or close an electric circuit. Fig. 7 is a view showing the application of the principles of my invention to the operation of a valve. Fig. 8 shows another modified arrangement embraced within the spirit and scope of my invention whereby the relatively movable parts operate to close contacts upon each other. Fig. 9 is a sectional view showing another modified form of apparatus embraced within the scope of my invention, and wherein an electric circuit is made or broken through the movement of the relatively moving parts. Fig. 10 is a diagram showing another arrangement of angularly moving members with intermittently engaging parts for accomplishing the purpose of my invention, where the moving members do not bear the relation to each other of driving and driven members. Fig. 11 is a circuit diagram illustrating the manner of use of an electric switch form of mechanism embodying my invention.

The same part is designated by the same reference sign wherever it occurs.

In carrying out my invention I propose to employ, in its fundamental characteristic, adjacent members arranged to move at unequal angular velocities and having associated therewith, or carried thereby engaging parts, which, by reason of the different angular velocities at which the adjacent members move, come in contact or interfere with each other only at certain intervals which may be predetermined by the relative speeds of movement of the adjacent members, the gear ratio thereof, the relative sizes of said members, or in any other suitable or convenient manner, and I propose to employ the contact or interference of said associated parts to effect the desired safety limit, arrest or other operation sought to be accomplished. This operation may be the opening or closing of a valve, the opening or closing of a switch, or any other desired manipulation necessary to secure the intended results. The contact or interference of the parts referred to may result in directly opening or closing an electric circuit, operating a valve, or the like, or such contact or interference may initiate the operation of other and intermediate connections, as, for instance, through the relative yielding movement of said parts when brought into contact or interference with each other, and through which relative yielding movement the desired switch, valve

or other operation is effected. The essential characteristic in this regard being that the movement of the adjacent members having said parts associated therewith is not interrupted by the contact or interference of said associated parts.

In the accompanying drawings I have shown several different forms of embodiments of the principles of my invention, and therefore in the broad scope of my invention as defined in the claims, I do not desire to be limited or restricted to exact details of structure. Nor is my invention, as defined in the claims, to be limited or restricted in respect to the use of my invention, as the same may be employed in any relation where a safety limit stop, or predetermined arrest of the operation of a machine is required or desired.

A structure embodying my invention, while well adapted for other purposes, is particularly suitable for use in connection with the operation of hoisting cranes, lifting mechanisms, and other similar machinery. In the operation of such devices it is important to provide means for preventing accident or damage by reason of the overrunning of the hoisting drum or other mechanism.

In the accomplishment of the objects and purposes of my invention, I provide a limit stop mechanism constructed and arranged to be actuated by the hoisting machine at some convenient point, and which limit stop is adjusted so as to operate at the desired point in the hoisting operation to arrest the hoisting motor. To this end I arrange the limit stop in one form of embodiment of my invention which I have selected to illustrate the same, to open or close an electric circuit, the opening or closing of which operates to release a switch, which interrupts the hoisting or other motor circuit, or to apply the brake, or to perform such other function in the arrest of the mechanism as may be desired. It is to be understood however, that other specific embodiments of the broad idea of my invention may be employed with equal facility.

I will now first describe my invention as applied to a limit contact for opening an electric circuit, it will, of course, be understood that my invention as defined in the claims is not to be limited or restricted in this respect, as the same results may be attained by the closing of the circuit, or by the opening or closing of valves, or other devices.

Referring to the drawing, and first, to the arrangement shown in Figs. 1, and 2, reference sign 3, designates a box or casing in which the limit stop mechanism is carried. This casing is provided with a boss or hub 4, in which is journaled a short stub shaft 5, adapted to receive rotary movement from any suitable or convenient source, prefer-

ably from the hoisting or other mechanism in connection with which the safety or limit stop is employed, and in such relation and gearing proportion with reference thereto as that said shaft will make a definite number of rotations while the hoisting motor or apparatus is operating to a certain and corresponding point of action. The driving connection for rotating the stub shaft 5, may be of any suitable or convenient construction. I have shown a simple arrangement wherein the end 6, of the hoisting shaft carries a stud 7, in the end thereof and in eccentric relation with respect to its axis. This stud is arranged to operate within a slotted crank 8, carried by the stub shaft 5, so that the rotation of the drum imparts coincident rotation to the stub shaft. Mounted upon the stub shaft is a gear wheel 9, to rotate therewith. Also mounted upon the stub shaft in the form of my invention shown in Figs. 1 and 2, is a block 10, carrying a projecting finger 11. The block 10, carrying the finger 11, is held on the stub shaft by means of a collar 12, adapted to be clamped against the block 10, by means of the nut 13. By this construction the angular position of the block 10, or of the gear 9, may be readily adjusted, and these parts, when once adjusted, may be clamped securely in their adjusted positions. Within the case 3, is mounted a rocking or swinging yoke 14, carrying a contact strip 15, at its free end. Also carried by this rocking or swinging yoke is a stud 16, upon which is mounted a gear wheel 17, and a block 18, these parts being held together to rotate in unison upon the stud 16. The gear 17, is arranged to intermesh with and be driven by the gear 9, on the stub shaft 5. The block 18, carries a projecting finger 19, adapted to cooperate with the finger 11, carried by block 10. The yoke 14, which carries the contact 15, and the stud 16, is yieldingly held in position by spring 20, to normally maintain the gears 17 and 9, in mesh with each other and the finger 19, in position to be engaged by the finger 11, when these fingers are brought into position to contact with each other. The contact 15, carried by the swinging yoke 14, cooperates with fixed contacts 21, one of these contacts being connected to be in circuit with the binding post 22, and the other with the binding post 23. Normally, in this specific arrangement, the contact 15, is held out of contacting relations with respect to contacts 21, though, as above indicated, the arrangement may be such as to be the reverse of this without departure from the scope of my invention as defined in the claims. One of the gears 9, 17, is provided with one more tooth than the other gear.

In practice, the gear 9, is provided with the hunting tooth, and in assembling the

apparatus the gears are so relatively adjusted with respect to each other, as well as with respect to the operation of the hoisting or other mechanism to be stopped at a definite limit, that by reason of the hunting tooth, the fingers 11, 19, will come in contact or will interfere with each other when the mechanism to be automatically arrested reaches the point where the arrest is to take place. When this point in the operation is reached, the fingers 11, 19, meet and contact with each other, and they are of such length that in meeting and passing each other the one must be forced away from the other, and since the tooth 19, is mounted upon the movable or swinging yoke, it is obvious that by reason of the engagement of the fingers 11, 19, as explained, the yoke 14, will be rocked or swung against the action of spring 20, and in a direction for the contact 15, to be brought into electrical connection with the contact 21, thereby completing the circuit therebetween. The closing of this circuit operates the switch controlling mechanism, as will be more fully explained hereinafter, thereby resulting in the interruption of the motor circuit, and hence the arrest of the motor. It is obvious that the contacts 15, 21, may be respectively arranged in the main circuit which may thus be made or broken. By the hunting tooth relation of the gears 9, 17, the fingers 11, 19, are brought into engaging relation with respect to each other only at the proper point according to the adjustment of the relation of the gears and their associated blocks 10, 18, to effect the arrest of the hoisting mechanism at the desired point in its operation. If, however, for any reason, the fingers 11, 19, are carried past each other after being brought into contacting or engaging relation, or if through the overspeed of the hoisting mechanism this should happen, or if from any other cause the hoisting mechanism should not be arrested, no damage results to the circuit breaker mechanism since the fingers 11, 19, will continue to be carried around or revolved, and hence there would be no jamming or breaking of parts.

From the foregoing description it will be seen that the fundamental idea of my invention involves the employment of two members moved at differing angular velocities which, at predetermined points are made to contact or interfere with each other, whereby there is secured a relative movement of parts away from each other, such relative movement being utilized to accomplish the desired arrest or safety control of the machinery in connection with which the safety limit stop mechanism is employed. Therefore, in the broad scope of my invention, it is immaterial whether the interfering or relatively movable members are gear teeth or separately mounted fingers. It is equally

immaterial whether the parts which move at differing angular velocities are gear wheels intermeshed the one with the other, or whether one is a driving and the other is a driven part, or whether they are both driving or driven. It is also immaterial in the broad scope of my invention, and as above indicated, whether the relatively movable members operate to open, close or control an electric circuit, or to effect the actuation of a valve or other controlling means, or whether one or another form, construction or arrangement of contacts to be operated is employed.

As illustrative of the broad scope of my invention I have shown various forms, constructions and arrangements, in addition to the form shown in Figs 1 and 2, and above described. Thus, in Fig. 3, I have shown as one form of embodiment of my invention two gears 30, 31, intermeshing with each other and constituting members which move at different angular peripheral speeds. The gear 30 is provided with a tooth 32, somewhat longer than the other teeth thereof, while gear 31, is provided with a space 33 between two adjacent teeth which is not as deep as the spaces between the other teeth. With this arrangement it will be seen that at a certain point in the operation of the gears, predetermined by the relative angular adjustment of the two gears, the tooth 32, will engage in the space 33, thereby causing a relative movement apart of the two gears, and this relative movement apart secures the desired arrest of the machinery, make or break of the circuit, operation of the valve, or other desired action above described.

In the arrangement shown in Fig. 4 the gears 34 and 35 correspond to the gears 9 and 17, above described with reference to Figs. 1 and 2. In this case, however, the interfering finger or part 36, is carried by the gear 34, while a rock lever 37, is pivoted upon an arm 38, carried by the hub 39, of gear 35. One end of lever 37, is arranged to form the interference with finger 36, at the predetermined point in the operation. The other end of said rock lever 37, carries a contact spring 40, which cooperates with a contact block 41, connected to one terminal 42, said spring being electrically connected in any convenient manner to the other circuit terminal 43. A spring 44, may serve to normally retain the lever 37 in position to hold the contact 40 away from block 41.

With the arrangement shown in Fig. 4, employed in place of the arrangement shown in Figs. 1 and 2, the circuit through the limit stop mechanism may be traced as follows,—referring to the diagram Fig. 11, hereinafter to be more fully described, from positive contact to wire *a*, wire *n*, terminal 43, to spring 40, contact 41, terminal 42,

wire *m*, solenoid L, wire *k*, wire *f*, contacts H, J, wire *h* to the negative wire *j*, and negative contact.

In Fig. 5, I have shown the gears 45, 46, as carrying insulated sleeves 47, 48, respectively, upon which operate brushes 49, 50, constituting, in this instance the circuit terminals. The sleeves 47, 48, respectively carry circuit contacts 51, 52, which at the desired predetermined point in the operation are brought into contact with each other, thereby closing the circuit between the brushes 49, 50.

In Fig. 6, I have shown the gear structure shown elementally in Fig. 3, as applied to the operation of closing and opening contacts 53, 54, the gear 31, being carried by a swinging support 55, and yieldingly held in meshing relation with gear 30, by means of a spring 56.

In Fig. 7, I have an arrangement embodying the gear constructions of Figs. 3 and 6, as applied to the operation of a valve. In this case the support 57, for gear 31, is provided with a hooked end 58, arranged to engage and form a detent for a hook 59, to form a support for a valve 60. When the hook 59 is disengaged by the relative movement of the gears 31, 30, the one away from the other, thereby carrying the hooked end 58 of support 57, away from detent 59, the valve is free to move. This may be a movement to open or to closed position as may be desired.

In Fig. 8, I have shown an arrangement similar to that shown in Fig. 4, except that in this case the contact 60, is not carried by the end of a lever 37, but is engaged by said end when the lever is rocked through the interference at its other end with, or engagement by, the part 36, and thereby forced into contact with the contact 61.

In Fig. 9, I have shown another arrangement wherein the hub 62, of one of the gears 63, 64, has mounted thereon two sleeves or rings 65, 66, insulated from each other and from the hub, with brushes 67, 68, respectively bearing thereon to constitute the circuit terminals. One of these sleeves has connected thereto a contact spring, 69, which is adapted to be brought into contact with the other sleeve 65 by the relative endwise movement of the part 71, due to the interference therewith of part 70.

In Fig. 10, I have shown both the gears 72, 73, as driven gears, each carrying a finger or part 74, 75, to form the interference or contact.

It is obvious that many other specific arrangements and embodiments may be provided which will equally well fall within the spirit and scope of my invention.

In Fig. 11, I have shown a circuit diagram arrangement of the apparatus, suitable for use in connection with the circuit

controlling mechanisms above described. The box 3, contains the limit stop mechanism, and into this box the circuit is led through the terminals 22, 23. In this diagram, A, designates the motor, B, the main control lever, C, D, E, and F, contact strips controlled by the lever B; G, a switch lever controlling the main circuit between the points H, and J. K, is a latch for holding the switch lever G, in position to close the circuit between the points J, and H, L, is a solenoid for controlling the latch K. The positive supply circuit wire *a*, is connected to contact strip F, thence, through the bridging contact 85, to contact E, thence through wire *b*, the armature of motor A, wire *c*, to contact D, bridging contact 86, to contacts C, the wire *e*, the field coil M, of the motor A, wire *f*, to the point *g*, thence continuing to contact H, through switch G, to contact J, when said switch is closed, which is the position thereof as shown, and thence through wire *h*, to the return or negative wire *j*. The other branch of the circuit is in parallel to the motor circuit and may be traced as follows:—from the positive contact to wire *a*, wire *n*, terminal 22, through the limit stop mechanism to terminal 23, through wire *m*, solenoid L, wire *k*, to point *g*, and thence on through contacts H and J, wire *h*, wire *j*, to the negative contact. Under normal conditions this branch parallel circuit through the limit stop mechanism is broken, but when it is closed within the box 3, through the operation of the mechanism as above described, the circuit of solenoid L is completed thereby releasing the lock K, and causing the main circuit to be broken between the contacts H, J. Under normal conditions, when no current is flowing through the branch circuit referred to, the latch K, occupies a position to retain switch lever G, in position to close the circuit between the points H, J. The latch K, is connected to the core of the solenoid L, so that when the circuit of said solenoid is completed, the latch K, is moved to release the switch lever G, thereby permitting said switch lever, through the action of a retracting spring P, or otherwise, as may be convenient, to break the circuit between the points H, J.

From the foregoing description it will be seen that the limit stop mechanism cooperates with the switch in such manner that when the limit stop operates, it controls the operation of the switch to automatically operate the latter, or permit it to be operated, to open the motor circuit and arrest the motor.

While I have shown one arrangement of circuit connections for effecting the cooperative action of the circuit breaker and the switch, it is obvious that other arrangements and relations of circuit connections

may be employed for accomplishing the same results without departure from the scope of my invention as defined in the claims, the essential feature being that the motor is controlled by the automatic limit stop mechanism, said limit stop mechanism being controlled automatically by the action or operation of the mechanism driven from or by the motor.

It will be observed that I employ relatively movable engaging devices, adapted to be moved relatively to each other by being brought into interfering or engaging relation with respect to each other, but that this relation is established only at the desired point in the operation of the apparatus which the limit stop mechanism is designed to control, where the relative movement of said parts effects the arrest of such operation, while at the same time, injury to the mechanism, by reason of the continued operation of the apparatus, is avoided.

It will be seen from the foregoing description that I provide a construction and arrangement which permits of exact adjustment of the point at which the operation of the hoisting mechanism or other apparatus is to be arrested, while at the same time the construction is such that the limit stop permits long distances of travel, to which the apparatus may be adjusted, or high speeds of operation of such apparatus, and gives a quick action when the stopping point of operation is reached.

Having now set forth the object and nature of my invention, and a construction embodying the principles thereof, and having explained such construction, its purpose, function and mode of operation, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent is:

1. A safety or limit stop mechanism, including members mounted to move at unequal angular speeds and having associated therewith relatively interfering parts, one of said parts being movably mounted whereby at predetermined points said parts engage each other to effect a relative movement thereof.

2. A safety or limit stop mechanism including members mounted to rotate with reference to each other, and having associated therewith interfering parts mounted to move the one away from the other when they interfere.

3. A safety or limit stop mechanism including members mounted for relative rotative movement, and having interfering parts associated therewith, one of said parts mounted to move away from the other when they interfere.

4. In a safety or limit stop mechanism: two adjacent members mounted to rotate at unequal angular velocities, an abutting part

carried by each of said members, one of said parts mounted for movement away from the other when said parts abut, and contacts controlled by such movement.

5. In a limit stop mechanism, the combination with separable contacts, of periodically interfering, relatively movable members, one of said members being driven from the apparatus to be controlled by said stop mechanism, said relatively movable members being mounted for relative adjustment.

6. A limit stop mechanism including rotating members carrying parts arranged to be brought into engaging relation with respect to each other at predetermined points, one of said members being mounted for movement away from the other under the influence of such engagement.

7. A limit stop mechanism including gears mounted for movement toward and from each other, means for driving one of said gears, and means operated by the rotation of said gears for moving the same toward and from each other.

8. A limit stop mechanism including gears, means for driving one of said gears, and engaging fingers carried by said gears, one of said gears being mounted for movement toward and from the other, the engagement of said fingers effecting such relative movement of the gears.

9. A limit stop mechanism, including intermeshing gears mounted for movement toward and from each other, one of said gears having a hunting tooth, and parts connected to said gears for engagement with each other, and operating, when brought into engagement with each other to move said gears away from each other.

10. In a limit stop mechanism the combination with separable contacts, of a movable member carrying one of said contacts and an engaging part mounted upon the said movable member for movement thereon, a member having a cooperating engaging part, whereby, when said engaging parts are brought into contact with each other, said movable member is operated to relatively move said contacts.

11. A limit stop mechanism including a movable member, a gear mounted to rotate upon said movable member, and carrying an engaging finger, and a driving gear carrying a cooperating engaging finger.

12. A limit stop mechanism including a movable member, a gear mounted to rotate upon said movable member and carrying a contact finger, a driving gear carrying a cooperating driving finger, and means for relatively adjusting said engaging fingers.

13. A limit stop mechanism including a yielding member, a gear carried thereby and provided with an engaging finger, a second gear having a cooperating engaging finger, one of said gears having a hunting tooth.

14. A limit stop mechanism including a yoke, a stud carried by said yoke, a gear mounted upon said stud to revolve thereon, and having an associated engaging finger, and a driving gear meshing with said first mentioned gear, said driving gear having a cooperating engaging finger, and means for yieldingly maintaining said gears in mesh with each other.
15. In a limit stop mechanism, a drive shaft and means for driving same, a gear mounted thereon, and having associated therewith an engaging finger, a movable member carrying a stud, a cooperating gear mounted thereon and meshing with, and driven by said driving gear, and an engaging finger associated with said cooperating gear, and cooperating with the engaging finger of the driving gear.
16. A limit stop mechanism including intermeshed gears mounted for movement toward and away from each other, means for driving one of said gears, and means respectively connected to said gears, and adapted to engage with each other, to move said gears away from each other.
17. In a limit stop mechanism, the combination with separable contacts, of means for operating the same, including rotative parts, carrying engaging fingers adapted, when brought into engagement with each other to separate said rotating parts.
18. In a limit stop mechanism, a casing, separable contacts mounted therein, a rocking part carrying one of said contacts, a stud carried by said rocking part, a gear mounted upon said stud to rotate thereon, an engaging finger associated with said gear, a drive shaft extending into said casing, a gear mounted thereon and having a cooperating engaging finger associating therewith, the engagement of said fingers with each other operating to separate said gears, means for rotatively adjusting one of said engaging fingers, and means for yieldingly maintaining said gears in mesh with each other.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 4th day of June, A. D. 1909.

CHARLES W. SPEAR.

Witnesses:

T. C. AKIN,  
W. B. LAKEY,  
P. J. KNIPERS.