No. 868,604. PATENTED OCT. 15, 1907.

C. E. GLESSNER.

SPEED REGULATOR.

APPLICATION FILED JULY 9, 1906.

5 SHEETS—SHEET 1.

Fig. 1.

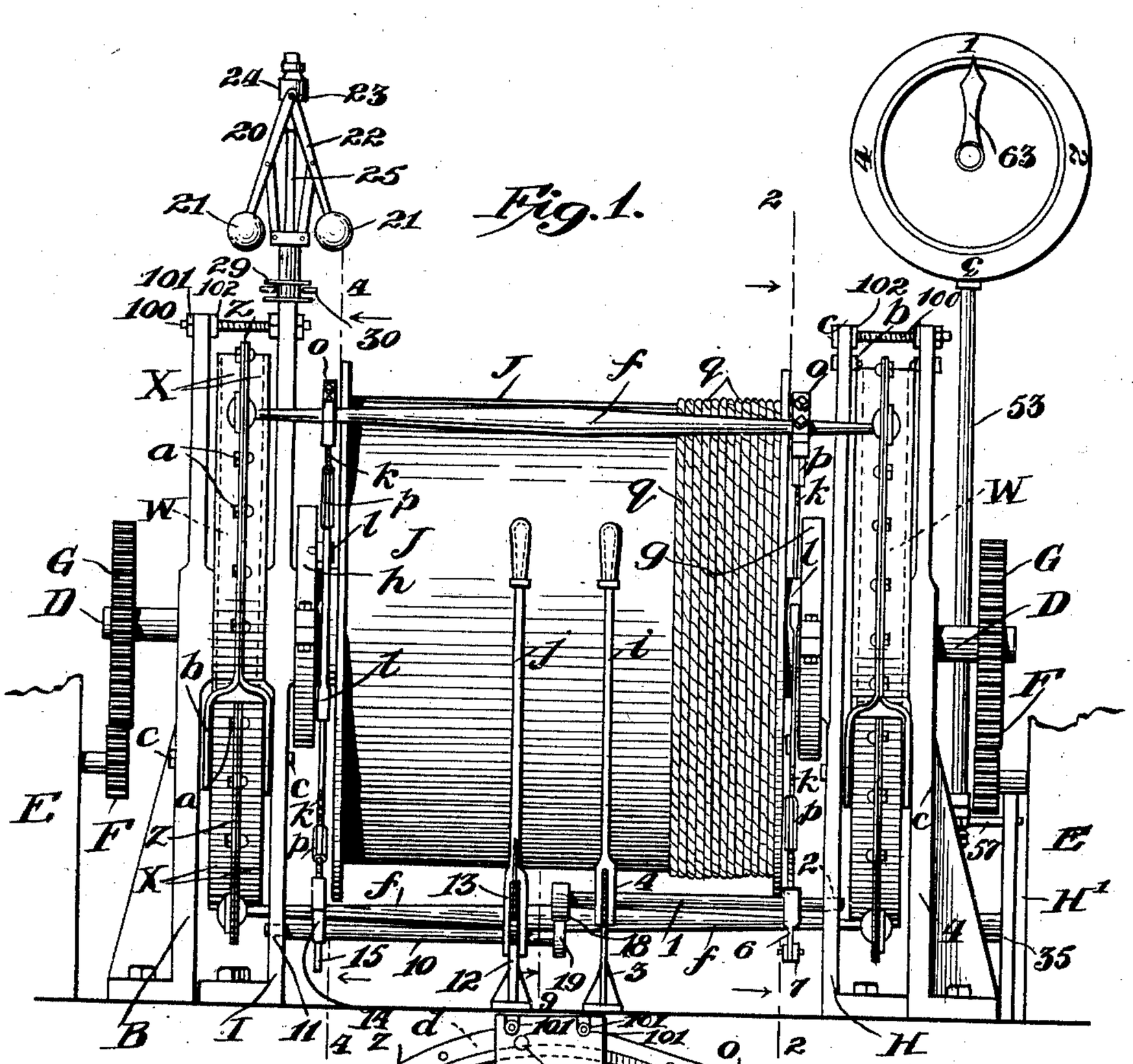
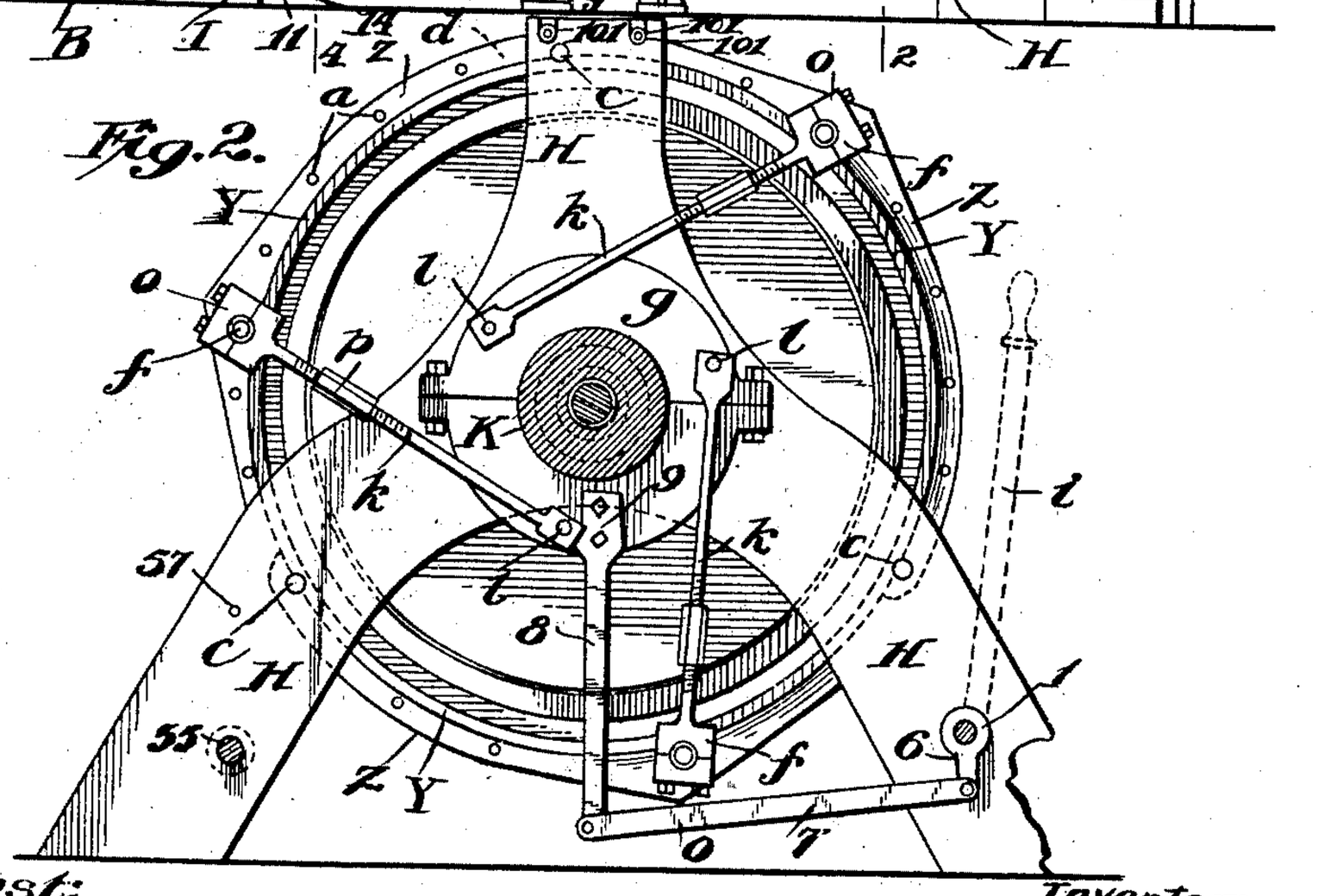


Fig. 2.



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5 SHEETS—SHEET 2.

Fig. 3.

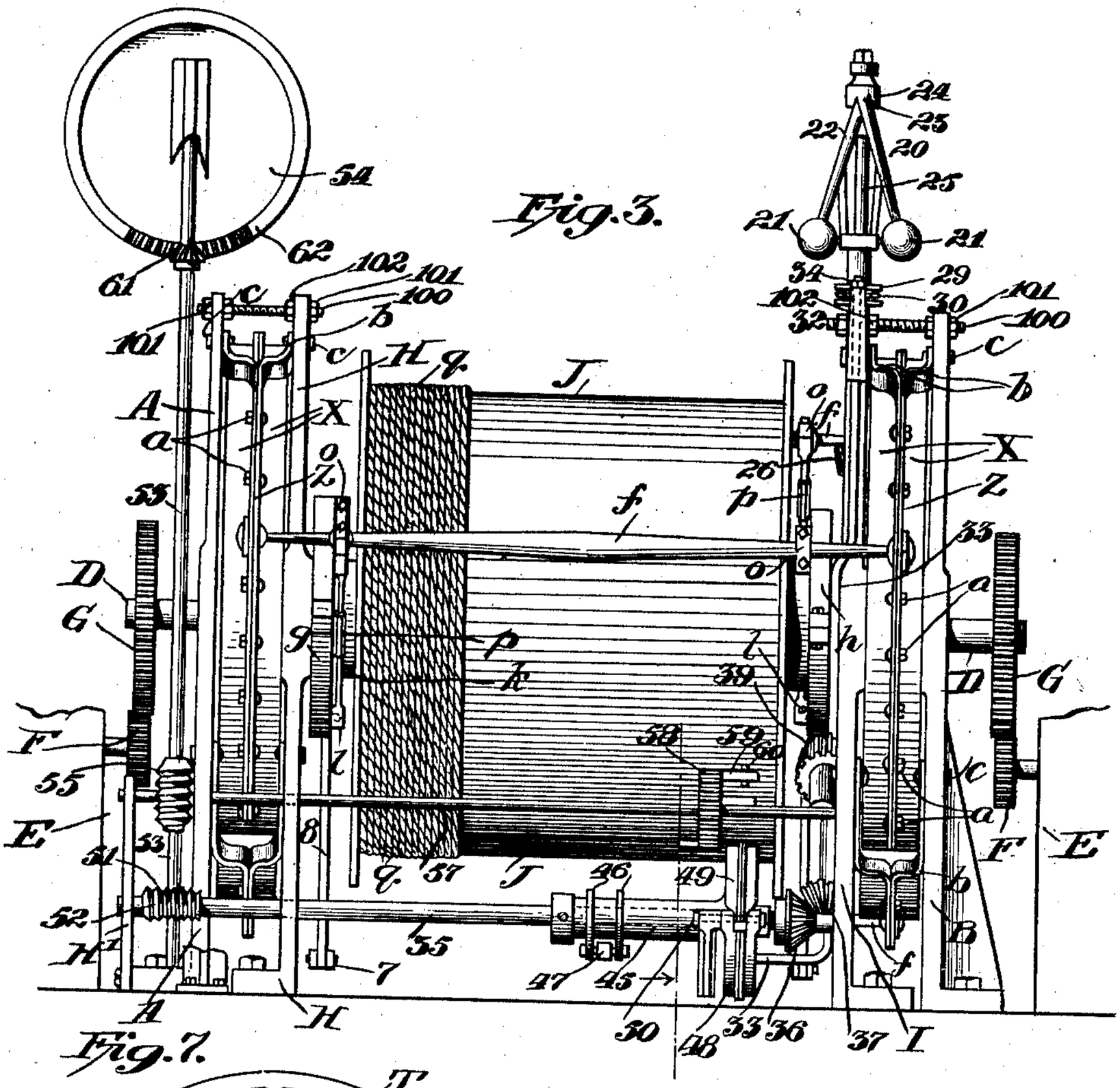


Fig. 7.

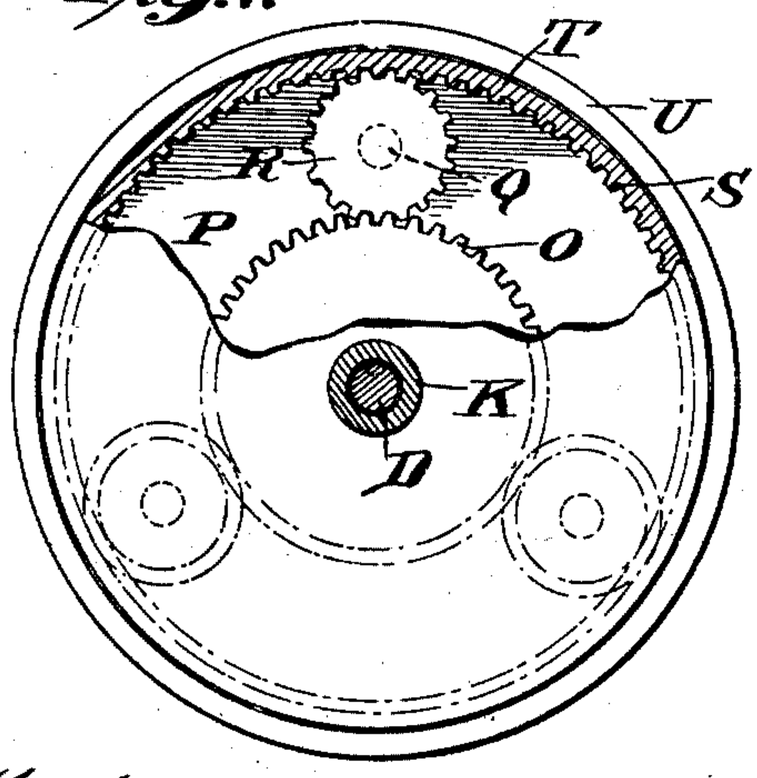
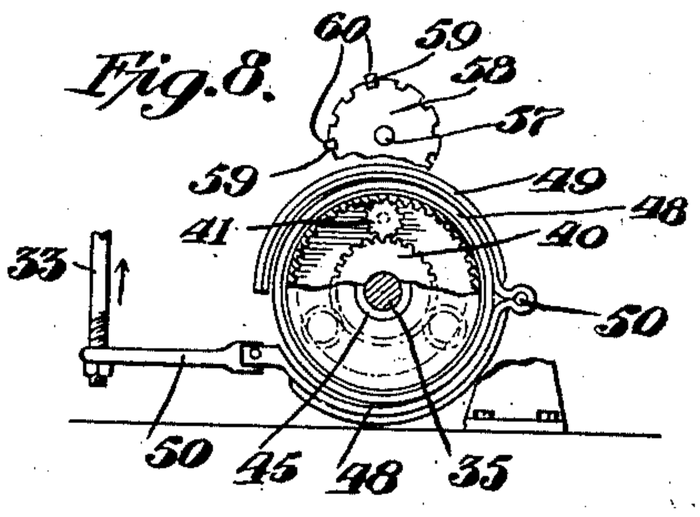


Fig. 8.



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5 SHEETS—SHEET 3.

Fig. 4.

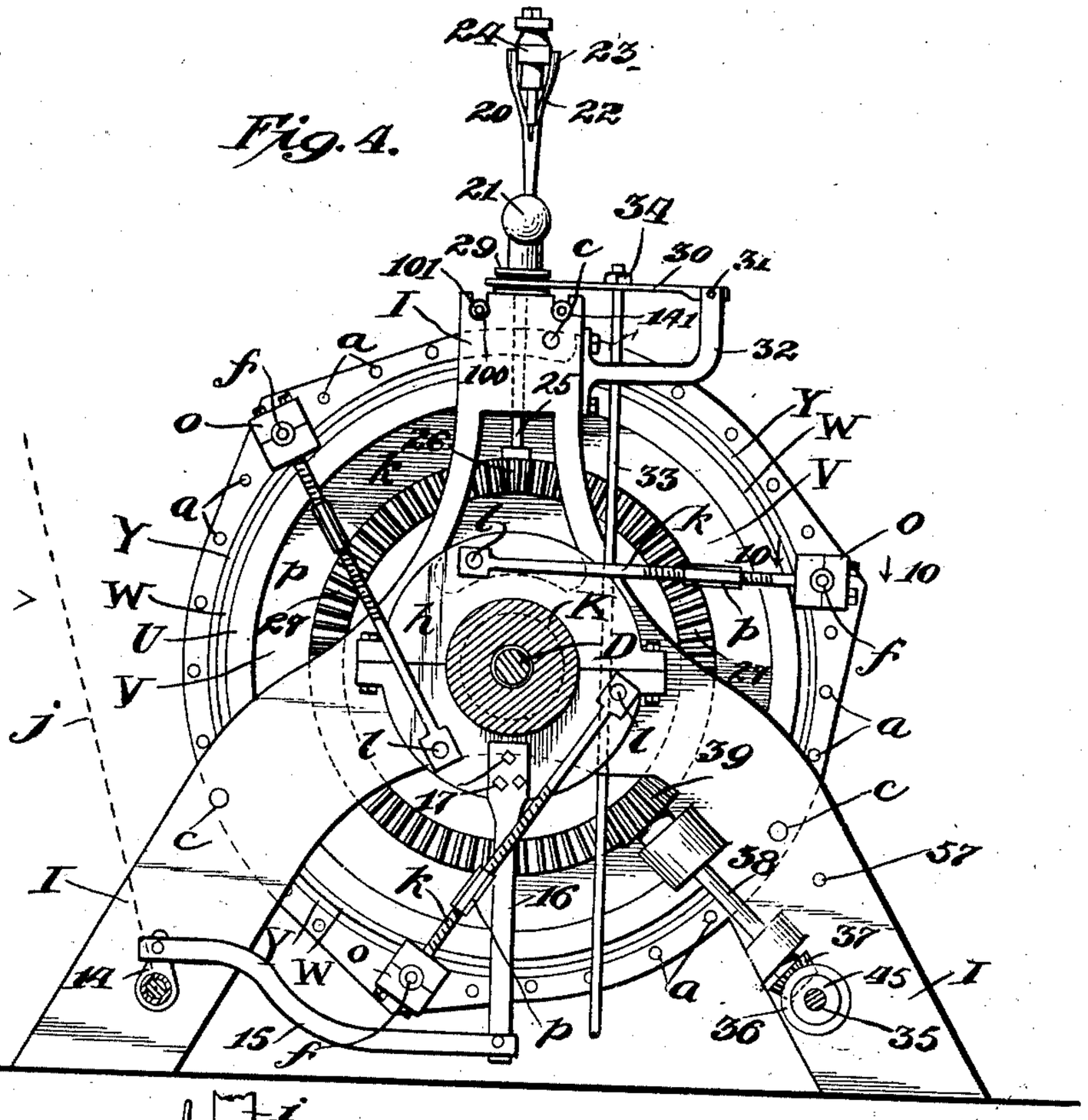


Fig. 9.

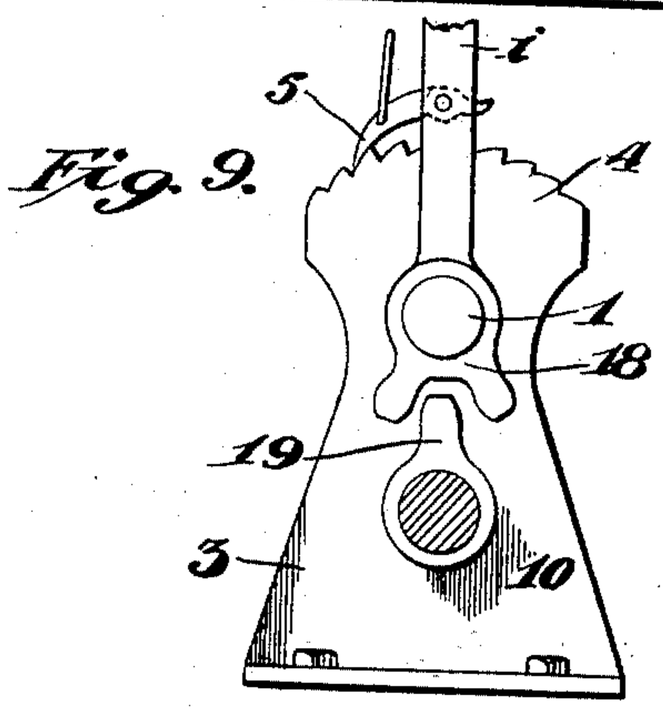


Fig. 10.

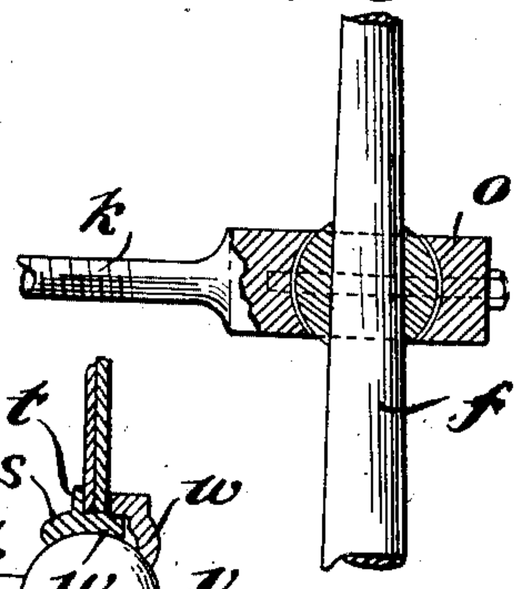
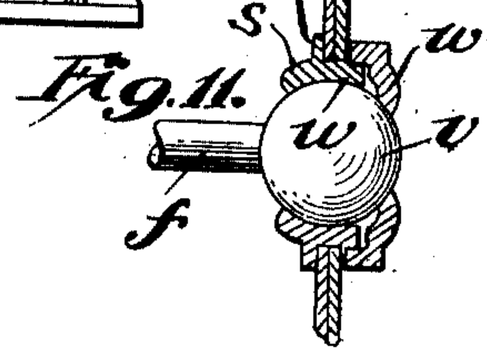


Fig. 11.



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No. 868,604. PATENTED OCT. 15, 1907.

C. E. GLESSNER.

SPEED REGULATOR.

APPLICATION FILED JULY 9, 1906.

5 SHEETS—SHEET 4.

Fig. 12.

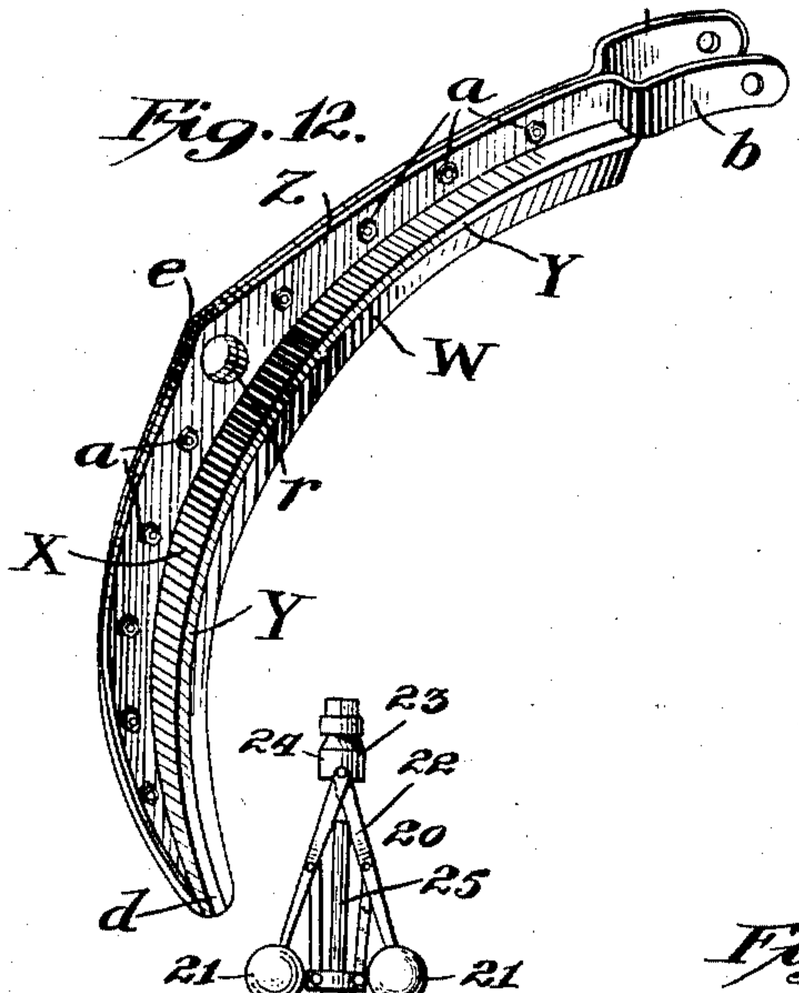


Fig. 13.

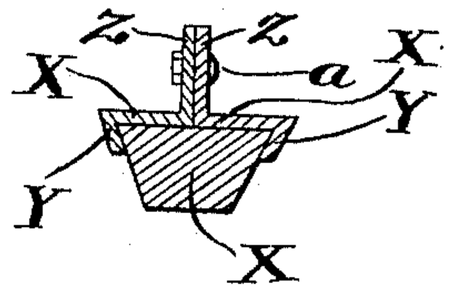
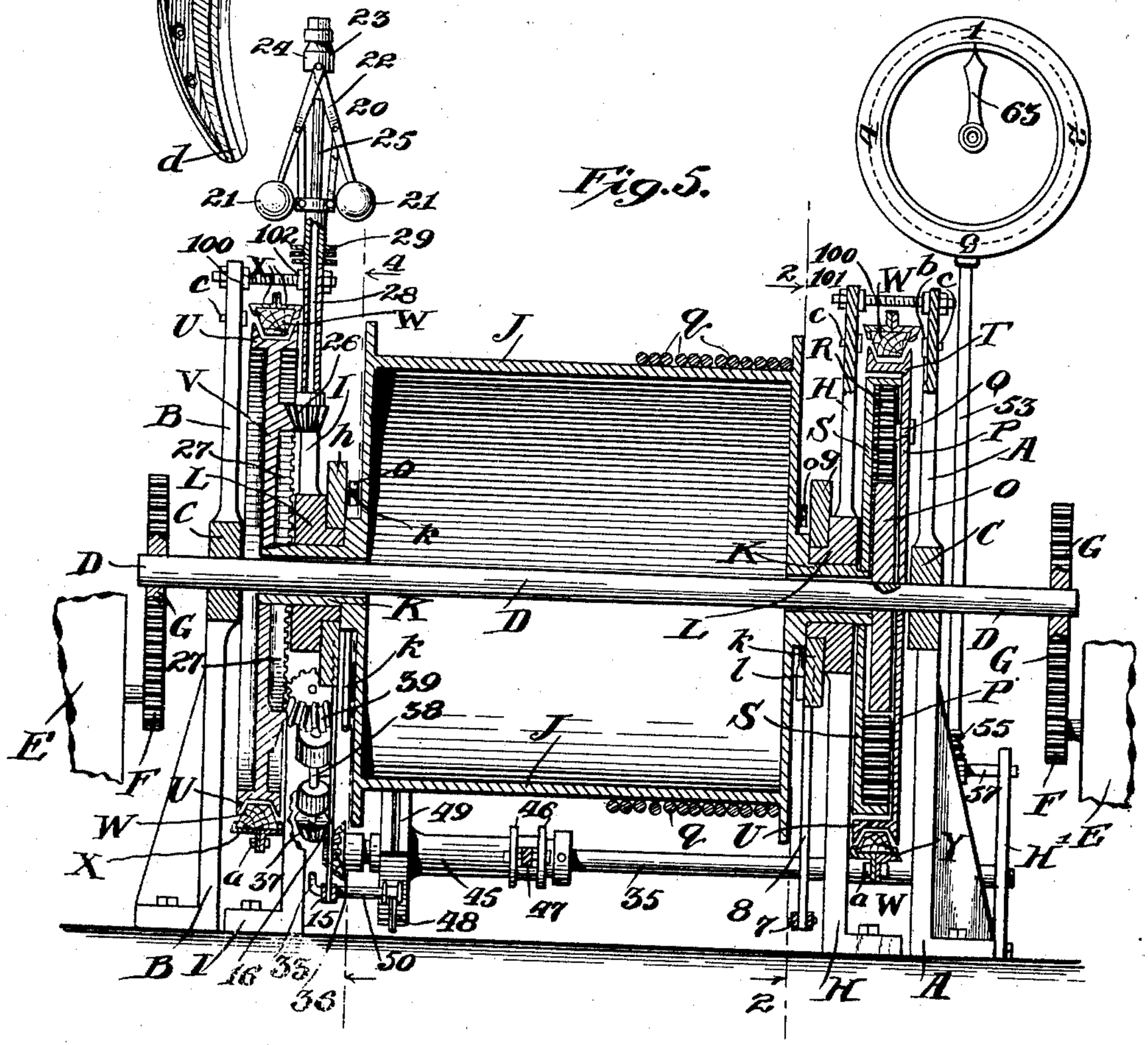


Fig. 5.



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C. E. GLESSNER.

SPEED REGULATOR.

APPLICATION FILED JULY 9, 1906.

5 SHEETS—SHEET 5.

Fig. 6.

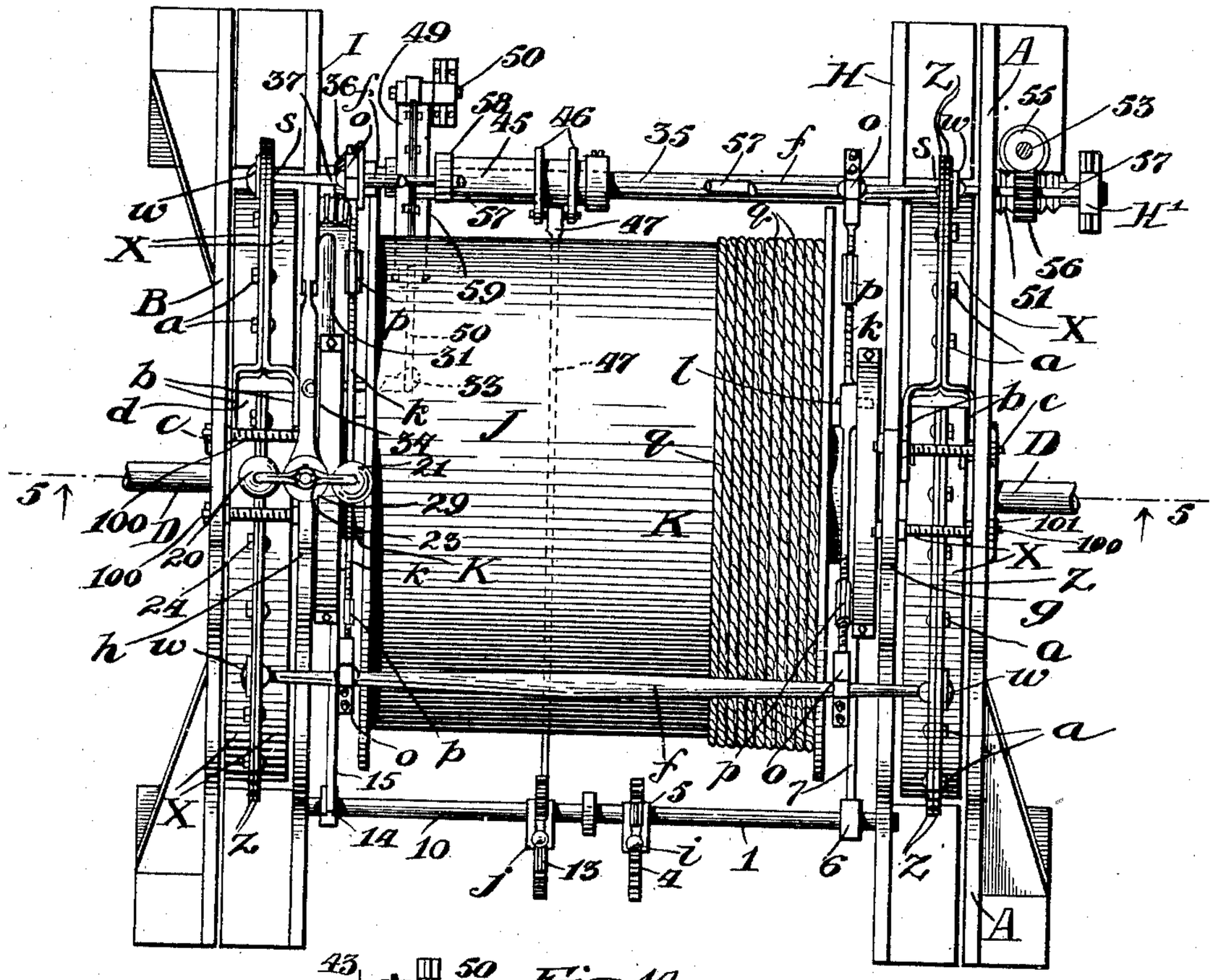


Fig. 14.

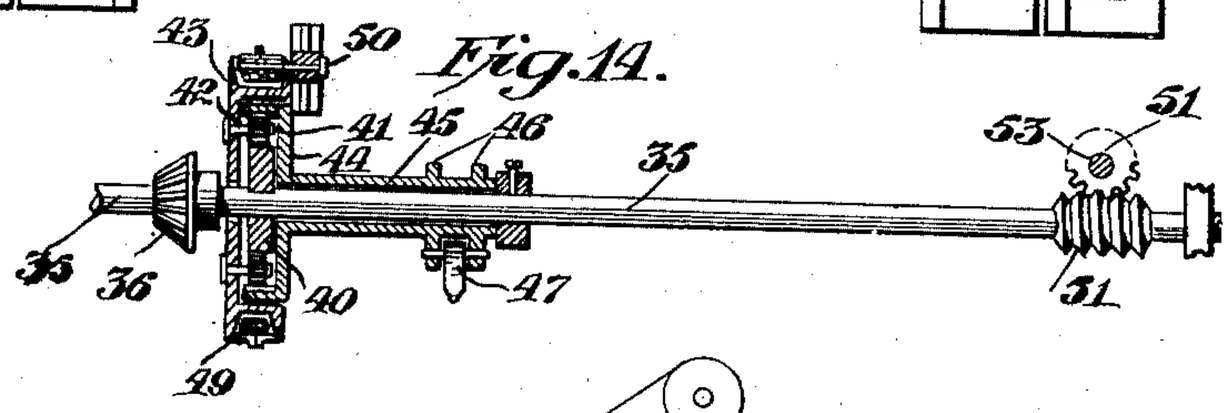
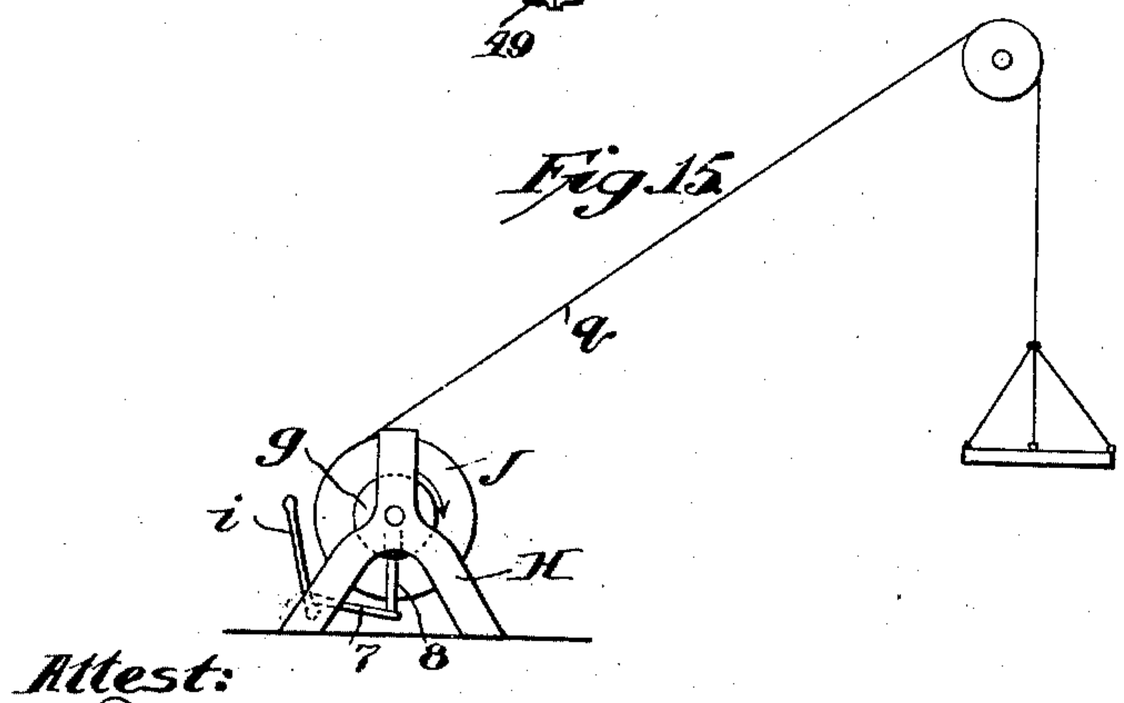


Fig. 15.



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UNITED STATES PATENT OFFICE.

CHARLES E. GLESSNER, OF OURAY, COLORADO, ASSIGNOR OF ONE-HALF TO COOPER ANDERSON, OF TELLURIDE, COLORADO.

SPEED-REGULATOR.

No. 868,604. Specification of Letters Patent. Patented Oct. 15, 1907.

Original application filed December 30, 1905, Serial No. 293,922. Divided and this application filed July 9, 1906. Serial No. 325,202.

To all whom it may concern:

Be it known that I, CHARLES E. GLESSNER, a citizen of the United States, and a resident of Ouray, county of Ouray, State of Colorado, have invented certain new and useful Improvements in Speed-Regulators, of which the following is a specification accompanied by drawings.

This application is a division of my co-pending application Serial No. 293,922, filed December 30, 1905, for an improvement in hoists, and the present invention relates to improvements in speed regulators for machinery of all classes to which the invention is applicable.

The objects of the invention are to improve upon the construction and operation of speed regulators for machinery and render the regulator more certain and efficient in operation.

The speed regulator has been shown in connection with the improved hoist disclosed in my co-pending application Serial No. 293,922, but I am not to be understood as limiting the invention to this apparatus, for the drawings are merely to illustrate one application of the invention, and many other uses will occur to those skilled in the art without departing from the spirit of my invention.

Further objects of the invention will hereinafter appear and to these ends the invention consists of apparatus for carrying out the above objects embodying the features of construction, combinations of elements and arrangement of parts having the general mode of operation substantially as hereinafter fully described and claimed in this specification and shown in the accompanying drawings, in which,—

Figure 1 is a front elevation of a hoist embodying the invention; Fig. 2 is a transverse sectional view on the line 2—2 of Fig. 1, looking in the direction of the arrows; Fig. 3 is a rear elevation of the machine; Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 1, looking in the direction of the arrows; Fig. 5 is a longitudinal sectional view of the machine on the line 5—5 of Fig. 6; Fig. 6 is a top plan view partly in section of the machine; Fig. 7 is a face view in section and partly broken away of the main transmission gearing of the machine; Fig. 8 is a view similar to Fig. 7 of the automatic braking apparatus and its gearing; Fig. 9 is an enlarged detail transverse sectional view on the line 9—9 of Fig. 1, looking in the direction of the arrows, showing the means for tying the two controlling levers together; Fig. 10 is an enlarged detail horizontal sectional view of one of the ball and socket joints on the line 10—10 of Fig. 4, looking in the direction of the arrows; Fig. 11 is an enlarged detail horizontal sectional view taken through one of the ball and socket joints which connect the brake shoes to their shafts; Fig. 12 is an enlarged detail perspective view of one of the brake shoes. Fig. 13 is a transverse enlarged sectional detail view of one of the brake shoes; Fig. 14 is a longitudinal sectional view through the small transmission gearing for the automatic speed controlling device; Fig. 15 is a diagrammatic view illustrating the relative positions of the hoist and load.

Referring to the drawings A and B represent frames provided with bearings C for the shaft D, which is connected to be driven from the source of power, in this instance represented by two constant speed induction motors E suitably geared to the shaft D by means of pinions F and gears G. Any suitable motors may be provided for operating the hoist, and any suitable gearing may be utilized for connecting the motors to the shaft D. Preferably two motors are used, as shown, one at each side of the hoist, as is customary in practice.

Arranged inside of the frames A and B are the frames H and I, which may be termed the main frames for supporting the hoisting drum J, in this instance shown hollow and provided with hollow trunnions K in the form of sleeves loose upon the shaft D and independent thereof, and turning loosely in bearings L in the frames H and I.

The hoisting drum J is connected to be driven from the shaft D by means of suitable transmission gearing, by means of which the speed of the drum may be controlled without changing the speed of the motors, and the load may be gradually applied in starting. In this instance I prefer to use a planetary system of gearing for connecting the hoisting drum to the shaft D, and as shown, there is a gear O suitably connected to the shaft D, as by means of a key, and loose on the shaft D is a disk P, to the periphery of which is adapted to be applied a brake or brakes so that said disk may be held from rotation or permitted to rotate at full speed, or permitted to slip under the brake shoes. Suitably pvioted to the rotatable disk P on studs Q are planetary pinions R, meshing with the gear O, and also meshing with the internally toothed gear S having the toothed rim T adapted to fit beneath the rim U of the brake disk P. The internally toothed gear S is fast upon the sleeve K of the hoisting drum J, being connected thereto in any suitable manner as by means of a key and thus rotates therewith. It is obvious that according to whether or not the brake disk P, carrying the pinions R, is held from rotation or permitted to rotate at varying speeds, the power will be transmitted from the shaft D to the drum J and said drum may be operated at varying speeds according to the amount of slip permitted for the disk P.

Suitable means are provided for braking the disk P of the planetary gearing, and means are also provided for applying a brake to the drum J, as by means of the

brake disk V connected to rotate with the sleeve or hollow trunnion K of the drum J in order to stop the drum in any desired position by means of said brake, although as will hereinafter appear the load or cage connected to the cable may be stopped in any desired position by permitting the slip on the disk P to compensate for the power applied. From this point the speed of the drum J may be varied as desired up to full speed.

Both disks P and V are provided with grooved peripheries U and the brake shoes are adapted to conform to said peripheries, by means of such construction the disks P and V are centered or maintained in one plane when the brakes are applied. It is more important that the disk P should be centered and prevented from getting out of alinement, since in this instance the brake shoe is not applied over the center of the disk as in the case of the brake disk V, but I preferably make the peripheries of both disks alike and construct the shoes substantially alike. The disk V, as stated, is keyed directly to the sleeve K on the drum, while the disk P on the other hand is loose on the shaft D, and for this reason the means for centering the disk add greatly to the efficiency of the machine. The grooved disk V, since it is part of the drum, aids in centering the disk P.

The brake shoes may be constructed in any suitable manner, but I prefer to construct them substantially as shown in detail in Fig. 12, in which W represents a wooden shoe gripped between steel angle irons X having inwardly projecting flanges Y for gripping the shoe W. The upright legs Z of the angle irons are suitably connected together as by means of bolts *a*, and means are provided for pivoting said angle irons carrying the shoes W around the periphery of the brake disks P and V, and operating means are provided for tightening and loosening said brake shoes upon the periphery of said disks. In this instance the upright legs Z of the angle irons X are bent outwardly at the heel of each shoe to form lugs or ears *b* which are pivoted on the pins *c* between the frames A H and B I around the periphery of the disks P and V. According to this construction the disks are maintained in one plane and substantially the whole of the strain comes upon the frames and the operating levers are relieved of a large part of the strain. I preferably provide three brake shoes for each brake disk, although any suitable number may be provided in any suitable arrangement, but I have found three brake shoes in the arrangement described to operate satisfactorily. The angle frames X of the brake shoes are pivoted at suitable intervals around the disks on the frames of the machine, and the shoes are of sufficient length to substantially cover the entire periphery of the brake disks. The toe *d* of each shoe preferably extends between the forked portion of the angle irons between the ears *b* of the shoe immediately in front. Preferably the webs or vertical legs Z of the shoe angle irons are thickened at their middle portions *e* and provided with bearings for the brake beams *f* connecting the shoes, of which there are three extending longitudinally of the hoist. Suitable means are provided for operating the brake shoes and in this instance disks *g* and *h* are provided adjacent each drum head and seated in bearings on frames H and I respectively in such manner that said disks may be rotated slightly in their bearings. These disks are connected in this instance to be rotated by the hand levers *i* and *j* although any suitable means may be provided for operating the brakes, and the disks *g* and *h* are pivotally connected by levers *k* to the brake beams *f* which extend longitudinally across the machine and are connected to the brake shoes.

One of the objects of this invention is to enable the power for applying the brakes to the disks P and V to be alternately compounded or not as desired. The machine is so constructed that by properly manipulating the hand levers *i* and *j*, the thrust or leverage may be all applied to one brake or the other as desired, and by a system of compound leverage the brake pressure on one disk or the other may be greatly multiplied over that which might be applied by one lever only.

The levers *k* for the brake shoes on the periphery of the brake disk P are pivoted at the point *l* to the disk *g*, and are pivoted by means of any suitable form of ball and socket joints *o* to the brake beams *f*. The levers *k* are preferably provided with turn buckles *p* in order to make their length adjustable. The levers *k* connected to the disk *h* at the other side of the drum are constructed in the same manner and connected to the brake beams by ball and socket joints *o*. The brake shoes for each brake disk P and V are pivoted on the frames of the machine at the points *c* and the shoes extend around the peripheries of the disks from their pivotal points in the proper direction to apply the brake pressure in the most advantageous manner according to the direction of the rotation of the disk to which pressure is applied. The brakes for the disk P extend in the direction of rotation of said disk when power is being applied to the drum J to raise the load and the brakes for the disk V preferably extend in the direction of rotation of the drum when the cable *q* is unwinding and lowering the load. In the drawings the brake shoes W are shown extending in the same direction and this is correct because the direction of rotation of the disk P when power is applied to the drum is the same as the direction of the rotation V when the drum is reversed and the cable is unwinding.

Any suitable form of ball and socket joint may be provided for connecting the ends of the brake beams *f* to the angle irons forming the body portions of the brake shoes. In this instance, the thickened portions *e* of the webs of the angle irons for the shoes are provided with hollowed sockets *r*, into which fit split sleeves *s*, provided with bearing flanges *t* and having screw threaded portions *u*. The ball heads *v* of the brake beams *f* are placed in the sleeves *s* and internally screw-threaded caps *w* are screwed over the ends *u* of the split sleeves *s*, thereby securing the balls *u* in their bearings.

The operating lever *i* is fast to the shaft 1, which is suitably rotatably supported in a bearing 2 in the main frame H and in a bracket 3. In this instance, the lever *i* is forked and straddles a toothed segment 4, and the lever is provided with a spring pressed pawl 5 adapted to coöperate with the teeth on the segment 4. As shown, the outer end of the shaft 1 is provided with a downwardly extending arm 6 fast thereto, to which is pivotally connected one end of a link 7, the other end of said link being pivotally connected to an arm, in turn connected to the lever *g* as by means of the bolts 9 so that the arm 8 turns with the lever *g*. By

operating the hand lever *i* the disk *g* may be rotated. I am not to be understood as limiting myself to the connection shown and described for operating the disk *g* because any suitable form of mechanism may be provided. By pressing the lever *i* inward it will be seen that the disk *g* will be rotated in a direction to tighten the brake shoes upon the periphery of the disk P, and by pulling the brake lever outward, the brake shoes on the lever P will be loosened.

Suitable mechanism is provided for operating the brake shoes on the disk V. As shown, the hand lever *j* is connected to a longitudinally extending shaft 10 supported in the bearing 11 in the frame I and in the bracket 12. As shown, the lever *j* straddles the toothed segment 13, the teeth of which extend in the opposite direction to the teeth on the segment 4, and a spring-pressed pawl connected to the lever *j* coöperates with said teeth. The shaft 10 is provided with an upwardly extending arm 14, in this instance at its outer end, having one end of a link 15 pivotally connected thereto, the other end of said link being pivotally connected to an arm 16 connected to the disk *h* by suitable means, as the bolts 17, so that the disk and arm 16 move together. By pulling the hand lever *j* outward the disk *h* will be rotated in a direction to loosen the brakes upon the disk V, and by pushing the arm *j* inward, the brakes will be tightened on said disk.

Preferably the two shafts 1 and 10 are tied together with a lost motion connection in such manner that when the lever arm *i* is pressed inward to tighten the brakes on the disk P, the lost motion may be taken up and the connecting tie or coupling brought into action to force the arm *j* outward, thereby loosening the brakes on the other disk V. On the other hand by forcing the lever *j* inward the brakes for the disk V are applied and the lost motion connection between the shafts 1 and 10 may be taken up, thereby forcing the arm I outward and loosening the brakes on the other disk P. Any suitable lost motion connection may be provided for the shafts 1 and 10, in this instance, the shaft 1 being provided with a fork 18 and the shaft 10 with a coöperating lug or ear 19 which enters the fork 18 and has a certain play therein. According to this construction, rotation of one shaft will cause rotation of the other shaft in an opposite direction. I am not to be understood as limiting myself to this construction because any suitable means may be used for accomplishing this same end.

In order to compound the leverage for the brakes and increase the pressure on one disk P or the other one V, the levers *i* and *j* must be operated in different directions. If, for instance, the lever *i* is pressed inward to apply the brakes to the disk P, the other lever *j* may be pulled outward, thereby loosening the brakes on the disk V, and at the same time forcing the ends of the brake beams *f* at that side of the drum outwardly, with the ball and socket joints *o* at the opposite ends of the brake beams as pivotal points, thus forcing the brake shoes on the disk P more strongly against the disk. If the operation of the levers *i* and *j* is reversed, the leverage may be compounded to apply the pressure more strongly to the brake disk V. When the lever *j* is pulled outward to apply the brakes to the disk V, if the lever *i* is forced inward at the same time, the ends of the brake beams *f* on the geared side of the drum will be forced outwardly about the ball and socket joints *o* at the other ends of the brake beams as pivotal points, thus increasing the leverage on the brake shoes for the disk V. It is important to hold the disk P very firmly, especially under heavy loads and it is also important to hold the drum very firmly in order to stop the cage at any desired point as in a mining hoist, for instance.

According to the construction of this machine, one brake is thrown off as the other is thrown on, although the slight lost motion between the operative parts permits the operator to apply the brake to a certain degree to the drum before the transmission gear is entirely released and vice versa. In this way a skilful operator may readily learn to control his hoist because he can tell by manipulating the lever arms *i* and *j* at just what point he is to release the transmission gear and apply the brake to the drum. In other words, he may feel his load either in ascending or descending, and still accidents due to carelessness are prevented because both brakes cannot be applied at the same time and the load could not drop. According to this construction, the load may be applied gradually to a motor rotating constantly at the same speed and the load on the other hand may be removed gradually therefrom. If the machine is being used for a mining hoist or elevator, power will be applied to raise the load and it will be permitted to fall of its own weight. According to this machine, sudden strains on the apparatus are entirely obviated and all the operations take place gradually. The operator at all times has the machine under complete control.

In accordance with this invention, my improved automatic controlling means are provided for limiting the travel at the top and bottom of the shaft and this automatic controlling means may be adjusted to stop the cage if in a hoist at any desired level. In case of an accident this automatic controlling means will stop the apparatus at one or the other limits of its travel, or in an intermediate point if it is adjusted for such a stop. I utilize in connection with this controlling means a transmission gear substantially like the planetary gearing for transmitting power to the drum and a governor for controlling the operation of said transmission means. The controlling transmission gearing is connected to operate the brakes on the disk V connected to the drum so that the drum is stopped automatically. Any suitable form of apparatus may be provided for carrying out this object, but I have shown in this instance a ball governor 20 having the balls 21 carried on arms 22 pivoted at 23 to a cap 24, which is held in frictional contact with the vertical shaft 25, said shaft being provided with a bevel pinion 26, meshing with the bevel gear 27 on the inside of the disk V. The balls are also connected to the sleeve 28. The sleeve 28 is provided with a collar 29, which coöperates with a forked rod 30 pivoted at 31 on a bracket 32 carried by a frame I. Forked arm 30 supports a vertical rod 33 having an adjusting nut 34 for adjusting the length of said rod. When the drum speeds up beyond a predetermined limit the rod 33 will be raised and set in operation the mechanism for applying the brakes to the disk V on the drum. Extending longitudinally along the back of the machine is a shaft 35 supported in suitable bearings in the frame I in the bracket H′. This shaft is provided with

a bevel gear 36 meshing with a bevel gear 37 carried on a shaft 38 provided with another bevel gear 39 meshing with the large bevel gear 27 on the disk V, so that rotation from the disk V is imparted to the shaft 35. This shaft 35 also carries a small planetary transmission gearing, having the gear 40 connected to rotate with the shaft as by means of a key and meshing with planetary pinions 41 carried on studs 42 connected to the grooved brake disk 43 loose on the shaft 35. Internally toothed gear 44 also meshes with the planetary pinions 41 and is connected to a sleeve 45 loose on the shaft 35 and provided with collars 46, to which is pivoted a transversely extending rod 47 so that the construction acts like a crank and crank pin. The rod 47 is connected to operate the hand lever *j* and in this instance is shown pivoted to said lever coöperating with the brake disk V. On the small transmission gearing are brake shoes 48 and 49, in this instance pivoted to each other at 50 and substantially encircling the grooved periphery of the brake disk 43, thus maintaining the same in one plane. As shown, the lower brake shoe 48 is connected by means of the link 50 to the lower end of the governor operated rod 33 so that when said rod is raised by the operation of the governor, the shoe 48 is applied to the periphery of the disk and the disk is partially prevented from rotating. The other end of the shaft 35 is provided with a worm gear 51 meshing with pinion 52 carried on the indicator rod 53, which extends up to the indicator 54 for indicating the levels or points at which the load or cage is to stop. The indicator shaft 53 is also provided with a worm 55 meshing with a pinion 56 carried by a longitudinal shaft 57 supported in suitable bearings in the frame I and bracket H′. Said shaft 57 is also provided with a small drum 58 provided with adjustable stops or fingers 59 having adjusting screws 60 adapted to bear upon the upper brake shoe 49 when one of said fingers comes opposite said brake shoe in the course of rotation of the shaft 57 and drum 58, thereby forcing said brake shoe against the periphery of the brake disk. I have described suitable shafting and gearing for operating the parts of the automatic controlling means, but I am not to be understood as limiting myself to the construction disclosed as any suitable means may be provided for this purpose.

In the operation of the governor controlled braking device the application of the lower brake shoe 48 to the periphery of the brake disk 43 causes rotation of the internal gear 44 and loose sleeve 45 on the shaft 35, thereby pulling the lever 47 transversely of the machine, rocking the hand lever *j*, thus applying the brakes to the disk V on the drum with a certain amount of pressure and partially retarding the rotation of the drum and keeping it within the speed limit. The rotation of the shaft 35 also causes rotation in the shaft 57 through the gearing described, thereby rotating the drum 58 and bringing one of the stops 59 into contact with the other brake shoe 49 and forcing said brake tightly against the periphery of the brake disk 43, thereby strongly applying the brakes thereto and holding said disk from rotation. The rod 47 connecting the sleeve 45 with the lever *j* is therefore drawn with maximum force against the lever *j*, thereby applying the brakes to the disk V with maximum pressure. At the same time the pawl on hand lever *j* locks said lever in its forward position and locks the drum from rotation. This locking of the drum will occur either at the top or bottom of the travel of the load or at any intermediate point according to which one of the stops 59 has been brought into operation. This automatic stopping means may be used as a safety limit only or adjusted for any desired position.

The indicator rod 53 is provided with a gear 61 meshing with a gear 62 on the indicator disk 54, and said disk is provided with a pointer 63 and the disk itself is marked off into suitable divisions to indicate the points at which the load is to be stopped. In this instance the pointer is shown stationary and the disk revolves but any suitable construction may be provided. Preferably the fingers or stops 59 are slidable in grooves in the periphery of the drum 58 so that they may be adjusted as desired.

In the operation of the apparatus, the motor or motors E are supposed to be continuously running at substantially constant speed. Let is be assumed that the load represented, as for instance by a loaded cage, has been stopped at a certain level by applying the brakes to the disk V connected to the drum, thereby preventing the drum from rotating. The brakes on the disk P of the transmission gearing have then been removed and rotation cannot be imparted to the drum from the shaft D. In order to lower the cage the brake pressure is gradually relieved on the drum disk V by pulling the hand lever *j* toward the operator away from the drum. In this case if the drum should speed up the governor 20 will come into operation and automatically apply the brakes in order to keep the speed within limits.

When the brake drum is held from rotation by the brakes on the disk V as described, if it is desired to raise the cage the hand lever *i* is forced away from the operator in the direction of the drum, thereby beginning to apply the power and after the power is applied the lost motion connection between the hand lever shafts comes into operation and begins to relieve the brake pressure from the drum disk V. The construction is such that the point at which power begins to be applied to the drum and the brake leverage is removed from the drum is automatically taken care of, but because of the lost motion between the connections this point is also within the control of the operator so that he can feel the point at which the load is supplied and govern the operation of the hoist accordingly.

A skilful operator will soon learn to operate the hand levers *i* and *j* in accordance with this construction back and forth feeling the load on his drum all the time, so that it can be readily told when more power should be applied or when the drum should be more greatly retarded.

The automatic controlling means for limiting the travel of the load or cage is applicable to various forms of apparatus. I have shown one application of it in the machine disclosed; but I am not to be understood as limiting the invention to this particular class of apparatus for it may be used in connection with the transmission of power wherever it is applicable, as for instance in connection with elevators, cranes, electric cars especially on grades, cog roads, tramways, and on many classes of mining machinery.

In order to stiffen the frame, the upper ends of the

frames A H, and B I are suitably tied together as by means of the bolts 100 having the nuts 101 and collars 102 for bracing the frames. These bolts are placed in slots in the upper ends of the frames.

I claim and desire to obtain by Letters Patent the following:

1. In automatic speed controlling apparatus, the combination of a part, the speed of which is to be controlled, a governor connected thereto, a frictionally controlled transmission gearing connected to be operated by said governor, means controlled by said transmission gear for regulating the speed of the part to be controlled, and safety means coöperating with said gearing for automatically stopping the movement of said part at the desired limits of its travel.

2. In automatic speed controlling apparatus, the combination of a part, the speed of which is to be controlled, a governor connected thereto, a frictionally controlled transmission gearing adapted to be thrown into operation by said governor, means controlled by said gearing for regulating the speed of the part to be controlled, and stop mechanism with said gearing for limiting the movement of said part at the desired points in its travel.

3. In automatic speed controlling apparatus, the combination of a part, the speed of which is to be controlled, a governor connected thereto, a frictionally controlled transmission gearing, means operated by the governor for applying frictional pressure to said gearing, automatic means for applying additional frictional pressure to said gearing, and operative connections from said gearing for regulating and stopping the movements of the part to be controlled.

4. In automatic speed controlling apparatus, the combination of a part, the speed of which is to be controlled, a frictionally controlled variable speed transmission gearing, brakes therefor, a governor connected to the part to be controlled and connected to apply one of said brakes, means connected to said gearing for regulating the speed of the part to be controlled, and automatic means for applying the other brake to the transmission gearing to limit the movement of the part to be controlled at the ends of its travel.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES E. GLESSNER.

Witnesses:
T. W. EMERSON,
C. A. ARMSTRONG.