

F. R. C. BOYD.
 EMERGENCY GOVERNING MECHANISM.
 APPLICATION FILED JUNE 3, 1909.

980,483.

Patented Jan. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

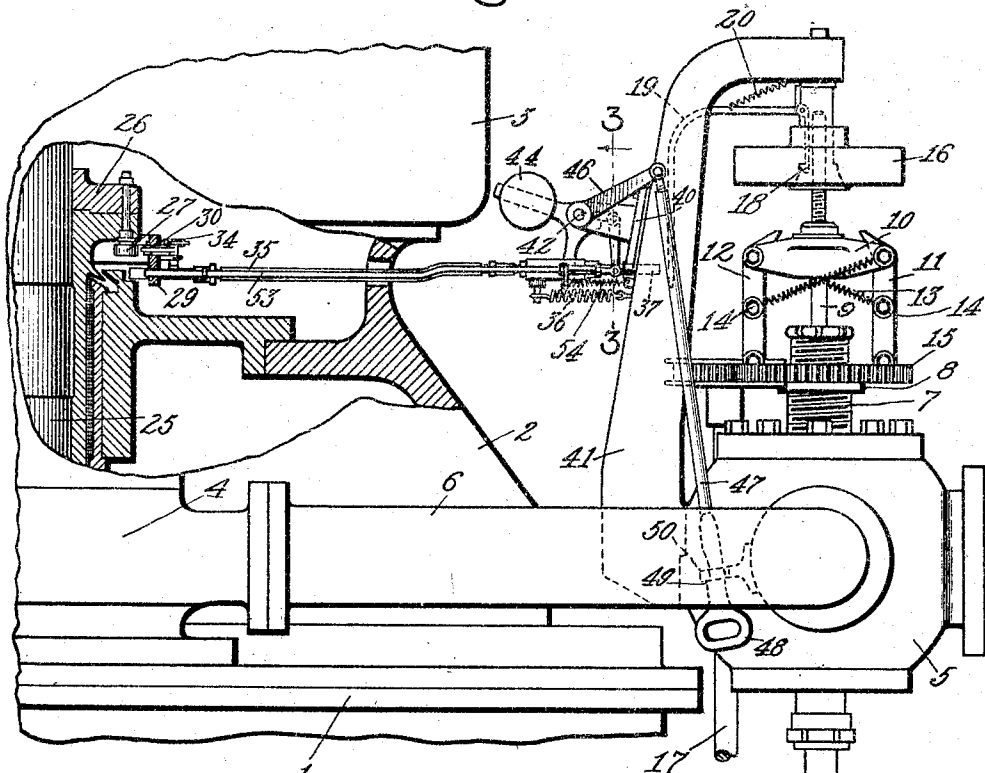


Fig. 2.

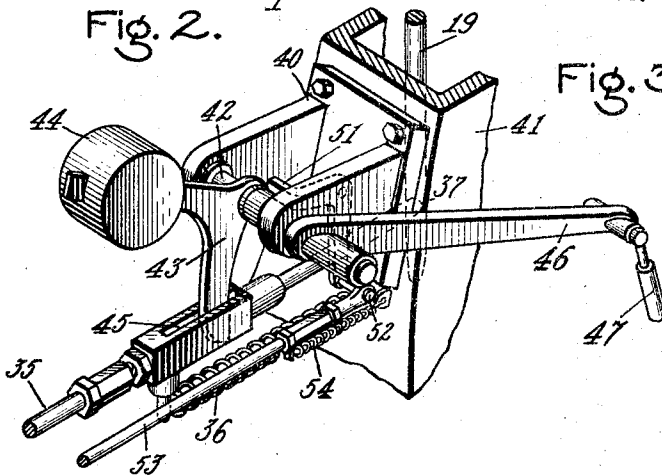
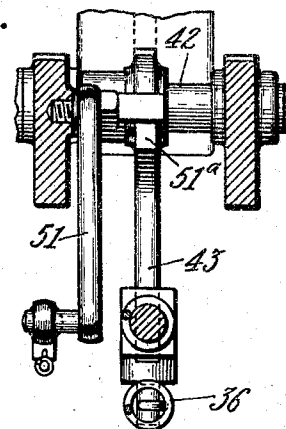


Fig. 3.



Witnesses:
J. Ellis Elen.
J. Earl Ryan

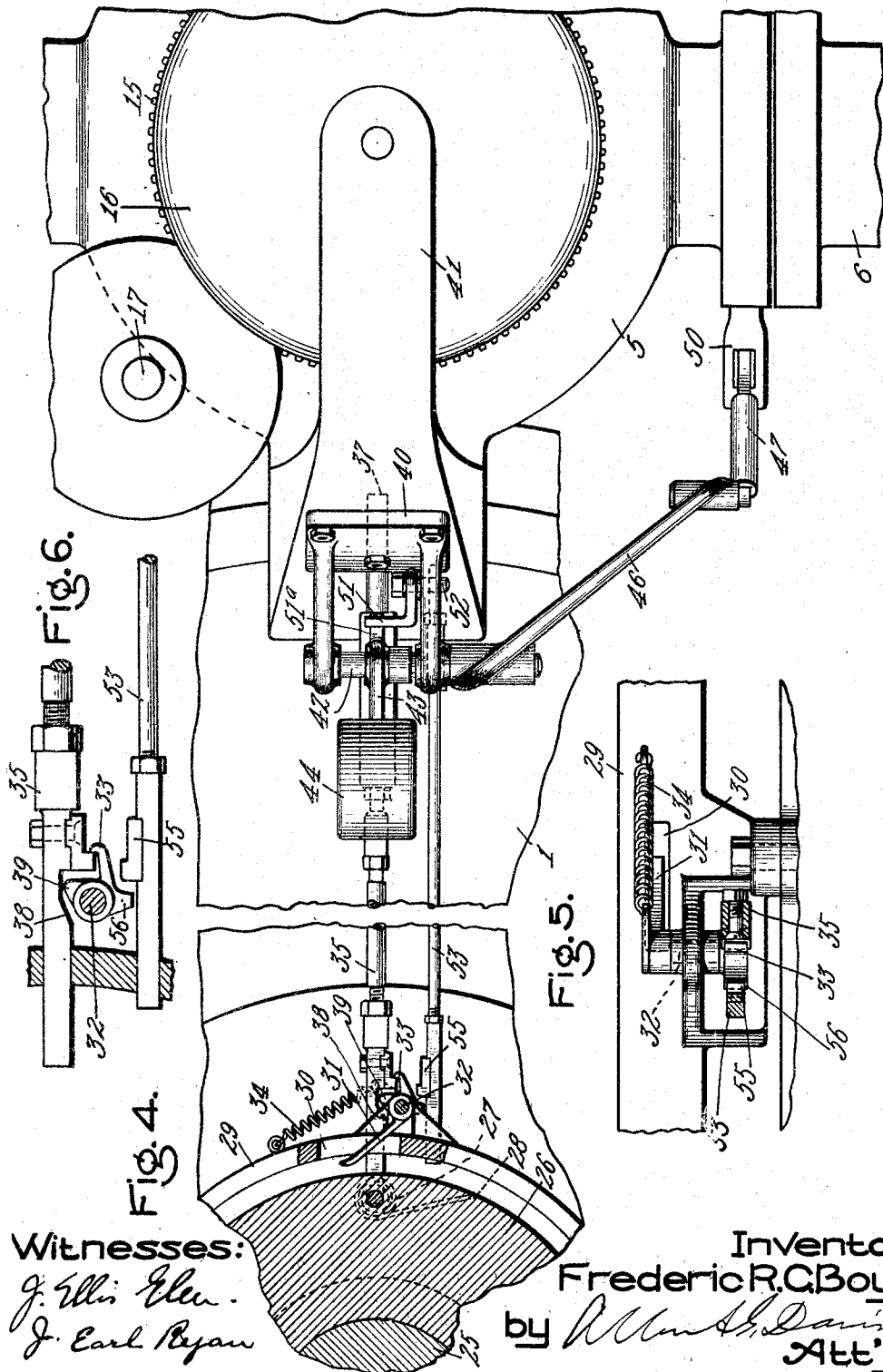
Inventor,
 Frederic R.C. Boyd,
 by *Alfred Davis*
 Att'y.

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3 SHEETS—SHEET 2.



Witnesses:
J. Ellis Allen.
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UNITED STATES PATENT OFFICE.

FREDERIC R. C. BOYD, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

EMERGENCY GOVERNING MECHANISM.

980,483.

Specification of Letters Patent.

Patented Jan. 3, 1911.

Application filed June 3, 1909. Serial No. 499,854.

To all whom it may concern:

Be it known that I, FREDERIC R. C. BOYD, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Emergency Governing Mechanism, of which the following is a specification.

The present invention relates to emergency governing mechanisms for turbines and other apparatus, and has for its object to improve their construction.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the accompanying drawings, which are illustrative of one embodiment of my invention, Figure 1 is a partial view in elevation, with certain of the parts broken away, of a turbine and the generator driven thereby, together with a combined throttle and emergency valve for regulating the admission of steam to the turbine; Fig. 2 is a perspective view of a portion of the tripping and resetting mechanism located near the valve; Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 1; Fig. 4 is a partial plan view on a somewhat enlarged scale of the tripping mechanism of the valve and the emergency governor; Fig. 5 is a detail view showing a part of the tripping mechanism that is actuated by the emergency governor; Fig. 6 is an enlarged detail view of the valve tripping rods and a part of the trigger which normally holds one of them in position, and Fig. 7 is an enlarged detail view of the manually actuated means for resetting and tripping the mechanism.

1 indicates the turbine, which may be of any suitable character and either horizontally or vertically disposed. I may also utilize my invention in connection with other forms of apparatus. In the present illustration the turbine is of the vertical type. Mounted on top of the turbine casing is a support 2 for the electric generator 3. Steam is supplied to the turbine by one or more steam chests 4 which communicate with the combined emergency and throttle valve 5 by means of pipes 6. This valve may be of any suitable type. I have elected to show the type of valve disclosed in the patent to Richard H. Rice, No. 838,455, dated December 11, 1906, although my in-

vention is not limited thereto, as it is of wider application. I have illustrated this particular type of valve for the reason that my invention has been successfully operated in connection therewith.

Briefly, the valve comprises the usual casing with a diaphragm therein that supports the seat of the valve. The upper side of the valve is provided with a bonnet upon which is a screw-threaded hub like portion 7 that carries the nut 8. The valve is mounted on the stem 9, and secured to the stem is a cross-head 10. Between the nut and the cross-head is a breakdown connection comprising toggles 11 and 12. These toggles may, if desired, be provided with cross springs 13 to assist the pivots 14 of the toggles in moving over the dead centers to the locking position. When the toggles are locked, as shown, the nut 8 may be rotated by the gear 15 or a hand wheel affixed thereto, to open and close the valve. When the toggles are broken or collapsed by permitting the weight 16 to fall, the valve will be closed suddenly. The valve also has a certain self-closing tendency due to unbalanced areas or other means. The valve may be opened and closed slowly for ordinary purposes by means of a vertical shaft 17 and the pinion on its upper end which meshes with the gear 15. The shaft may be rotated manually or by power, as desired. The weight 16 is normally held in the position shown by the hook 18. This hook is pivotally secured to a fixed part of the valve and is provided with an arm 19, by means of which it can be moved to release the weight in opposition to the spring 20.

25 illustrates the main shaft of the turbine and mounted thereon is a head, flange, or equivalent device 26, which forms a part of the emergency governor. The emergency governor may be made in a variety of ways so long as it will respond to a certain predetermined excess speed. I prefer that the emergency governor shall be capable of resetting itself automatically after an emergency operation, since this makes for simplicity, but it is not essential. I prefer to use a governor which is simple, small and relatively light. To this end, one, two or more springs 27 are provided, which are mounted on the head 26 and are made after the fashion of a clock spring with a free end 28. This free end, as the speed of the

main shaft increases, moves outwardly against the initial tension and trips the emergency mechanism. Surrounding the emergency governor and acting as a guard to prevent the free ends of the springs from moving outwardly from the shaft more than a predetermined distance, is a ring 29 which is slotted at 30 to receive the arm 31 of the trigger. The trigger is secured to a pivot 32, the latter being mounted in a bearing carried by the ring 29. On the lower end of the pivot 32 is the other part of the trigger comprising a latch 33 which is moved by the arm 31 when the latter is struck by the emergency governor springs. The movement of the trigger is opposed by a coiled spring 34, which tends at all times to keep the latch in engagement with the shoulder on the main pull rod 35. This shoulder may be formed on the rod or it may be made on a separate piece as shown in Fig. 6; the latter arrangement is preferable, since the block can be hardened and also renewed in case of wear or injury. The main rod 35 is guided at its ends and tends at all times to move outwardly away from the turbine shaft. This tendency is due to the coiled extension spring or motor 36, Figs. 1 and 2, which tendency is resisted by the trigger. The right hand end 37 of the main rod, shown in dotted lines Figs. 1 and 7, is adapted when the rod is released to strike and move the arm 19 and cause the latter to release the hook 18 and permit the weight 16 to drop. The latter in falling first opens the toggles and then delivers a blow to the cross-head 10 and forces the valve to its seat. Between the end of the rod 35 and the arm 19 is a space more or less great, which forms a lost motion so that the rod will deliver a hammer blow to the arm and insure the release of the weight.

It is evident that unless some means is provided to prevent it, that the emergency governor springs will deliver successive blows to the arm 31 of the trigger when the governor operates. To avoid this detrimental action, the left hand end of the main rod is provided with a cam surface 38, Fig. 6, which when the rod is released and moves to the right under the action of its spring or other motor 36, engages the projection or cam 39 of the trigger and moves it and the arm 31 in a direction to move the latter out of the path of the emergency governor. In other words, this action moves the arm 31 so that it is wholly outside the orbit of the free ends of the springs.

It sometimes happens that it is necessary or desirable to stop or shut down the turbine or other apparatus more quickly than can be done by rotating the shaft 17. It is also desirable to operate the tripping mechanism controlled by the emergency governor by hand from time to time in order to test

it and to make sure that the apparatus is in working condition; also to reset the trigger by means located at an accessible point instead of at or near the governor itself. To this end a special mechanism is provided, which for the purpose of illustrating my invention may be constructed as follows:—A bracket 40 is mounted upon a suitable support, such as the arm 41 of the combined emergency and throttle valve. Mounted in bearings in the bracket 40 is a spindle 42 to which is secured a bell-crank lever 43. One arm of the lever is provided with a counterweight 44 to return or restore it and the cooperating parts to the position shown, and also to counter-balance the weight of the attached parts. The other arm enters a slot 45 formed in an enlargement of the rod 35. On the spindle 42 is secured an arm 46, the outer end of which is connected to the downwardly extending rod 47. On the lower end of the rod is a handle 48 and a notch or shoulder 49 that is adapted to engage, when in the position shown in Figs. 1 and 7, with a stop 50 carried by the valve or other suitable support. Located in back of the bell-crank lever and carried by the bracket 40 is a lever 51, which is used in tripping the valve by hand. This lever normally engages a shoulder or projection 51^a on the back side of the weight carrying lever 43. The lower end of the lever 51 is provided with a pin 52, to which the right hand end of the auxiliary or push rod 53 is attached. This rod is normally urged to the right or away from the turbine shaft by the motor or coiled extension spring 54, one end of which is attached to the rod and the other end to a fixed support, such as the arm 41 of the valve. The spring holds the lever 51 in the position shown in the figures, and is best shown in Fig. 7. In order to trip the valve manually, the handle 48 is moved upward and the counterweight 44 downward and in so doing the lever 51 is moved about its pivot, and the lower end which is connected to the push rod 53 moves the latter to the left or inward toward the shaft of the turbine. Mounted on the push rod is a cam block 55, Fig. 6, which as it moves strikes the projection 56 of the trigger and cams, or moves, the latch 33 out of engagement with its cooperating shoulder. As soon as this takes place, the motor or coiled extension spring 36 moves the main or pull rod 35 to the right, causing it to strike the arm 19 a hammer blow and release the weight supporting hook 18 and permit the weight 16 to fall and close the valve.

Two different means have been described for quickly closing the combined emergency and throttle valve or regulator, *i. e.* automatic and manual. The resetting operation is the same in both cases and is as follows:—Assuming the main or pull rod 35 to be at 130

its extreme right-hand position, the left-hand end of the slot 45 will be in close proximity to the lower end of the bell-crank lever 43. The handle 48 is pulled down, which oscillates the spindle 42 and the lower end of the arm 43 engages the wall at the end of the slot 45 and pushes the rod 35 back to its normal position and against the action of its motor or spring 36. As the cam 38, Fig. 6, moves off the projection 39, the spring 34, Fig. 4, restores the trigger to its normal position where the latch engages the shoulder on said rod and locks it against the action of the motor or spring 36. The downward movement of the handle 48 moves the projection 51^a on the back of the bell-crank lever 43 away from the lever 51 and the spring 54 holds the push rod 53 in its normal position, *i. e.* that shown in the figures with the right-hand end engaging the bracket or some other fixed stop. The counterweight 44 returns the handle and attached parts to the position shown when the apparatus is ready for further operation. After the tripping mechanism is reset the operator raises the weight 16 by hand or otherwise and hooks it in position. The toggles are then straightened out by rotating the nut in the valve closing direction. After the toggles are straightened the direction of rotation of the nut is reversed by rotating the spindle 17 in the opposite direction which resets the pivots 14 of the toggles, and the valve can be opened to any desired extent within its range of operation.

It will be seen that the resetting of the tripping mechanism is accomplished from a point remote from the turbine shaft and the governor, thus avoiding the necessity of getting in between the turbine and the generator. The emergency governor merely trips or actuates the trigger, which is of as light a construction as possible. The motive power for actually tripping the remainder of the apparatus is furnished by the spring or other motor 36.

By the use of the auxiliary or push rod 53 the trigger 33 is actuated each time it is desired to quickly shut the valve manually, thereby in effect testing the same. The handle 48 is moved through one region or zone to reset the apparatus after an emergency operation, and the same handle is moved through a different region or zone to trip the apparatus. In the particular illustration of my invention, the handle is moved in one direction from the initial position to perform one operation, and in the opposite direction from said position to perform the other operation, but I do not limit myself to this arrangement unless it is so stated in the claims.

The handle is so counterweighted that it always returns to the mid or initial position when released after having been moved

downward. This is particularly advantageous, since it insures the parts being returned to their proper place irrespective of the acts of the engineer. Without the weight 44 or its equivalent the spring 36 would have to overcome the inertia of the handle and other parts, and it is my experience that said spring does not possess sufficient power for this purpose unless made of too great power for tripping purposes only. Further, it is objectionable to increase the power of the spring, because it causes too great a shock when the apparatus operates, and because it requires too much work to reset it and the rod 35. The arrangement described overcomes these objections.

I have illustrated a throttle valve as forming the regulator for the machine equipped with my improved mechanism, but where the machine is of a different character another form of regulator will or may be substituted.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. In combination, a motive power agent, a regulator therefor, an emergency governor driven by the agent, an actuator moved by the governor for operating the regulator, a manually operated device which when moved to one position restores said actuator to its initial position, means operated by said device when moved to a different position for releasing the actuator, and a restoring means for said device.

2. In combination, a motive power agent, a regulator therefor, an actuator including a motor which is normally restrained from acting and which when released causes the regulator to shut off the supply of energy to the agent, a governor for releasing the motor, a manually operated device which re-sets the motor when moved to a given position and releases the motor when moved to a different position, and a restoring means for said device.

3. In combination, a motive power agent, a regulator therefor, a governor, a means controlled by the governor for causing the regulator to shut off the supply of energy to the agent, a manually actuated device which when moved in one direction actuates said means independently of the governor to shut off the supply of energy to the agent and when moved in the opposite direction resets the means in position to be acted upon by the governor, and a restoring means for said device.

4. In combination, a prime mover, a self closing valve therefor, an emergency speed governor, an actuator for releasing the valve, a trigger for restraining the actuator
5 which is moved by the governor, a means independent of the governor for actuating the trigger, a device for resetting the actuator after an emergency operation and releasing it when it is desired to close the valve
10 independently of the governor, and a restoring means for the device.

5. In combination, a prime mover, a self closing valve therefor, an actuator, a motor tending to move the actuator in a given direction, a trigger for holding the actuator
15 against the action of the motor, an emergency speed governor for moving the trigger in a direction to release the actuator at a predetermined speed of the prime mover, a
20 means independent of the governor for moving the trigger to release the actuator, a device for actuating the means and also resetting the actuator after it is released, and a restoring means for the device.

25 6. In combination, a motor, a valve therefor having a closing tendency, an emergency governor, means actuated by the governor for tripping the valve when the speed of the motor reaches a predetermined value, a hand
30 actuated agent which operates through said means to release the valve, and a restoring means for the agent.

7. In combination, a motor, a valve therefor having a closing tendency, an emergency
35 governor, means actuated by the governor for tripping the valve when the speed of the motor reaches a predetermined value, a hand actuated agent which resets the means after governor actuation and which also acts
40 through said means to close the valve independently of the governor, and a restoring means for the said agent.

8. In combination, a motor, a valve therefor having a closing tendency, an emergency
45 speed governor, a rod which when released by the governor causes the valve to close, a second rod which is capable of releasing the first, an agent which resets the first rod when moved through a portion of its region
50 of movement and actuates the second rod when moved through another portion of its region of movement, and a restoring means for said agent.

9. In combination, a motor, a valve therefor having a closing tendency, an emergency
55 speed governor, a rod, a motor which moves the rod when it is released to close the valve, a governor controlled trigger for holding the rod against the action of the second motor, a second rod by means of
60 which the trigger can be released, a lever for moving the second rod, a means for restoring the rods to their normal positions, and a counter-balance for the last mentioned
65 means.

10. In combination, a prime mover, a regulating valve therefor, a speed governor, a rod for causing the valve to close suddenly, the said rod acting by a hammer blow, a
70 spring for moving the rod, a trigger controlled by the governor for releasing the rod and its spring, a handle for resetting the rod against the action of the spring, and a restoring means for the handle.

11. In combination, a prime mover, a regulating valve therefor, a speed governor, a rod for causing the valve to close suddenly, a spring for moving the rod, a trigger controlled by the governor for releasing the rod
80 and its spring, a second rod for actuating the trigger, a handle for resetting the first rod and its spring when moved in one direction and for actuating the trigger when moved in the other, and a restoring means
85 for the handle.

12. In combination, a prime mover, a regulating valve therefor, a speed governor, a rod for causing the valve to close suddenly, the said rod acting by a hammer blow, a
90 spring for moving the rod, a trigger controlled by the governor for releasing the rod and its spring, a lever for resetting the rod and spring, an operative handle attached to the lever, a second rod for actuating the trigger, a means for transmitting motion
95 from the lever to the second rod, and a restoring means for the handle.

13. In combination, a prime mover, a regulator therefor, a speed governor, a rod and spring for actuating the regulator, a trigger controlled by the governor that restrains
100 the rod and spring against acting, a lever for resetting the rod and spring after acting, a second rod for moving the trigger to release the spring, a second lever acted upon
105 by the first and connected to the second rod, means for moving the levers, and a weight for restoring the last mentioned means.

14. In combination, a prime mover, a regulator therefor, a speed governor driven by
110 the prime mover, a means under the control of the governor for releasing the regulator and permitting it to close, a lever for resetting the means, a handle for the lever, and a weight for restoring the handle.
115

15. In combination, a prime mover, a regulator therefor, a speed governor driven by
120 the prime mover, a means under the control of the governor for releasing the regulator and permitting it to close, a lever for resetting the means, a device independent of the governor for releasing the means, a handle that serves to move the lever and also the said device, and a restoring means acting on
125 the handle through the resetting lever.

16. In combination, a prime mover, a regulating valve therefor, an emergency speed governor, means for causing the governor to close the valve suddenly under certain
130 conditions including a movably mounted

rod, a motor for moving the rod, and a trigger controlled by the governor for releasing the rod to the action of the motor, a handle rotatably mounted adjacent the rod for re-
5 setting it against the action of the motor, and means for automatically restoring the handle to its normal position after the re-setting operation.

In witness whereof, I have hereunto set my hand this twenty-eighth day of May 1909.

FREDERIC R. C. BOYD.

Witnesses:

JOHN A. McMANUS, Jr.,
CHARLES A. BARNARD.