(No Model.) 2 Sheets—Sheet 1.

M. E. HALL.

VALVE GEAR.

No. 420,058. Patented Jan. 28, 1890.

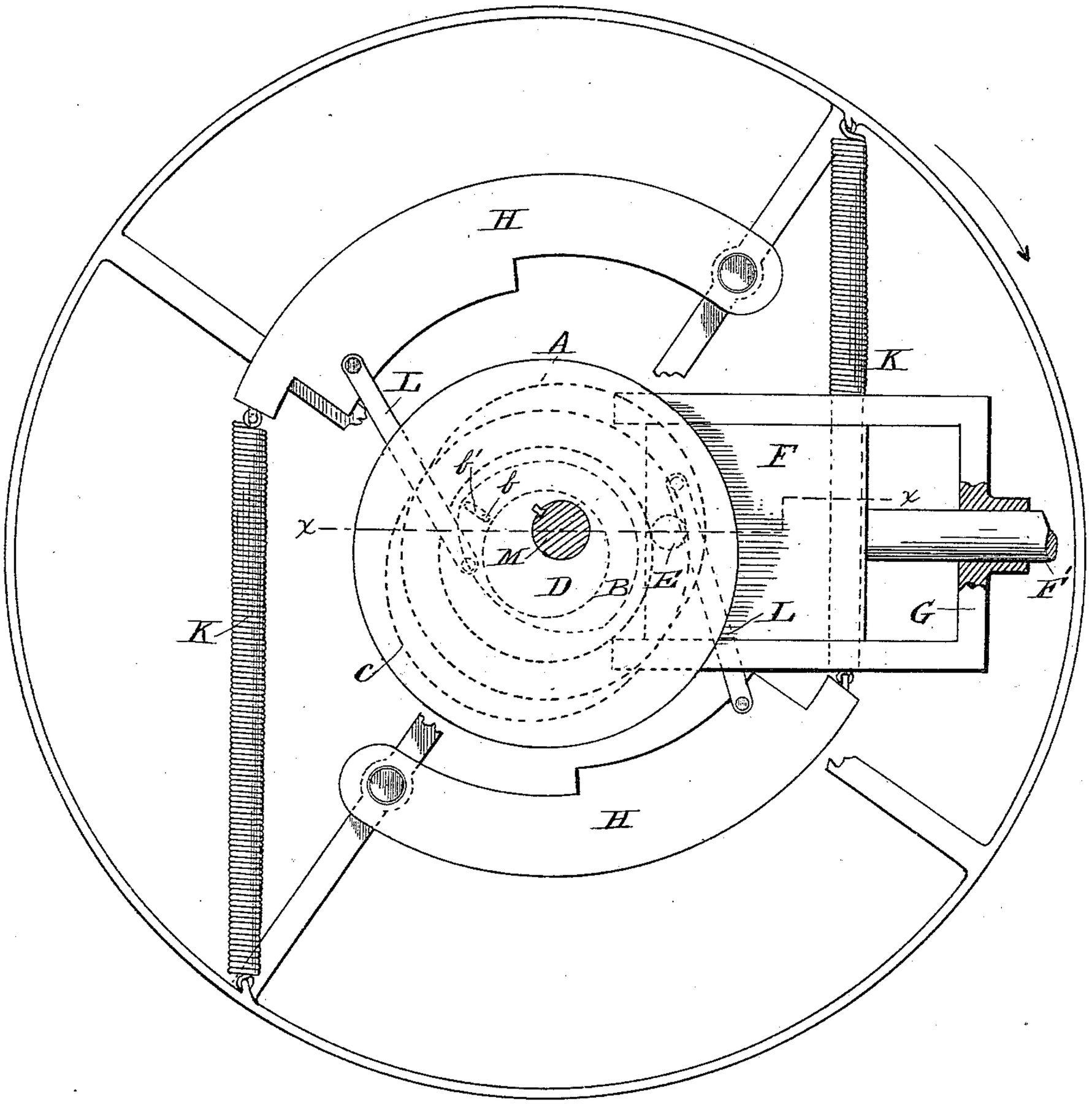

Fig. 1.

WITNESSES:

Jas. H. Blackwood

W. L. Sargent

INVENTOR,

Marvin E. Hall.

per R. D. Dodge

his Att'y.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

M. E. HALL.

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Fig. 4.

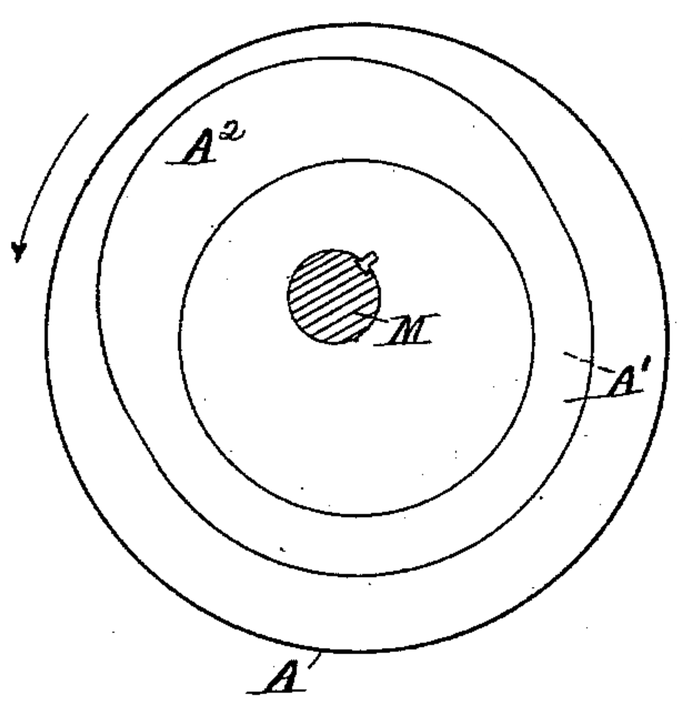


Fig. 3.

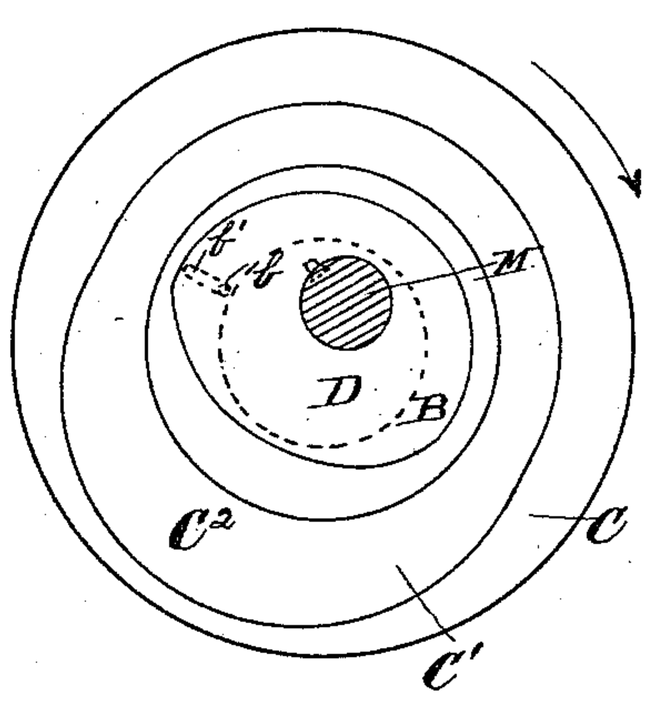
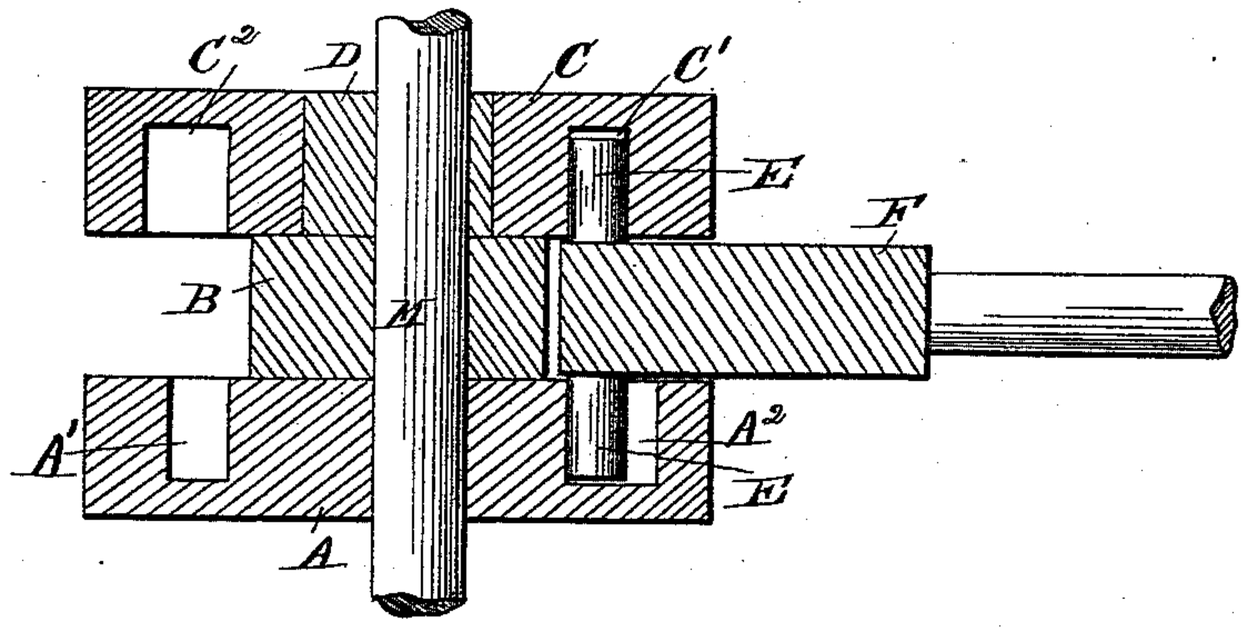


Fig. 5.



WITNESSES:

Jos. A. Blackwood

W. L. Sargent

INVENTOR,

Martin E. Hall,

per Dodger Bros

his Att'y.

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

MARTIN ELLSWORTH HALL, OF THE UNITED STATES NAVY.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 420,058, dated January 28, 1890.

Application filed August 15, 1889. Serial No. 320,909. (No model.)

To all whom it may concern:

Be it known that I, MARTIN ELLSWORTH HALL, an officer of the United States Navy, and a citizen of the United States, have invented certain new and useful Improvements in Valve-Gears; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in automatic valve-gearing for steam-engines, and more particularly to an improvement in the invention disclosed in Letters Patent No. 406,835, granted to me July 9, 1889, the primary object of the present invention being to keep the valve under positive control, and in so doing to effect a complete and instantaneous cut-off of steam without any change whatever in the lead, release, or compression; and with this end in view the invention consists in improved mechanism for automatically regulating the passage of steam through the valve of an engine, or of cutting off the supply at varying points of the stroke of the engine when necessary to cause the engine to run with uniform speed and with an economical use of steam.

Referring to the accompanying drawings, Figure 1 is a view in side elevation of my invention as adapted to a single-acting engine. Fig. 2 is a horizontal section on the line *x x* of Fig. 1. Fig. 3 is a view of the cam, the inner face of the grooved loose disk, and small eccentric upon which the loose disk turns; and Fig. 4 is a view of the inner face of the grooved fixed disk.

A represents a grooved disk keyed to the crank-shaft M. This disk has an eccentric groove A′ in its inner face, Figs. 2 and 4. Said groove is wider at A^2—that is, on the steam side—to admit of sufficient movement of the valve to cut off steam, as hereinafter explained. A small eccentric D is also keyed to the crank-shaft in such a position that the loose grooved disk C, which turns upon the eccentric D, will always have its groove C′ concentric to the groove A′ of the fixed disk A.

B is a cam loosely mounted on shaft M between the grooved disks A and D and actuated by the loose disk C through the instrumentality of the pin *b*. By means of this pin *b* the loose disk C and the cam B are connected and made to maintain the same relative positions to each other; but as the loose disk and cam are on different centers there has to be a slight slip motion between the two parts. This is accomplished by forming a slot *b*′ in the loose disk for the pin *b* to work in, Figs. 1 and 3. The loose disk C has a wide portion C^2 to its groove, and when in its normal position this wide part commences where the wide part of the groove A″ in the fixed grooved disk ends.

The ends of the pin E of the slide-block F (which latter works between the disks A C) enter the groove A′ of the fixed groove on one side and the groove C′ of the loose disk on the other. The pivoted centrifugal weights H H are connected with the loose disk C by means of the links L L, the springs K K keeping these weights in until the centrifugal force overcomes the tensile action of the springs, Fig. 1.

F′ is the valve-stem, and G is the guide for the valve-stem F′ and slide-block F.

The action of this valve-gear is as follows: Steam being admitted to the cylinder, the engine revolves, and the pin E in the slide-block F of the valve-stem F′ is confined to a narrow eccentric groove, as shown in Fig. 1, for where the groove in the fixed disk is wide that in the loose disk is narrow; so the combined effect of the loose and fixed disks is to give the valve the ordinary normal movement, the cam B not coming into play thus far at all, due to the fact that only ordinary speed has been maintained. Now, if the engine increased its speed beyond the limit of revolution for which the governor is adjusted, the centrifugal weights H H fly out, and by means of the links L L increase the angular advance of the loose disk C, to which the links are connected, and also the cam B. This brings a greater or less part of the wide portion of the groove C′ of the loose disk C opposite or coincident with the wide portion A^2 of the groove A′ of the fixed disk A, and it brings the cam B into a sliding contact with the slide-block F, thus instantly cutting off steam by means of the valve at the end of the valve-stem F′. The wide parts of the grooves of the fixed disk A and the loose disk C permit the pins E to take the movement

given to the slide-block F by the impingement of the cam B against the block F, and the edge of the cam B, when shifted to this position by the loose disk C, conforms to the wide portion of the grooves in the loose disk and fixed disk so perfectly as to prevent any play of the pin E in the grooves, thus defining the course taken by the pins E. As the loose disk C and the cam B advance together, the wide part of the groove in the disk C overlaps the wide part of the groove in the fixed disk A just enough to allow the pin E to move in them the same distance, and no more, that the cam B moves the slide-block F. As soon as the normal point of release is reached, the actuating portion of the cam having passed the slide-block, the valve renews its normal movements until the point of cut-off is again reached. Should the speed of the engine slacken, so that the tension of the springs L L becomes greater than the centrifugal force of the weights H H, the weights will be drawn in and the valve be actuated, so as to cut off steam at a later portion of the stroke in order to keep the engine up to its speed. Thus it will be seen that this valve-gear with a single valve gives any required cut-off without changing the lead, release, or compression, and right here I may say in conclusion that while the drawings show the valve-gear as adapted to a single-acting engine it is also applicable to double-acting engines as well.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a shaft, a grooved rigid disk keyed thereon, a small eccentric also keyed to the shaft, and a grooved disk loosely mounted on the small eccentric, of a valve-rod having pins which extend loosely into the grooves in the rigid and loose disk and an automatic centrifugal governor connected with the loose disk, whereby the angular advance of the latter relative to that of the grooved rigid disk is increased, substantially as described.

2. The combination, with a shaft, a grooved rigid disk keyed thereon, a small eccentric also keyed to the shaft, and a grooved disk loosely mounted on the small eccentric, of a cam loosely mounted on the shaft between the rigid and loose disks, said cam having connection with the latter, a valve-rod having pins which extend loosely into the grooves in the rigid and loose disks, and an automatic centrifugal governor connected with the loose disk, whereby the angular advance of the latter relative to that of the grooved rigid disk is increased, substantially as described.

3. The combination, with a valve-rod and actuating crank-shaft, of cam, rigid and loose disk mechanism located on said shaft, and an automatic centrifugal governor having such connections with the said cam and concentric mechanism that their relative positions are changed according to the speed of the engine to effectually control the movement of the valve, substantially as described.

4. The combination, with a valve-rod and actuating crank-shaft, of cam, rigid and loose disk mechanism located on the crank-shaft, the said rigid and loose disk mechanism being grooved, substantially as described, and an automatic centrifugal governor loosely connected with the loose disk and cam, and adapted under normal speed to maintain such relative positions of the grooves in the rigid and loose disk mechanism that the valve having connection therewith is kept within its normal limits and when under abnormal speed to so vary the relative positions of the grooves and cam that the valve is given an earlier cut-off and the supply of steam is more limited, substantially as described.

5. The combination of a valve-rod, a crank-shaft, a grooved disk (whose groove is widest on the steam side) rigidly secured thereto and directly actuating said valve-rod and valve, whereby the admission, release, and compression are normally and invariably controlled, a cut-off cam loosely mounted on said crank-shaft, and a grooved disk loosely suspended upon a small eccentric fixed to the crank-shaft, each provided with a rotary movement upon said crank-shaft, substantially as described.

6. The combination of a single valve and valve-rod, a crank-shaft, a grooved disk (whose groove is widest on the steam side) rigidly secured thereto and directly actuating said valve-rod and valve, whereby the admission, release, and compression are normally and invariably controlled, a cut-off cam loosely mounted upon said crank-shaft, and a grooved disk loosely mounted upon a small eccentric fixed to the crank-shaft, each adapted with a rotary movement upon said crank-shaft and small eccentric, respectively, and operated by an automatic centrifugal governor, whereby steam is cut off at varying points of the stroke by said valve without change in the lead, release, or compression, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MARTIN ELLSWORTH HALL.

Witnesses:

G. D. CHAPMAN,

W. L. SARGENT.