(Model.)

U. HASKIN.

Cut Off Mechanism for Steam Engines.

No. 239,492. Patented March 29, 1881.

Fig. 1.

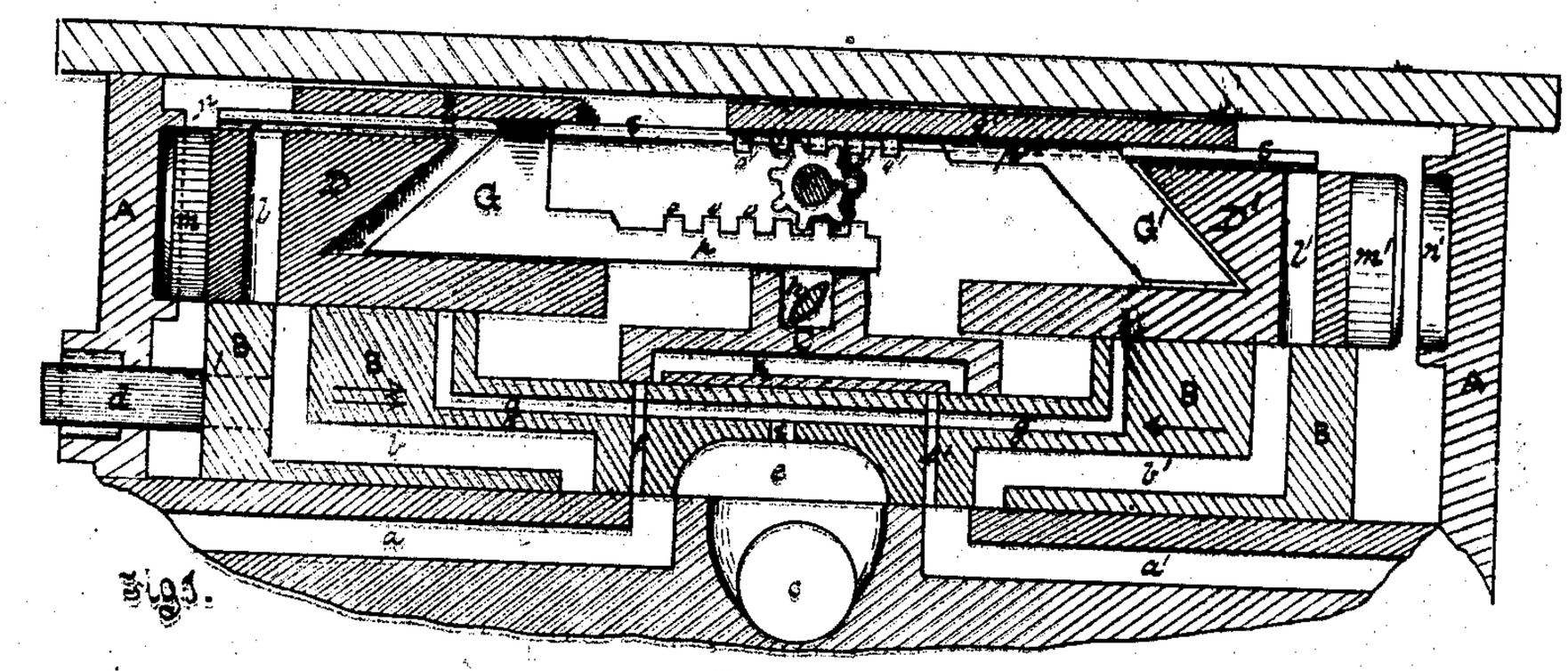

Fig. 3.

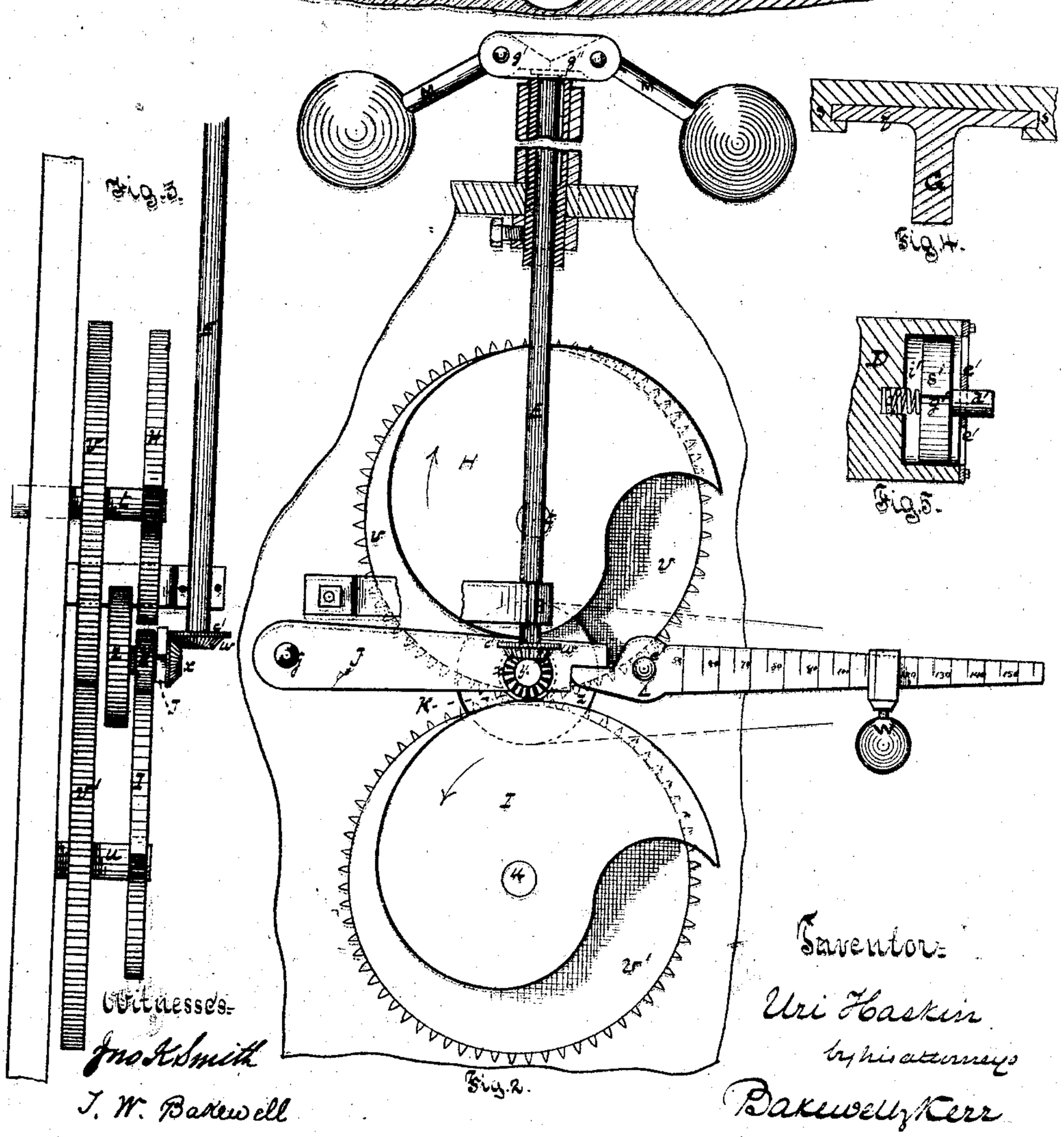

Fig. 4.

Fig. 5.

Witnesses:

Jno. K. Smith

J. W. Bakewell

Fig. 2.

Inventor:

Uri Haskin

by his attorneys

Bakewell & Kerr

UNITED STATES PATENT OFFICE.

URI HASKIN, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO HIMSELF, JOSEPH DILWORTH, AND S. T. OWENS, OF SAME PLACE.

CUT-OFF MECHANISM FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 239,492, dated March 29, 1881.

Application filed December 8, 1880. (Model.)

To all whom it may concern:

Be it known that I, URI HASKIN, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Cut-Off Mechanism for Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section through the steam-chest or valve-box of a steam-engine. Fig. 2 is a vertical section of the governor of the engine and of the apparatus connected therewith for operating the cut-off valves. Fig. 3 is a side view of the apparatus shown in Fig. 2. Fig. 4 is a sectional view of the flange of the stops and of the rail on which they ride. Fig. 5 represents a steam-cushion to receive the stroke of the cut-off valves.

In the several figures like letters refer to the same parts.

In the drawings, A is the steam-chest in which the slide-valve B works.

a a' are steam-ports admitting steam to the two ends of the steam-cylinder, through the corresponding steamways *b b'* in the slide-valve.

c is the exhaust-port.

The slide-valve is operated in the usual manner from the steam-engine by the valve-rod *d*.

e is the exhaust-way in the slide which connects the steam-ports *a a'* alternately with the exhaust-port *c*. The steam-ports *a a'* and exhaust-port *c'* on the cylinder are so situate in relation to the steamways *b b'* and exhaust-way *e* in the slide-valve that when the slide-valve is in the position shown in Fig. 1, the live steam in the steam-chest is entirely cut off from the cylinder.

In the slide-valve B are two small steam-passages, *f f'*, one on each side of the exhaust-way *e*, and so placed that when the slide-valve is in the position shown in Fig. 1, and during so much of its stroke as the steam is cut off from entering either end of the cylinder through the steam-ports *a* or *a'*, both of the steam-passages *f f'* are in communication with the ports *a* and *a'*, respectively. There is also an exhaust-steam passage, *g*, in the slide-valve connecting with the exhaust-way *e* at *i* and extending backward and forward to the upper surface of the slide-valve at two points not far from the upper orifices of the steamways *b b'*, respectively, the purpose of which will be hereinafter explained.

In a recess on the upper surface of the slide-valve B is placed the exchange-valve C, which has a steamway, *k*, which connects at either end with the small steam-passages *f f'* in the slide-valve when their orifices coincide. The purpose of this exchange-valve C is to admit a small amount of steam to pass from one end of the steam-cylinder to the other, for a very short time, when the live steam is cut off, and just before the slide-valve changes the live steam from one end of the cylinder to the other as the stroke of the piston is nearly completed. The exchange-valve C is kept in place by a stop, *h*, operated by a stem from the outside, or by two adjustable stops, one placed on either side of a projection from the upper side of the exchange-valve, said stops extending to the outside of the valve-chest A, so as to be set, by means of a screw or otherwise, either close to the projection of the exchange-valve, in which case they hold it rigidly in place, or at a slight distance therefrom, so as to allow of a slight longitudinal movement of the exchange-valve in the direction of motion of the slide-valve. By this means the point of the stroke of the piston, at which steam is allowed to "exchange" from one end of the cylinder to the other, may be adjusted with accuracy.

On the upper face of the slide-valve B and resting thereon are two cut-off valves, D D', one placed at each end of the slide-valve. Each of these cut-off valves has a steamway, *l l'*, of the same diameter as their corresponding steamways *b b'* in the slide-valve, so that when either of the steamways *l l'*, in the cut-off valves D D', coincides more or less with the steamways *b b'* in the slide-valve, they admit steam from the cavity of the steam-chest into the steamways *b b'*, and when either of these latter coincides more or less with the steam-ports *a* or *a'* live steam is thereby admitted into the steam-cylinder; but when the steamways *l* or *l'* in the cut-off do not com-

municate with their corresponding steamways *b* or *b'* of the slide-valve the live steam is cut off from the steam-cylinder.

At the outer extremity of each of the two cut-off valves D D' is a cylindrical projection, *m m'*, which, when the cut-off valve is moved by the slide-valve to the end, gets stroke, enters a cup or cup-shaped cavity *n n'* in the end walls of the steam-chest A. These cup-shaped cavities *n n'* are just large enough to receive the projections *m m'* without friction, so that as either projection *m* enters its cup *n* it incloses a certain amount of live steam, which serves as a cushion, and prevents injury to the valve-chest from the stroke of the valve when it comes in contact with the end of the steam-chest, by which its outward stroke is limited. The inward stroke of the cut-off valves D D' is limited by adjustable stops G G'.

Although the cut-off valves D D' are not attached to the slide-valve they move with it during a part of its stroke until their motion is arrested in either direction by the steam-cushion on their outward stroke, or by the stop G or G' on their outward stroke. In order to effect this the under surface of the cut-off valves D D' is caused to adhere to the upper surface of the slide-valve by means of the exhaustion of steam from between their contiguous surfaces, through the steam-passage *g*, communicating with the exhaust-passage *e* and exhaust-port *c*, which causes the cut-off valves D D' to be pressed down upon the slide-valve by the live steam in the valve-chest A. As soon, however, as either of the cut-off valves D D', on its inward stroke, comes in contact with the stop G or G', its motion is arrested, the slide-valve B still continues its stroke; and to avoid friction caused by the cut-off valve being pressed down onto the surface of the slide-valve, as before described, the end of the stop G or G' which comes in contact with the cut-off valve D or D' is inclined, as also is the surface of the cut-off valve where they come together, the result of which is that the cut-off valve is raised slightly from its seat on the slide-valve, and steam is admitted between their surfaces, so that all frictional contact is avoided. From this construction it will be obvious that if the stops G G', being adjustable, are set farther apart they will reduce the inward stroke of the cut-off valves D D', and that their inward stroke may be so reduced as to prevent the steam-passages *l l'* of the cut-off valves from coinciding more than partially with the steam-passages *b b'* of the slide-valve, and that this may be adjusted so as to allow more or less steam to pass at each stroke of the slide-valve from the steam-chest to the cylinder of the steam-engine, the farther the stops G G' being moved outward the less steam will be admitted. The stops may therefore be furnished with arms projecting through the side or top of the steam-chest, which, being connected with a right or left screw-rod passing through female screws in the projections, will enable the quantity of steam supplied to the cylinder to be regulated at will by merely turning the rod connecting the stops G G'. I have provided a means by which this adjustment may be effected automatically by connecting the stops G G' with the governor, so that when the amount of steam supplied increases beyond the desired limit the rising of the balls of the governor will cause the stops to recede from each other, and thus reduce the supply of steam, and, vice versa, if the supply of steam becomes too small the stops will approach each other, thus allowing of a larger supply. To effect this each of the stops G G' has an arm, *p p'*, projecting toward and past the middle of the steam-chest, one on the upper and the other on the under side of its stop. These arms *p p'* have cog-teeth *o o o' o'*, which gear into a cog wheel or pinion, *r*, placed between them, so that the revolution of the pinion *r* in one direction moves the stops farther apart, and its revolution in the other direction brings them nearer together.

In order to prevent friction of the stops on the valves D D', each of the stops has a flange, *q q'*, which rides in a way, *s*. (See Fig. 4.)

The pinion *r* is keyed to a shaft, *t*, which passes through a stuffing-box in the side of the steam-chest A. Onto the other extremity of the shaft *r* outside of the steam-chest is keyed an eccentric friction-disk, H, (see Fig. 2,) so that a partial revolution of the eccentric disk H will cause the stops G G' to move toward or from each other, according to the direction in which the disk turns. Another similar eccentric disk, I, (see Fig. 2,) is keyed to a shaft, *u*, the bearings of the shafts *t* and *u* being stationary. Between the eccentric disks H and I is placed a friction-roller, K, which has its bearing in a swinging gear-frame, J, which has its center of motion on the fixed pivot *j*. The eccentric disks H and I are exactly alike in size and contour, so that, turning on their respective axes in opposite directions, their peripheries are at all times equidistant. They are the reverse of cams in their function, for, instead of raising and lowering the friction-roller K and parts connected therewith, they are acted upon by the roller K and caused to make a partial revolution in one direction or the other by the motion of the friction-roller K. The friction-disks are set with their peripheries not quite touching the periphery of the friction-roller K. This is their normal relative position until, by accelerated or lessened speed of the governor, the friction-roller is lowered or raised, in which case its periphery comes in contact with the edge of the lower or upper cam-disks, I or H, as the case may be. When this takes place, if the governor allows the roller K to rise into frictional contact with the upper friction-disk, H, and the disk H, commences to turn, and thereby the shaft *t*, to which it is keyed, turns the pinion *r*, so as to bring the stops G G' of the cut-off valves nearer to each other, thereby allowing a longer inward stroke of the cut-off valves D D', and admitting more steam to the cylinder of the steam-

engine. If, on the other hand, the supply of steam becomes excessive, the shaft of the governor is depressed, the friction-roller K is brought in contact with the lower eccentric-disk, I, only, which causes the disk I to turn in the opposite direction on its axis *u*. This causes the upper disk, H, to turn also, although not in frictional contact with the friction-roller K by means of a cog-wheel, *v v'*, on each of the shafts *t u* of the eccentric-disks, which cog-wheels gear into each other. Whenever the supply of steam is just sufficient and the governor-shaft neither rises nor falls, the friction-roller revolves out of contact with both disks H and I, and the stops of the cut-off valve remain at rest.

The revolution of the governor-shaft E is effected by a beveled pinion, *w*, on its lower extremity, which gears into a corresponding beveled pinion, *x*, on the shaft of the friction-roller K. A pulley, *z*, is secured to the shaft *y* of the friction-roller K, over which a band passes to another pulley, which is revolved by the steam-engine in the usual manner. The beveled pinion *w* on the lower end of the governor-shaft E has a flange, *c'*, which rests on the periphery of the beveled pinion *x*, performing the function of a stop for the governor-shaft.

As before stated, the shaft *y* of the friction-roller K, bevel-pinion *x*, and pulley *z* has its bearing in a swinging frame, J. This bearing is near the free end of the swinging frame J, which rests upon the short end of a lever or steelyard, L, which has its pivot at *e'*. On the steelyard L is a sliding weight, W, so that as the weight is slid from or toward the fulcrum of lever L, a greater or less upward pressure is exerted on shaft E of the governor through the bevel-pinions *x* and *w*. The revolving shaft E of the governor has an enlargement at its upper end, which is, by the upward pressure of the short arm of the lever (steelyard) L, pressed up against the under side of the short arms *g' g''* of the lever-arms M M of the governor. As this upward pressure on the revolving shaft E is increased it tends to force downward the ball-arms M M of the governor, and thus necessitates a greater rapidity of revolution of the governor-arms, and consequently more steam to raise them; and as the lowering or raising of the governor-shaft acts on the stops G G' of the cut-off valves D D', as before described, to separate them or bring them nearer to each other, so as to give less or more steam to the engine, so the increase of the upward pressure on the lower end of the governor-shaft, by means of the weight W, increases the effective power of the steam-engine. In place of a steelyard and weight an adjustable spring or pulley and weight, or other equivalent device, may be employed.

The peculiar advantage of my improved device for admitting steam to exchange from one end of the cylinder to the other, at or near the close of the stroke of the piston, is that I am enabled to combine it with the use of a cut-off, which hitherto has not, so far as I am aware, been accomplished; and, further, that by means of my exchange-valve and its stops, by which the position of the exchange-valve relatively to the ports or steam-passages of the slide-valve can be adjusted, and a slight motion of the exchange-valve can be effected, I am enabled to regulate the particular point of the stroke of the piston at which the exchange is effected.

The relative operation of the slide-valve, cut-off valve, and exchange-valve will be seen by reference to figures.

When the parts are in the position shown in Fig. 1 the steam is entirely cut off from the engine, and the slide-valve is about to shift so as to admit steam through the steam-passages *l' b'* and port *a'*. When the valve is moved in the direction of the arrow a connection is made between port *a'* and steam-passages *b'* and *l'*, but at the same moment the cut-off valve D', coming in contact with the stop G', is arrested, while the slide-valve B, moving on, nearly closes the passage between *l'* and *b'*, allowing but little steam to pass. Were the stop G' moved nearer to the shaft *t* by the pinion *r* this stoppage of the cut-off valve D' would not take place so soon, and a wider opening would be permitted for the steam between *l'* and *b'*. Before the slide-valve B completes its stroke in the direction of the arrow, the cut-off valve D (at the other end of the steam-chest) is arrested by the projection *m* entering its cup *n*, while the slide-valve moves on. On the return-stroke of the slide-valve, and before the piston of the engine has completed its stroke, the slide-valve, moving in the direction of the double arrow, carries with it both of the cut-off valves D and D', the passages *l* and *b* being in full communication. The steam is then cut off entirely from the steam-engine by the closing of the ports *a a'* and shortly before the piston completes its stroke, and before steam is admitted through the steam-passages *l* and *b* and port *a* into the cylinder, the exchange steam-passages *f f* in the slide-valve come in line with the steam-way *k* of the exchange-valve C and allow steam to exchange from one end of the steam-cylinder to the other, thus supplying the exhausted end of the piston with a small quantity of live steam before the commencement of its return-stroke. The exchange-valve C being fixed by the stops *h h'*, the duration of this exchange is only momentary. As the exchange-passages *f f'* in the slide-valve come in communication with the ports *a a'* of the steam-cylinder before they come in communication with the steam-passage *k* of the exchange-valve, the time at which this exchange shall occur may be varied slightly by regulating the movement of the exchange-valve C, by means of the stop *h*. The exchange of steam having been effected and the steam-piston having completed its stroke, the slide-valve advances farther in the direction of the double arrow, Fig. 1, un-

til the cut-off valve D (carried forward by the slide-valve) is arrested in its motion by the stop G, and the slide-valve, still moving on the communication between the steam-passages *l* and *b*, is partly closed. The steam-passage *b* is then brought, by the advance of the slide-valve B, over and in communication with the steam-port *a*, while the communication between steam-passages *l* and *b* is still partly open, and thus live steam is admitted from the steam-chest through port *a* into the steam-cylinder. As the slide-valve further advances the communication between the steam-passages *l* and *b* is closed before the steam-port *a* is closed by the slide-valve, by reason of the cut-off valve D being arrested in its motion by the stop G. It is obvious that if the stops G and G′ were brought closer together the amount of steam admitted through the ports *a* and *a′* to the steam-cylinder would be increased, while the time and extent of cut-off may still be varied at pleasure by regulating the motion of the slide-valve in the ordinary way.

In Fig. 5 is represented a steam-cushion, which may be used to prevent injury to the walls of the steam-chest from the stroke of the cut-off valves in lieu of the projections *m* and cups *n* shown in Fig. 1.

D represents one end of the cut-off valve, in which is a cylindrical cavity, *i′*, at the center of which is a recess which receives a short spiral spring, *c′*. A small disk or piston, *s*, works in the cylindrical cavity *i′*, having an outwardly-projecting stem, *d′*. The cavity *i* is covered at the end of the valve D by a perforated plate, *e*, through a central hole in which the stem *d′* passes, thus preventing the tilting of the disk *s′*. On the periphery of the disk *s′* is a groove, *g′*, which allows the live steam in the steam-chest A, entering through the perforations in the plate *e* to pass into the cavity *i* back of the disk or piston *s′*.

The operation of this device is as follows: When the cut-off valve D or D′ is carried, by the stroke of the slide-valve B, to the end of its stroke, the stem *d′*, coming in contact with the casing of the steam-chest A, causes the disk *s′* to be forced down into its cavity *i′*, and as the steam confined therein cannot immediately escape through the groove *g′* it acts as a cushion and arrests the motion of the cut-off valve gently and without injury to the walls of the steam-chest. On the return-stroke of the valve D′ the spring *c′* forces the disk outward and allows the cavity *i′* to be refilled with steam through the groove *g′*.

Having thus described my improvement, what I claim as my invention is—

1. The combination, with the cylinder of a steam-engine and its slide-valve, of a cut-off valve and exchange-valve, and stops whereby the relative action of the cut-off and exchange valves are regulated and adjusted, substantially as described.

2. The combination, with a slide-valve for steam-engines, having steamways for connecting the steam-ports of the cylinder, of an exchange-valve for making and breaking the steam-connection between opposite ends of the cylinder, substantially as described.

3. The combination, with a slide-valve for steam-engines, of an exchange-valve for effecting a steam-connection between the opposite ends of the cylinder through steamways in the exchange-valve and slide-valve, and a stop or stops for adjusting the position of exchange-valve, substantially as described.

4. In combination with the slide-valve of a steam-engine, the cut-off valves, each having a separate adjustable stop for limiting and regulating the cut-off as well as the amount of steam supplied to the engine, substantially as and for the purpose described.

5. The slide-valve, cut-off valves, and adjustable stops for limiting and regulating the cut-off and supply of steam to the cylinder, in combination with the governor of a steam-engine, and interposed gearing for the automatic adjustment of the stops of the cut-off valves, substantially as described.

6. The combination of the eccentric-disks H I and their gearing, and interposed friction-roller *k* with the governor of a steam-engine, and with stops for regulating the stroke of the cut-off valves, and with the cut-off and slide valves, substantially as described.

7. The combination of a steelyard and weight or equivalent device with the governor of a steam-engine and with adjustable stops operated by the governor for regulating the stroke of the cut-off valves, and with the slide-valve, substantially as and for the purpose hereinbefore described.

8. The steam-cushion consisting of the cavity *i′*, disk *s′*, stem *d′*, spring *c′*, and passage *g′*, combined and arranged substantially as described.

In testimony whereof I have hereunto set my hand.

URI HASKIN.

Witnesses:
JOHN S. KENNEDY,
JNO. K. SMITH.