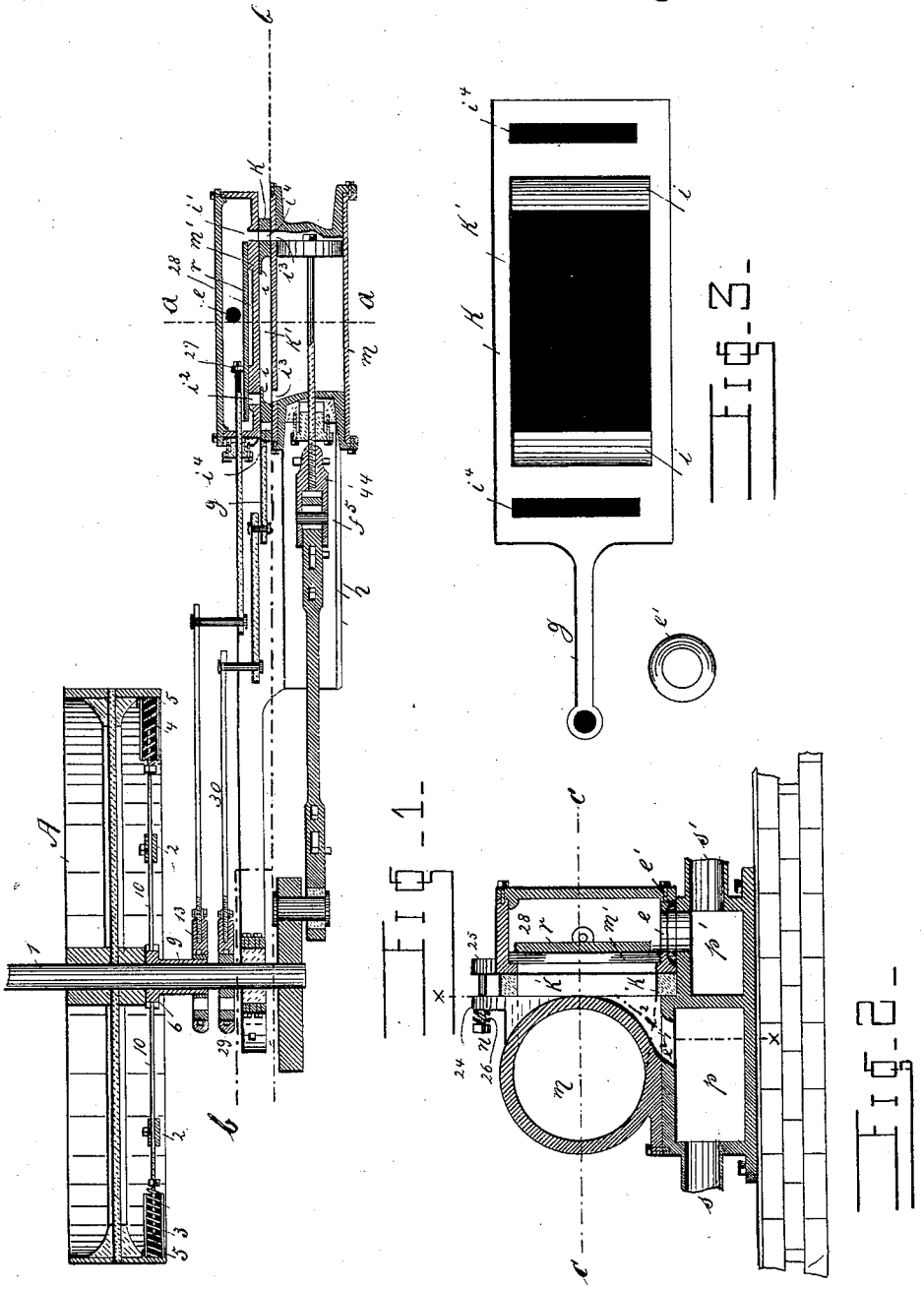
(No Model.) 2 Sheets—Sheet 1.

I. R. KERN.

STEAM ENGINE.

No. 347,616. Patented Aug. 17, 1886.



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(No Model.) 2 Sheets—Sheet 2.

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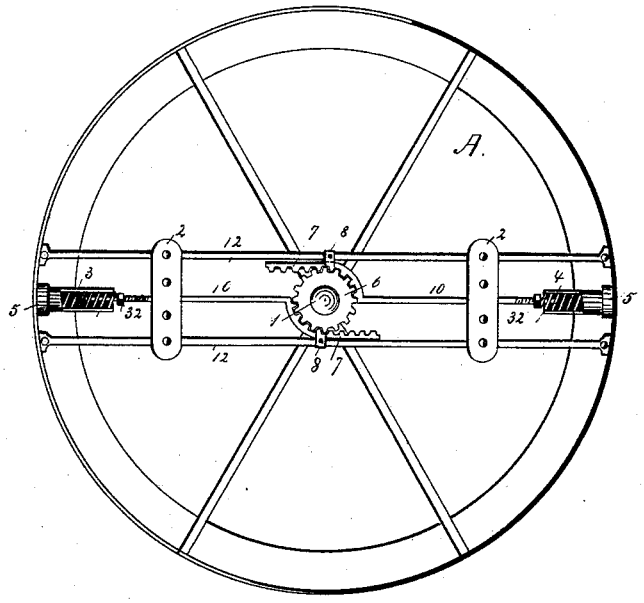

Fig. 4.

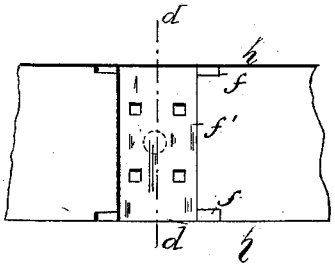

Fig. 5.

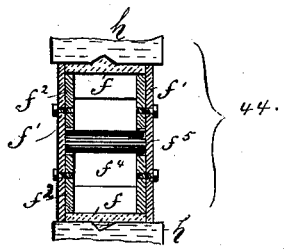

Fig. 6.

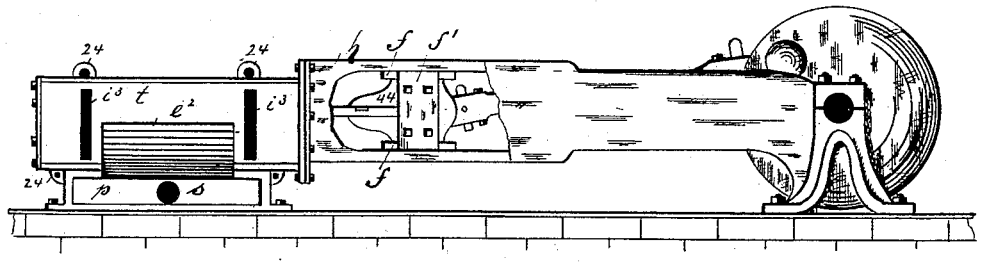

Fig. 7.

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UNITED STATES PATENT OFFICE.

ISAAC R. KERN, OF KANSAS CITY, MISSOURI.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 347,616, dated August 17, 1886.

Application filed March 9, 1886. Serial No. 194,600. (No model.)

To all whom it may concern:

Be it known that I, ISAAC R. KERN, of Kansas City, Jackson county, Missouri, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates, first, to an improved construction of cylinder and steam-chest and valves contained therein; second, to the construction of the cross-head of the engine and other contiguous parts; and, third, the invention relates to devices for controlling automatically the movements of the valves, the object being to increase the efficiency and lessen the cost of construction of steam-engines of the class known as "automatic cut-off engines."

The invention may be said to consist in the devices and combination and arrangement of parts exhibited by the drawings, and hereinafter set forth.

In the drawings, Figure 1 represents a sectional plan view of an engine embodying my improvements, the section being taken on line *c c*, Fig. 2. Fig. 2 is a vertical section through the cylinder, steam-chest, &c., on line *a a*, Fig. 1. Fig. 3 is a detail view of the main valve, enlarged, and showing its front face or the face that is next to the cylinder. Fig. 4 is a detached view of the fly-wheel of the engine, having the centrifugal devices for changing the position of the cut-off eccentric on the main shaft attached thereto. Fig. 5 is a detail view of a portion of the framing of the engine and a side view of the cross-head. Fig. 6 is a transverse section through the same on line *d d;* and Fig. 7 is a sectional side view of the engine, taken longitudinally on the line *b b*, Fig. 1, and vertically on line *x x*, Fig. 2.

The main valve K is made with two ports, i', which pass directly through it near to its respective ends, and an exhaust-opening, K′, occupies most of the remaining portion of its surface. By reference to Fig. 3 it will be seen that the exhaust-opening through the main valve is very long and almost as wide as the valve itself. It will also be seen that the ends of the exhaust-opening are made with an incline or curve, for the purpose of more effectually guiding the exhaust-steam in its passage from the cylinder downwardly to the exhaust-passage e^2, which extends under the cylinder *m* and to the chamber *p*, which is located under the cylinder. From the said chamber *p* an exhaust-pipe—such as *s*—may lead out into the open air or to any desired point.

The main valve K is made of a single plate of metal, faced on both sides for forming a tight joint with the face *t* of the cylinder and with the front side, *m′*, of the steam-chest, and having a stem, *g*, cast integral with its body. The stem *g* can be either square or round, as it does not work through a stuffing-box. The main valve in operation rides on its lower edge and on a plain surface formed on the bed-plate or framing of the engine just above the steam-chamber *p′*, and, for that matter, so does the entire steam-chest, carrying the cut-off valve *r*, lie loosely on its lower edge. In the lower edge of the steam-chest, at about the middle of its length, is formed an opening, *e*, for the entrance of the live steam. This opening flares downwardly, or, rather, a concave annular recess is formed around its lower end, and a packing-ring, *e′*, that is quadrangular in cross-section, is located in the recess and supports the greater part of the weight of the steam-chest and the appurtenances thereof. In this way a tight joint, and at the same time a flexible one, is maintained between the steam-chest and the steam-chamber *p′*, and the chest is allowed to adjust itself more perfectly to the face of the main valve than it could if the steam-pipe *s′* were connected to it in a rigid manner.

Projecting at suitable points around the outside of the steam-chest are a number of ears or lugs, 25, into which bolts *n* have one end screwed, and at opposite points on the outside of the cylinder *m* a corresponding number of ears or lugs, 24, are located. The bolts *n* pass through the lugs 24 and into the lugs located on the steam-chest, and a spring, 26, is located on them between their heads and the lugs 24. The tension of these springs can be regulated when desired, so as to pull the chest tighter against the main valve and the face of the cylinder by simply screwing the bolts farther into the lugs 25. Thus it will be seen the main valve can work perfectly free and

easy. The friction that would be caused by a stuffing-box is obviated, as its stem does not require one, and the only pressure that the steam can exert on the main valve is represented by the area of the ports *i'* in the side of the steam-chest. The ring *e'*, in connection with the steam-chest and the bed of the engine, forms a sort of universal joint between the steam-chest and the live-steam chamber *p'*, and it is obvious that the chest is free to move a limited distance to and from the cylinder.

The cut-off valve *r* is a plain rectangular plate of metal having no openings through it, and it is formed with a lug, 27, on its back, to which its stem should be attached. Said cut-off valve operates on a raised seat that is formed upon the inner surface of the front side, *m'*, of the steam-chest, and as the metal at 28 between the ports in the chest is cut away for the purpose of forming the raised seat, it should be clear that the steam can get nearly all around the valve. Thus it will be almost balanced, and can be moved with little power.

As the live steam will be contained in the steam-chest, and as the stem of the cut-off valve *r* must pass out through one end of the chest, a stuffing-box for it will be required, and is provided, as shown.

That portion of the framing which carries the main shaft 1 may be of any approved form that is different from what is here shown.

The main valve K is driven by an eccentric, 29, of ordinary construction, and its rod 30 may be connected to the stem *g* by any approved means. The cut-off valve *r*, however, is operated by the eccentric 13, which is carried by or attached to a sleeve, 9. This sleeve is loosely mounted on the main shaft, so that it may be revolved independently of it, and it carries or has attached to it, in addition to the eccentric 13, a toothed pinion, 6. It may be observed here that the eccentric 13 is an ordinary one, except that it revolves fixedly with the sleeve 9 and the pinion 6. The eccentric 13 is also designed to move in unison with the eccentric 29, except when the load on the engine is varied in some way.

The devices for controlling the cut-off valve may be described as follows: Extending across the fly-wheel or band-wheel, as the case may be, and having their ends secured to the inner side of the rim of the wheel are two guide-bars, 12. Two weights, 2, are loosely mounted on the guide-bars, so that they can slide to or from the main shaft, and they are adjustably, though securely, attached to respective rack-rods 10. Located diametrically opposite each other on the inner side of the rim of the fly-wheel A and between the guide-bars 12 are a pair of sockets, 5, which contain a spiral spring, such as 3 or 4. These spring-sockets can be cast integral with the rim of the wheel, or they may be secured thereto in any desired way. Formed upon or secured to the inner ends of the rack-bars 10 is a rack, 7, the teeth of which are adapted to mesh with the teeth of the pinion 6. The outer ends of the rack-bars are threaded and are fitted with a nut or nuts—such as 32—which rest upon the inner ends of the springs 3 and 4. The racks 7 are provided with a guiding-clip, 8, or a device of some kind for the purpose of holding them in line with and in position on the guide-bars 12. The rotation of the sleeve 9 upon the shaft 1 in either direction will cause a corresponding movement of the cut-off eccentric 13 and the cut-off valve *r*, as is well-known in practice with other engines which are fitted with a variable cut-off valve. The rotation of the sleeve 9 is produced and controlled by the centrifugal force of the weights 2, opposed by the springs 3 and 4. With this construction, then, the process of governing may be briefly described as follows: Suppose the engine to be started without any load. As the speed approaches the desired point, the weights 2 acquire centrifugal force sufficient to overcome the power of the springs and move outward, revolving the sleeve a little faster than the speed at which the main shaft is going, and cutting off the steam and restraining the engine within the desired limit of speed, while at the same time the movement of the main valve K remains unchanged, and the exhaust-steam is allowed to pass freely out of the cylinder without contact with the cut-off valve. Now, if work be put on the engine, the springs 3 and 4 will overcome the centrifugal force of the weights, and the necessary amount of steam to meet the load is admitted to the cylinder.

The novel construction of my improved cross-head 44 is, I think, worthy of special mention. The cross-head is adjusted for wear in its guides, formed in the framing *h*, by means of the oppositely-located wedges *f*, and said wedges are clamped in position after adjustment by means of the oppositely-located clamping-plates *f'*. The plates *f'* are bolted to the sides f^2 of the cross-head and are adapted to clamp the edges of the wedges *f*, and so hold them in position at any desired point, the cross-head pin f^5 being securely held in the sides of the cross-head in any desired manner without projecting through the plates *f'*. The cross-head is made with a cavity, f^4, in which the end of the connecting-rod is to operate, and is connected to the piston-rod in the usual manner. Although the wedges *f* may be provided with suitable guides of any desired form to prevent their lateral movement in the framing *h*, I would prefer that they be provided with a longitudinal rib upon their bearing-surface, which is V-shaped in cross-section, and which operates in a correspondingly-shaped groove in the framing, as shown.

It will be observed that the exhaust-openings throughout this engine are quite large and roomy, thereby affording the wasted steam a free and easy passage-way.

I would say that there will be no need of steam-cocks at the ends of the cylinder as sup-

plied to engines of ordinary construction, and the reason of this is the fact that the lower edge or side of all the ports are located on a plane below the lower and interior surface of the cylinder, as clearly shown in Figs. 2 and 7.

Having thus described my invention, what I claim is—

1. The combination, substantially as set forth, of the engine-cylinder provided with ports and supported upon the framing, the steam-chest yieldingly attached to the cylinder and to the framing and carrying a cut-off valve, and the main valve located between the cylinder and steam-chest and fitted to operate or to be operated without the intervention of a stuffing-box.

2. A steam-engine cylinder provided with the faced surface *t*, and having the exhaust-passage e^2 extending from the faced surface to the chamber *p*, beneath the cylinder, and having a steam passage or port, i^3, located at each side of the exhaust-passage and extending to the bore of the cylinder, substantially as described.

3. The combination, substantially as set forth, of the cylinder *m*, having lugs 24, the valve K, steam-chest carrying cut-off valve *r* and provided with lugs 25, bolts, such as *n*, and springs, such as 26, located on the bolts.

4. The combination, with the bed-plate or framing of a steam-engine, of a steam chest located thereon and provided with the recessed opening *e* and the packing-ring *e'*, located between the steam-chest and the framing, as set forth.

5. The combination, substantially as set forth, of main shaft 1, fly or band wheel A, weights 2, springs 3 and 4, located in sockets 5, pinion 6, secured to sleeve 9, bars or rods 10, having racks 7 formed upon one end, eccentric 13, also secured to sleeve 9, and the cut-off valve and intermediate connections, substantially as described.

6. A cross-head for a steam-engine, composed of wedges *f*, side plates, *f'*, secured to the body of the cross-head for clamping the edges of the wedges, and pin f^4, for carrying the end of the connecting-rod, substantially as set forth.

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

ISAAC R. KERN.

Witnesses:

J. W. NORTON,

C. B. KURTZ.