3 Sheets—Sheet 1.

J. N. KAUFHOLZ.

Reciprocating Engine.

No. 197,035. Patented Nov. 13, 1877.

Fig. 1.

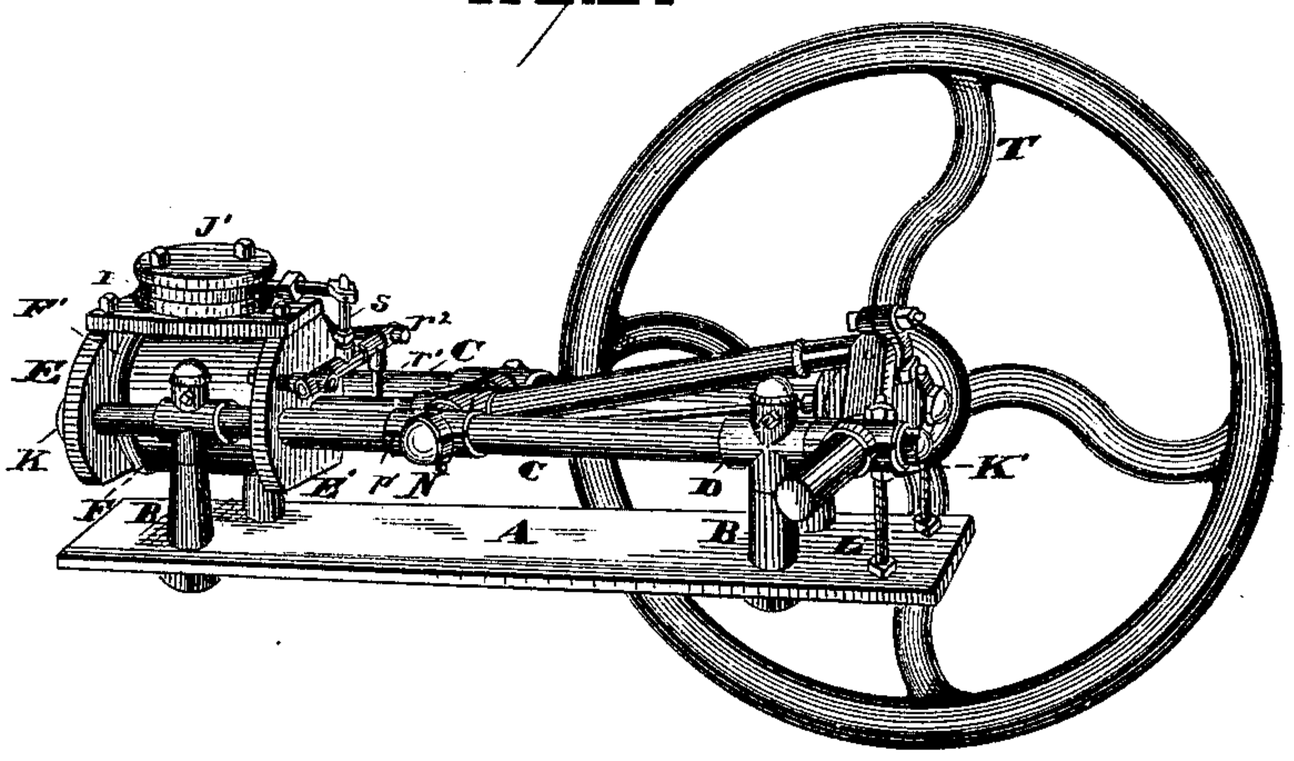
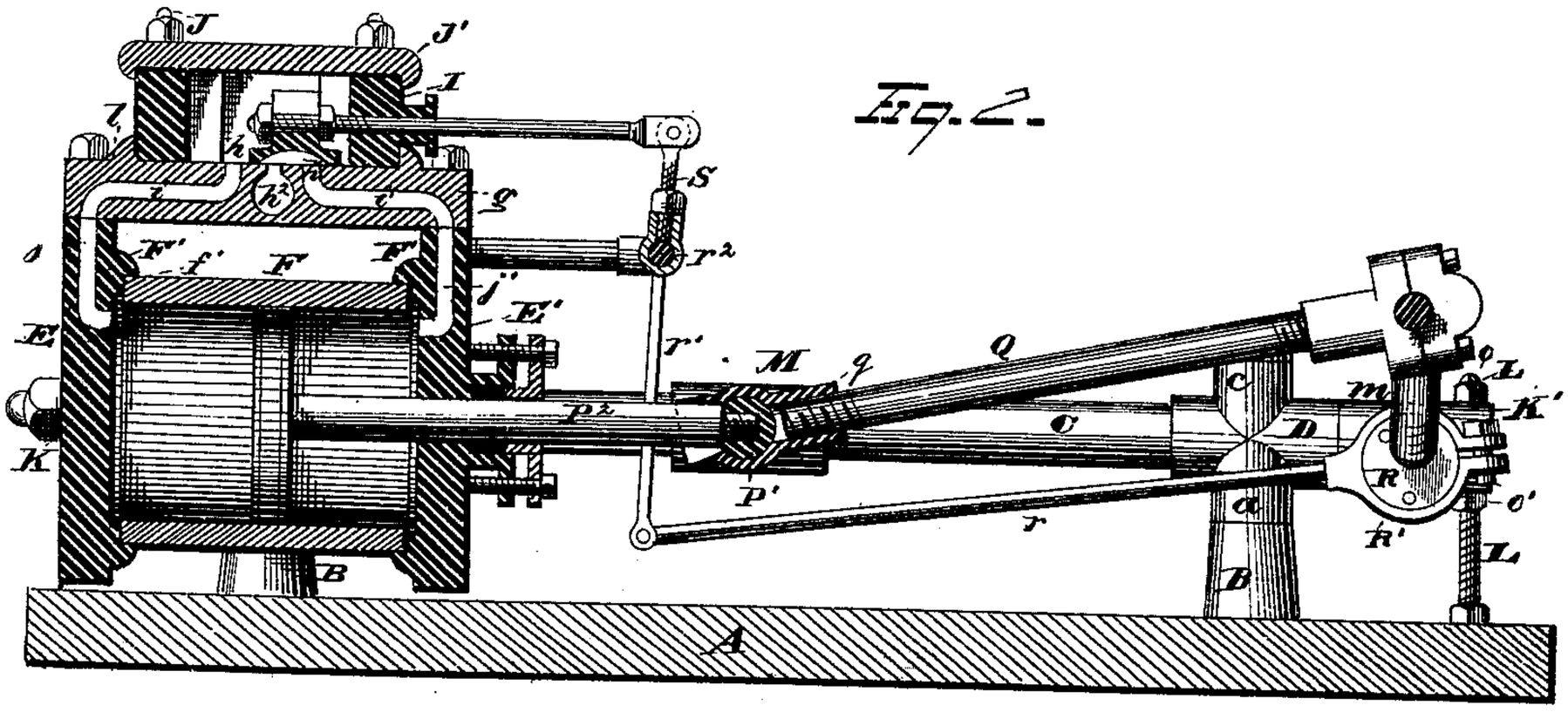


Fig. 2.



WITNESSES
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By Munn & Co
ATTORNEY

3 Sheets—Sheet 2.

J. N. KAUFHOLZ.

Reciprocating Engine.

No. 197,035. Patented Nov. 13, 1877.

Fig. 3.

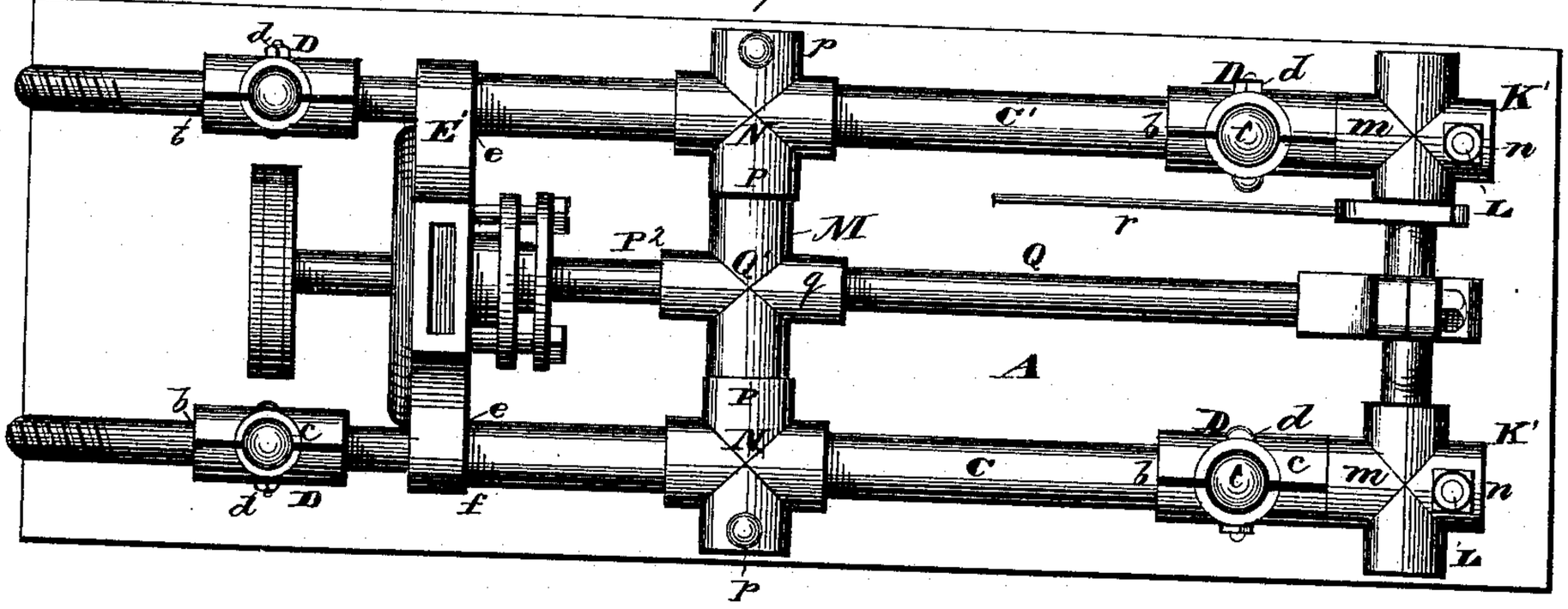


Fig. 4.

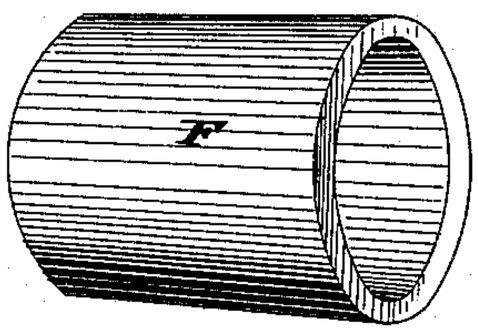


Fig. 5.

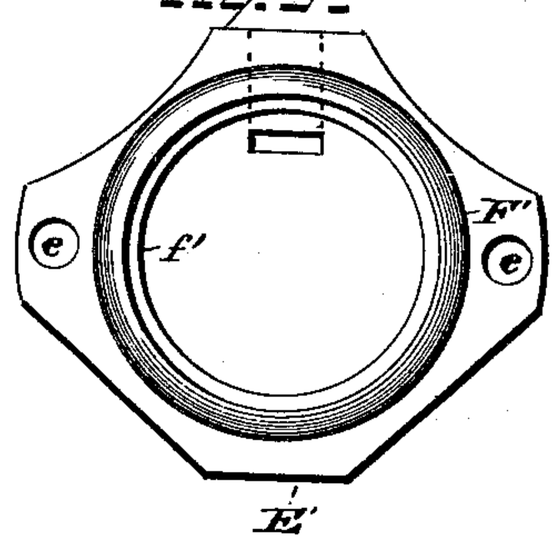


Fig. 6.

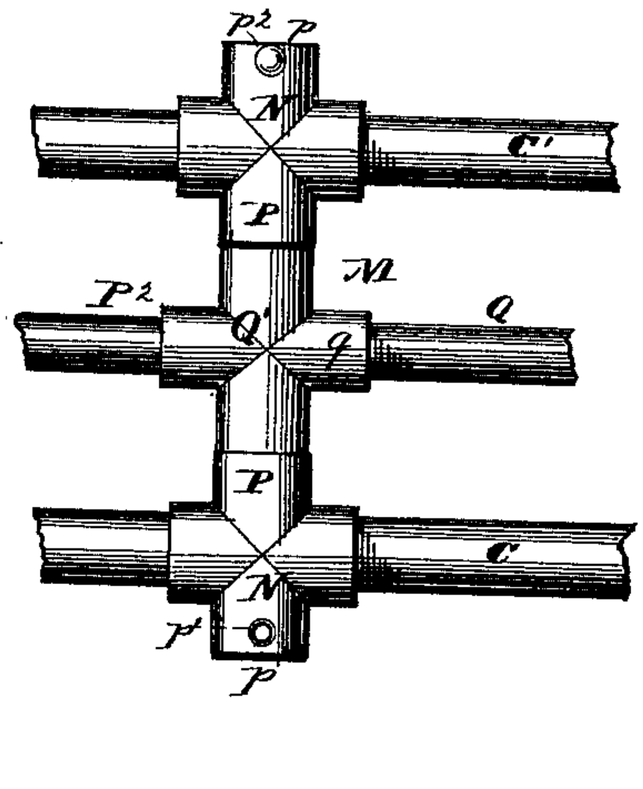
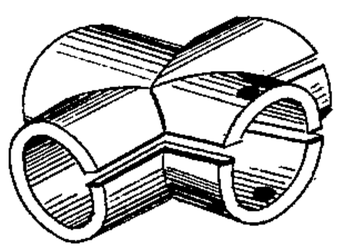


Fig. 7.



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3 Sheets—Sheet 3.

J. N. KAUFHOLZ.

Reciprocating Engine.

No. 197,035. **Patented Nov. 13, 1877.**

Fig. 8.

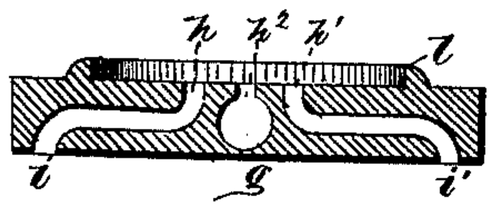


Fig. 9.

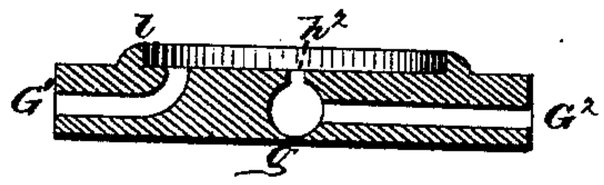


Fig. 10.

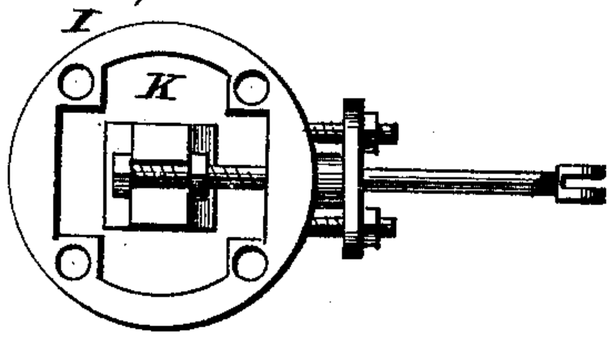
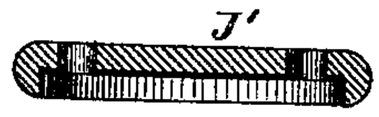


Fig. 11.



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UNITED STATES PATENT OFFICE.

JOHN N. KAUFHOLZ, OF CHATTANOOGA, TENNESSEE.

IMPROVEMENT IN RECIPROCATING ENGINES.

Specification forming part of Letters Patent No. **197,035**, dated November 13, 1877; application filed November 6, 1877.

To all whom it may concern:

Be it known that I, JOHN N. KAUFHOLZ, of Chattanooga, in the county of Hamilton and State of Tennessee, have invented certain new and useful Improvements in Steam-Engines; 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in steam-engines.

The object of this invention is to provide a steam-engine of such construction that the cylinder or barrel may be revolved between the cylinder-heads, and thereby enable the relative positions of the cylinder and piston to be readily changed, in order that the unequal wear of the piston—due to its weight resting upon the lower portion of the cylinder—may be provided for by turning the cylinder, and thus causing the lower portion of the piston to wear on different portions of the cylinder, and thus preserve the latter in its true cylindrical bore.

Again, a further object of this invention is to so construct and arrange the several parts of an engine that the cylinder-heads, cylinder-barrel, and steam-chest may be removably secured to each other by means of the guide-rods of the engine.

My invention consists, first, in a steam-engine, the combination, with independent and detachable cylinder-heads and steam-chest, of a cylinder-barrel, the latter constructed and arranged to be revolved between the cylinder-heads, to change the relative positions of the piston and cylinder-barrel, whereby the unequal wear of the piston on the cylinder—due to its weight—may be evenly distributed on all portions of the cylinder-barrel, and thus preserve the latter in its true cylindrical form.

My invention further consists in the combination, with independent cylinder-heads, each of which is provided with projecting annular seats, of flanges of an independent cylinder-barrel and guide-rods, for securing the cylinder-barrels between the cylinder-heads in any desired position.

My invention further consists in the combination, with independent cylinder-heads, each of which is provided with annular seats or flanges, having seats or ledges on their inner surfaces, of an independent cylinder or barrel, the latter being secured between the cylinder-heads in an adjustable manner by means of the guide-rods, which latter extend through the cylinder-heads, and serve to secure the same in place.

My invention further consists in the combination, with an independent cylinder or barrel, of independent cylinder-heads constructed with annular flanges or seats for retaining the cylinder against lateral displacement, each of said flanges having a ledge or seat formed on its inner surface to constitute a seat for the ends of the cylinder, and thereby permit the piston to travel the entire length of said cylinder.

My invention further consists in the combination, with a cylinder or barrel, of removable steam-chest and cylinder-heads, the latter provided with steam-passages leading to the ends of the cylinder, and guide-rods extending through the cylinder-heads, and serving to secure the same in place.

My invention further consists in the several details of construction and arrangement of parts, as will more fully appear from the following description and claims.

In the accompanying drawings, Figure 1 is a side elevation of my improved steam-engine. Fig. 2 is a vertical section of Fig. 1. Fig. 3 shows the engine with the cylinder removed therefrom. Fig. 4 is a detached view of the cylinder. Fig. 5 is a plan view of one of the cylinder-heads. Fig. 6 is a detached view of the cross-head. Fig. 7 is an enlarged view of one of the journal-bearings of the crank-shaft. Fig. 8 is a longitudinal vertical section through the valve-seat. Fig. 9 is a cross-section of the same. Fig. 10 is a plan view of the steam-chest and valve therein, and Fig. 11 is a vertical section of the steam-chest cap.

A represents the bed of the engine, and B the standards upon which the engine is supported. C represents guide-rods. These rods are supported at each end within the Greek-cross bearings D. The dependent arms *a* of bearings D are constructed with screw-threaded sockets, to receive the threaded bolts formed

on the upper ends of the several standards B. The upper portion of bearings D are divided by a longitudinal slit, *b*, and through the upper arm *c* of each of said bearings D extends an adjusting-bolt, *d*, which is provided with a tension and also a set nut.

From the above it will be observed that the bearings D are firmly seated on standards B, and the guide-rods C securely held in place within the adjustable Greek-cross bearings D.

E E′ are cylinder-heads, and F is the cylinder, which parts are held together in the following manner: Cylinder-heads E E′ are provided with holes *e*, located diametrically opposite each other, through which extend the ends of guide-rods C, the latter having shoulders *f* formed thereon, to serve as seats for the inner head E′.

Each cylinder-head is constructed with an annular flange or seat, F′, within which the end of the cylinder fits snugly, and is thereby prevented from lateral displacement. Flanges F′ are formed with ledges or seats *f′*, (preferably of less thickness than that of the cylinder,) whereby the extreme ends of the latter are kept from direct contact with the inner surfaces of the cylinder-heads, in order that the piston may make a complete stroke through the cylinder and cause an even wear throughout its entire length.

As the ledges *f′*, against which rest the ends of the cylinder, do not extend out flush with the interior surface of said cylinder, the piston is prevented from coming in contact with said ledges, although the cylinder may have been worn away to a considerable extent.

g is the valve-seat. G^1 is the steam-induction port, and G^2 the exhaust-passage. Instead of conducting the steam through passage G^1, which is located beneath the steam-chest, said passage may be formed in the cap or cover; yet it is preferable to construct the steam-passages in the manner illustrated, as it then allows a governor to be attached to the cap without inconvenience from a steam-pipe entering therein. The seat *g* is bolted through its ends to the cylinder-heads E E′. Seat *g* is provided with the steam-ports *h* h^1 and intermediate exhaust-port h^2.

Steam-passages *i i′* lead from ports *h* h^1 through the seat *g*, where they connect with steam-passages *j j′* formed in the cylinder-heads. The steam-passages *j j′* in the cylinder-heads extend below the juncture of the cylinder and cylinder-heads, to conduct the steam into opposite ends of the cylinder. When the cylinder, cylinder-heads, and steam-chest are firmly secured in place by nuts *k* on the ends of the guide-rods, the steam-passages above mentioned make tight joints, and steam is conveyed directly into the ends of the cylinder through the independent cylinder-heads.

This arrangement of parts enables the cylinder to be revolved and secured in different positions to obviate the wear of the piston on any one particular portion of the same. This result is accomplished as follows: After the engine has been running for a considerable length of time, the lower portion of the cylinder will have received greater wear than any other portion of the same, which excess of wear is due to the weight of the piston resting on the bottom of the cylinder. In order to prevent such undue wear on any particular portion of the cylinder, the bolts employed to secure the steam-chest to the cylinder-heads are first removed. Then the nuts attached to the ends of the guide-rods are loosened, and the cylinder is then free to be turned to any desired position to cause the piston to rest on a comparatively unworn portion of the cylinder. The nuts are then tightened, the steam-chest replaced and secured in position, when the engine is again ready for use. This adjustment is very readily made, and the engine can be thus kept in perfect working order without any serious delay, ordidinarily necessitated by the boring out of the cylinder.

The seat *g* is constructed with a raised annular flange, *l*, which extends above the surface of the valve-seat, and within which is seated the steam-chest I, the latter being held in place by means of the bolts J, which extend through the seat, the steam-chest, and the cap J′. The steam-chest is preferably constructed in the manner shown, the central portion K having an opening in the form of a Greek cross, which constitutes sufficient space for the free operation of the valve and induction of steam to the valve, and also affording sufficient bearing for the bolts J.

It will be observed that the steam-chest has a ground joint around the several bolts, extending vertically through the same, which thus serves to prevent the leakage of steam past such fastening-bolts.

The cap J′ is constructed with a depending annular flange, which fits over the steam-chest I.

From the above it will be observed that the several parts of the steam-chest are all adapted to be turned up in an ordinary lathe, and hence can be manufactured at a small initial cost, while every precaution is made for tight joints and durability of structure.

Another important feature of my invention relates to the guide-rods C, which serve a triple purpose: First, they together constitute the engine-frame; second, they serve the purpose of ordinary guides; third, the guide-rods serve to secure the cylinder and cylinder-heads together, in such a manner that the cylinder may be readily adjusted or removed, as may be desired.

Upon the ends of the guide-rod adjacent to the crank-shaft are secured the Greek-cross bearings K′, the arms *m* of said bearings being constructed with screw-threaded sockets which fit the correspondingly-threaded ends of the guide-rods. The ends of arms *m* are seated against the bearings attached to the standards, and hence prevent the movement of the guide-rods in one direction, while

the nuts secured to the opposite ends of said rods prevent any movement in the opposite direction. Thus the guide-rods operate to connect the cylinder and crank-shaft together, and preserve a fixed distance between all the parts of the engine, thus insuring the perfect working of the same under all circumstances.

The bearings K′ have their outer arms *n* divided by a longitudinal slit, to allow the bearing to be adjusted to compensate for wear, by means of the adjusting-bolts L, which latter pass vertically through the arms *n*, and are secured at their lower ends to the engine-bed. The upper ends of bolts L are screw-threaded, and are provided with tension and set nuts *o o′* above and below the bearing, whereby an even tension may be imparted to the upper and lower sections of the bearings.

M represents the cross-head, the bearings N of which consist of Greek-cross bearings, the outer arms *p* of which are divided by longitudinal slits p^1, and bolts p^2 extend through the same, for the purpose of contracting the bearings when worn. The inner arms P of bearings N serve as bearings for the shaft P^1, to which latter is secured the end of the piston-rod P^2, the same having a screw-threaded end, which is inserted in a screw-threaded socket formed in said shaft P^1. One end of the connecting-rod Q is attached to the crank-shaft, in the ordinary manner, while the other end is threaded and secured within the threaded socket *q* of the Greek-cross bearing Q′, which is supported on shaft P^1, between bearings N. Bearing Q′ is divided on one side by a longitudinal slit, to allow the same to be contracted by an adjusting-bolt when necessary to take up for wear.

The valve-gearing is constructed and arranged as follows: R is an eccentric, attached to the crank-shaft, and R′ is the eccentric-strap. *r* represents the eccentric-rod, one end of which is attached to eccentric-strap R′, while the other end of said rod connects with the crank r^1 of rock-shaft r^2, which latter is journaled in bearings on arms attached to the cylinder-head. Rock-shaft r^2 is provided with an arm, S, to the upper end of which is pivoted the valve-stem. All the several connections between the different parts of the valve-gearing are preferably made by means of Greek-cross bearings of the same construction as those hereinbefore referred to. T represents the fly-wheel, the driving-pulley being removed from the opposite end of the crank-shaft, in order to illustrate the journal-bearings. The several bearings may have plugs *t*, of any desired configuration, inserted in their outer arms, for the purposes of dust-guards and ornamentation, if so desired.

It is evident that many slight changes in construction and additional features might be resorted to without departing from the spirit of my invention.

In order to prevent the too rapid radiation of heat from the steam-cylinder, the same may be jacketed in the ordinary manner, or preferably the following method may be employed: The cylinder-heads may be provided with a narrow groove extending around the cylinder, and the ends of a Russia sheet-iron or other thin sheet-metal cylinder may be secured therein, said cylinder being of sufficient size to constitute an annular space around the steam-cylinder. This space may be left free, or it may be filled with any desired non-conducting substance, and thus allow the cylinder and jacket to be revolved when it is desired to alter the position of the steam-cylinder. Again, the guide-rods may be of any desired shape in cross-section, and still allow of the employment of the Greek-cross bearings on the cross-head. The seat of the steam-chest, instead of resting upon the upper portions of the cylinder-heads, may be constructed to fit snugly between the same. In such an event, the steam-passages in the cylinder-heads will extend from the inner sides of the heads, and connect with the passages leading toward the cylinder. Again, instead of using bolts to adjust the Greek-cross bearings, the adjustable arms may be provided with tapering screw-threads, and correspondingly-tapered screw-threaded caps be fitted to such arms, for the purposes of adjustment. In cases where either a bolt or cap cannot be employed, an adjustable band and set-screw may be placed on the free arm of the bearing, and the same result secured thereby.

Steam-engines constructed in accordance with my invention possess many advantages not found in engines of ordinary make. But few parts are necessary, and every part of the engine can be readily renewed at small cost. The cylinder can be quickly adjusted to distribute the wear of the piston equally on all portions of the cylinder. The piston can be readily repacked by simply removing the cylinder, which operation necessitates but the removal of the nuts on the ends of the guide-rods. All the different bearings of the engine can be kept tight by adjusting the nuts of the adjustable bolts. The bearings may be babbited, and, when unduly worn, are easily and cheaply replaced by duplicate bearings.

The guide-rods, while they serve the ordinary functions as guides for the cross-head, also serve as supports for the bearings of the crank-shaft, and, again, serve to connect the cylinder and its heads in such a manner that they may be quickly separated, when desired.

I make no claim in this application to the Greek-cross bearings *per se*, as I reserve the right to make a broad claim to the same in a separate application filed as of even date herewith; but,

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

1. A steam-engine provided with a plain cylinder, which is adapted to be revolved between the cylinder-heads, and adjusted in any desired position, said cylinder-heads being se-

cured by guide-rods which extend the entire length of the engine, substantially as set forth.

2. The combination, with independent cylinder-heads and steam-chest, of a plain cylinder, the latter being secured in any desired position by means of the guide-rods, substantially as set forth.

3. The combination of an independent steam chest and cylinder with cylinder-heads, the latter constructed with projecting annular seats or flanges, for receiving the ends of said cylinder, and guide-rods extending the entire length of the engine, and securing the cylinder and cylinder-heads in place, substantially as set forth.

4. The combination of an independent steam chest and cylinder with cylinder-heads, the latter constructed with projecting annular seats or flanges, having a seat or ledge formed on their inner surfaces, to allow the piston to make a complete stroke through the entire length of the cylinder, substantially as set forth.

5. The combination, with guide-rods extending the entire length of the engine, of independent steam-chest, cylinder, and cylinder-heads, the latter provided with steam-passages to conduct steam from the steam-chest to the ends of the cylinder, substantially as set forth.

6. The combination, with the valve-seat constructed with a raised annular flange, of a cylindrical steam-chest and chest-cap, the several parts being secured together by bolts extending through the seat, chest, and cap, substantially as set forth.

7. An engine provided with guide-rods, which serve to support the bearings for the crank-shaft at one end, and the opposite ends to connect the cylinder-heads, substantially as described.

8. The combination, with guide-rods which extend the entire length of the engine and secure the cylinder-heads in place, of a cross-head, provided with Greek-cross bearings, substantially as set forth.

9. The combination, with guide-rods which extend the entire length of the engine and secure the cylinder and cylinder-heads in place, of a cross-head, consisting of a shaft journaled in adjustable Greek-cross bearings, substantially as set forth.

10. The combination, with guide-rods which extend the entire length of the engine and secure the cylinder and cylinder-heads in place, of a cross-head, consisting of a shaft journaled in adjustable Greek-cross bearings, and the connecting-rod secured to a Greek-cross bearing sleeved on said cross-head shaft, substantially as set forth.

11. The combination, with guide-rods constructed with shoulders to form seats for one cylinder-head, of removable cylinder, cylinder-heads, and steam-chest, substantially as set forth.

12. The combination, with guide-rods extending the entire length of the engine, of standards for supporting said rods, and the crank-shaft journaled in Greek-cross bearings, which latter are seated against said standards, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of November, 1877.

JOHN N. KAUFHOLZ.

Witnesses:

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A. W. BRIGHT.