

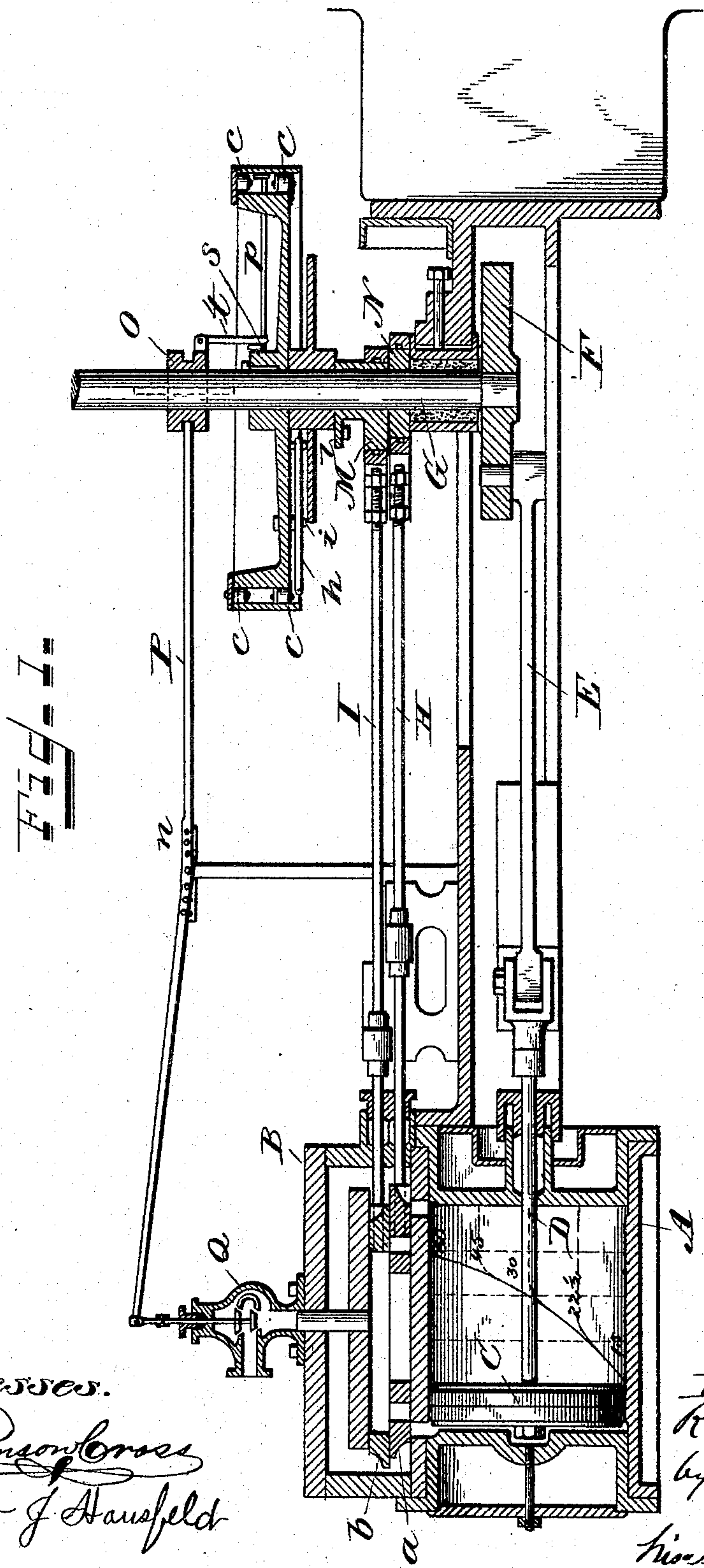
(No Model.)

2 Sheets—Sheet 1.

R. D. WERDEN.
STEAM ENGINE.

No. 500,749.

Patented July 4, 1893.



Witnesses.

Thompson & Cross
Bernard J. Hausfeld

Inventor:
R. Davis Werden
by Chas. M. Beck
his Attorney.

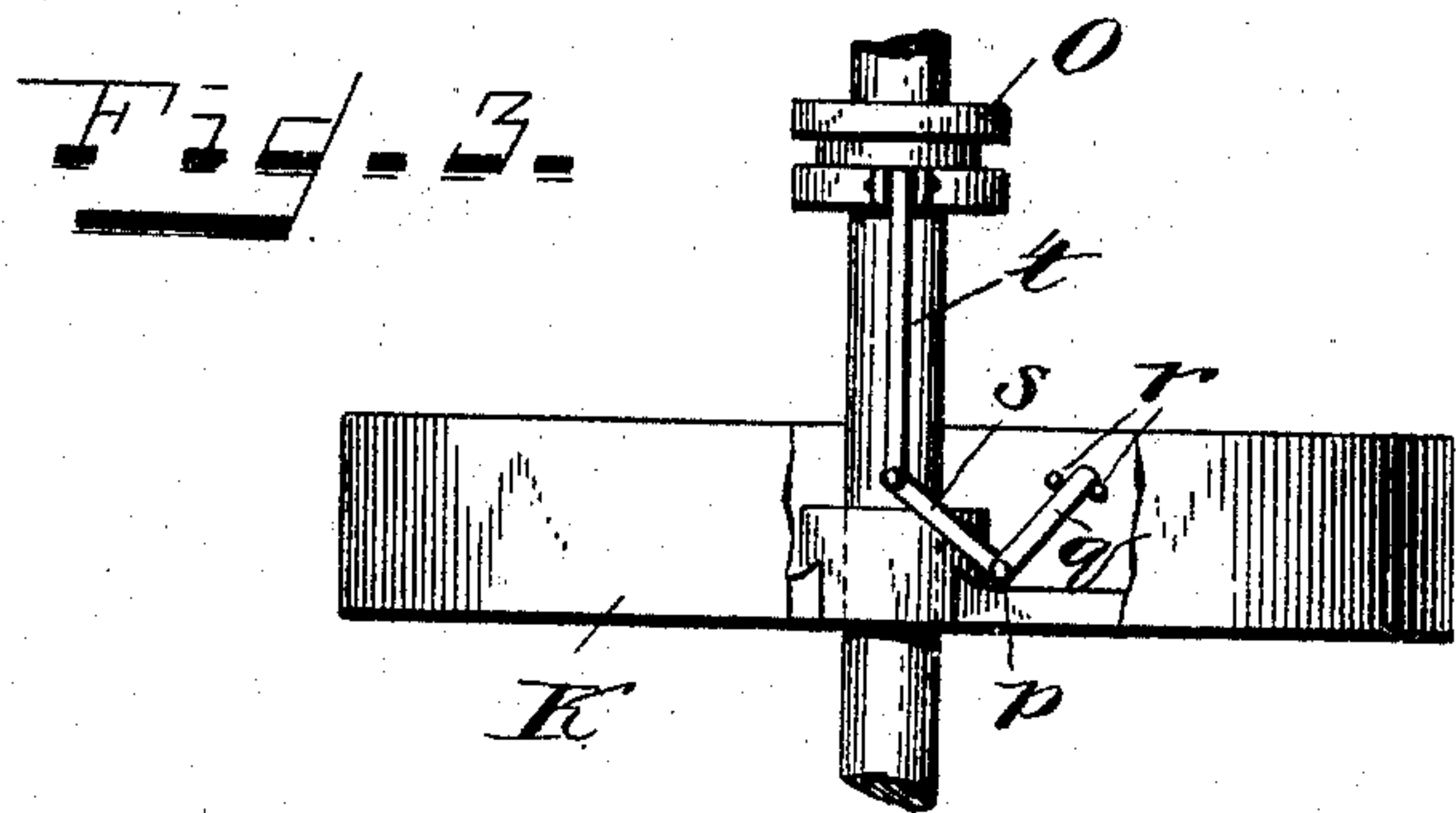
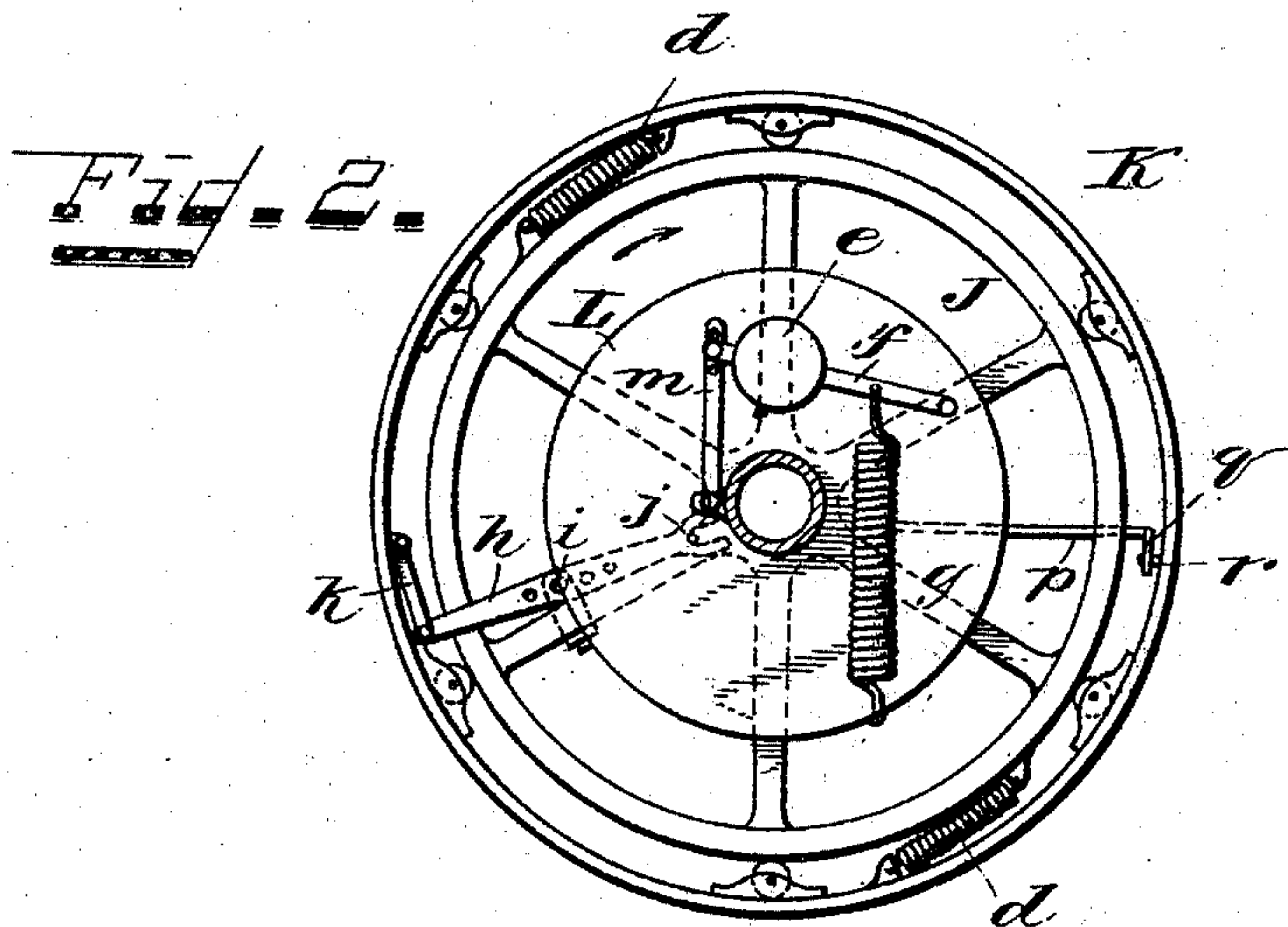
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UNITED STATES PATENT OFFICE.

RODOLPHUS DAVIS WERDEN, OF CINCINNATI, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 500,749, dated July 4, 1893.

Application filed December 9, 1892. Serial No. 454,673. (No model.)

To all whom it may concern:

Be it known that I, RODOLPHUS DAVIS WERDEN, a subject of the Queen of Great Britain, residing at Cincinnati, in the county of Hamilton and State of Ohio, 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 part of this specification.

My invention relates to all classes of stationary engines but is more particularly designed for those engines requiring a uniformity of speed under varying loads, and it has for its object the improved performance of such engines whereby there are secured an economy of steam, uniformity of speed under variable loads, the prevention of undue valve leakage, the prevention of terminal pressures below any back pressure, and the prevention of undue cylinder condensation.

The novelty of my invention will be hereinafter set forth and specifically pointed out in the claims.

In the accompanying drawings:—Figure 1, Sheet 1, is a sectional plan view of an engine embodying my invention. Fig. 2, Sheet 2, is an elevation of the governor, fly, and belt wheels taken on the dotted line *xx* of Fig. 1. Fig. 3, Sheet 2, is a plan view of Fig. 2 looking at the same in the direction of the arrow at the right, and with portions broken away to show the shifting mechanism for the valve controlling the admission of steam to the cylinder.

The same letters of reference are used to indicate identical parts in all the figures.

The construction of the engine, except in the particulars to be pointed out, may be that usually employed or it may be of any desired construction, and it is only necessary in describing it to say that, A is the cylinder, B the steam chest, with the usual ports and with slide valve *a* and cut off slide *b*, C the piston in the cylinder, D its rod, E the pitman, F the crank or crank disk, G the driving shaft, and H I the eccentric rods for the slide valve and cut off, respectively. The fly wheel J is fast on the shaft G and has secured upon it in the usual or any suitable manner the yielding driving wheel K with interposed bearing rollers *c* and connecting springs *d*, Fig. 2. Loose

on the shaft G beside the wheel J is the usual or any suitable governor wheel L with weight *e*, pivoted weighted arm *f* and spring *g*. A lever *h* Fig. 2, adjustably pivoted as at *i* to the fly wheel arm has its inner end pivoted to the governor wheel as at *j* and its outer end pivotally connected, in this instance by a pivoted link *k*, to the wheel K. Likewise loose upon the shaft G by the side of the governor wheel is the eccentric M for the cut off rod I while the eccentric N for the slide valve rod H is fast on the shaft G. The eccentric M has a hub with a projecting lug *l* which is adjustably and pivotally connected by a link *m* to the outer end of the weight arm *f*.

Feathered upon the shaft G is a collar O, Figs. 1 and 3 having a circumferential groove in which is confined the fork of a lever P pivoted as at *n* and suitably connected at its rear to the adjustable stem of the steam controlling valve Q, in this instance represented as an ordinary puppet valve, for admitting steam to the steam chest. Suitably journaled in the fly wheel, in this instance on its hub and through its rim, is a radial rod *p* having its outer end bent to form a crank *q* engaged by pins *r* on the inner side of the wheel K, see Figs. 2 and 3, and having its inner end bent to form a crank *s* which is pivotally connected by a link *t* to the collar O.

The adjustment of the parts is such that when steam is shut off and the engine at rest the springs *d* exerting their force on the rod *p* throw the collar outward so as to nearly but not entirely close the valve *q*. The eccentrics M N are properly adjusted to each other, and the weight *e* is drawn in. The wheel K is belted to the load and we will suppose the engine to be started by the admission of steam through the slightly open valve Q. The first effect would be the compression of the springs *a* the wheel K standing still for an instant, and the drawing in of the collar O thereby opening valve Q to an extent proportionate to the load. At the same time, and by the same relative movements of the wheels J and K the governor wheel is turned forward by lever *h* thereby shifting, through medium of link *m*, the eccentric M to such a position that the cut off *b* does not interfere with the full action of the slide valve. As the wheel K begins to turn and the inertia of the load is over-

come the wheel K is shifted forward by the action of the spring d thereby closing down the valve Q to admit less steam and bring the eccentric M into such position that the cut off

5 comes into play to cut off at any desired portion of the stroke so that the steam acts on the piston by its expansion alone but never to such a degree that it gets below back pressure at the termination of the stroke. Should

10 the speed increase beyond the normal degree desired the action of the weight e will so further shift the eccentric as to cause the cut off to act quicker and thereby prevent the acceleration of the speed. The moment however

15 an extra load comes on, the wheel K again shifts relatively to J by being retarded and the valve Q and eccentric M are again acted on to admit proportionate pressure, which is again gradually cut off as the conditions and

20 adjustments again become normal, and to cause the cut off to act quicker. In this way and by the use of these compound governors the action of the engine is entirely automatic in controlling the proper minimum amount of

25 steam and the speed, no matter how the load may be varied. In this way also the cut off is made to act in opposition to its former plan of use, for with my construction the greater the load the quicker the cut off is made.

30 By way of illustration of the action of the cut off with variable loads I have shown an indicator diagram in Fig. 1, where it is assumed that the initial pressure at the beginning of the stroke is sixty pounds, and the cut

35 off is made at quarter stroke. Under these conditions the pressure at quarter stroke when cut off is made, would be sixty pounds; at half stroke it would be thirty pounds; at three quarters stroke it would be twenty-two and

40 one-half pounds, and at the termination of the stroke fifteen pounds or atmospheric pressure, or very slightly above this. Now supposing the load to be decreased so as to close valve Q to admit thirty pounds the eccentric

45 M would then be adjusted by lever h to cut off at half stroke and pressure there would still be thirty pounds, and at three quarter stroke it would be twenty-two and one-half pounds, and at the end of the stroke fifteen

50 pounds, or slightly above as before.

While the greatest benefit of my invention comes from controlling the cut off both by the load and the speed, in connection with a throt-

ling governor, yet a large part of the benefit of my invention could be obtained by disconnecting the wheel K from the eccentric M, 55 through the medium of the governor wheel L, and making the latter fast to the shaft G or wheel J. In such case the eccentric M would only be adjusted by the speed, as will be readily understood; and while I have shown suitable mechanisms for connecting the load wheel and shaft wheel with the throttling governor and with the governor wheel and eccentric for the cut off I do not wish my invention 65 to be limited to these constructions as they might be varied in a variety of ways.

Having thus fully described my invention, I claim—

1. In an engine, the combination with a load 70 governor mechanism and throttle valve actuated thereby, of a variable cut off controlled by the speed.

2. In an engine, a variable cut off, a speed governor mechanism, a load wheel and shaft 75 wheel with interposed throttle valve mechanism actuated by their relative shifting, a connection between the load wheel and variable cut off, and a connection between the speed governor and variable cut off, whereby the engine is caused to run with uniform speed under 80 varying loads, substantially as described.

3. In an engine, a variable cut off, a speed governor mechanism, a load wheel and shaft 85 wheel with interposed throttle valve mechanism actuated by their relative shifting, an eccentric for said cut off loose on the shaft, a connection between the load wheel and eccentric, and a connection between the speed governor and eccentric, substantially as described. 90

4. In an engine, the combination of a slide valve, a cut off valve, a throttling valve for the steam chest, a load wheel and shaft wheel with interposed mechanism for actuating the 95 throttling valve controlled by their relative shifting, a speed governor an eccentric loose on the shaft for the cut off valve, a connection between the load wheel and said eccentric, and a connection between the speed governor and said eccentric, substantially as described. 100

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Witnesses:

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