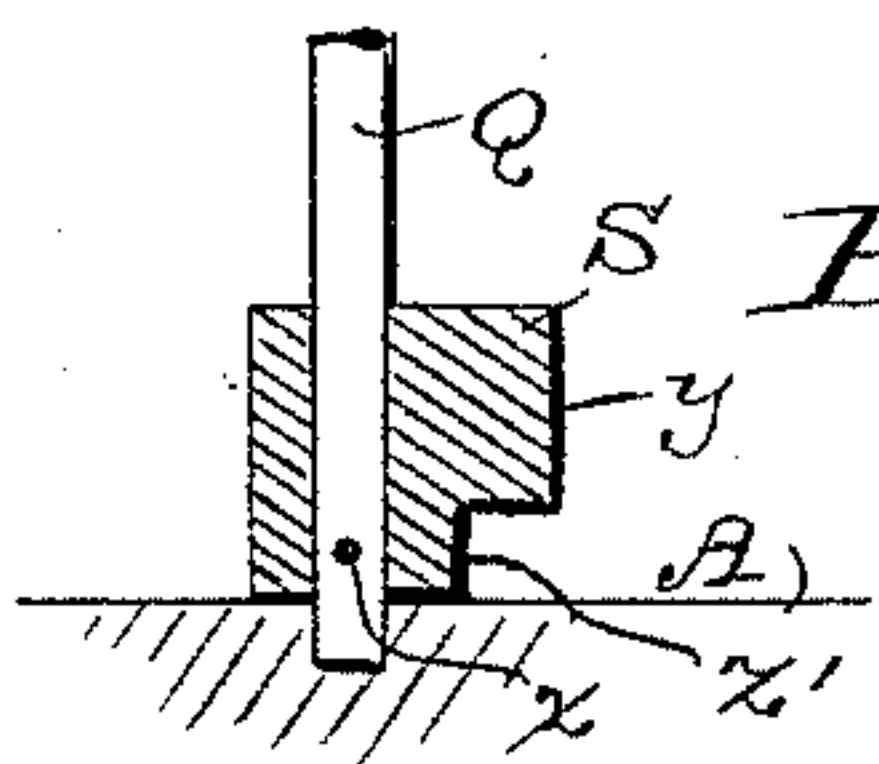
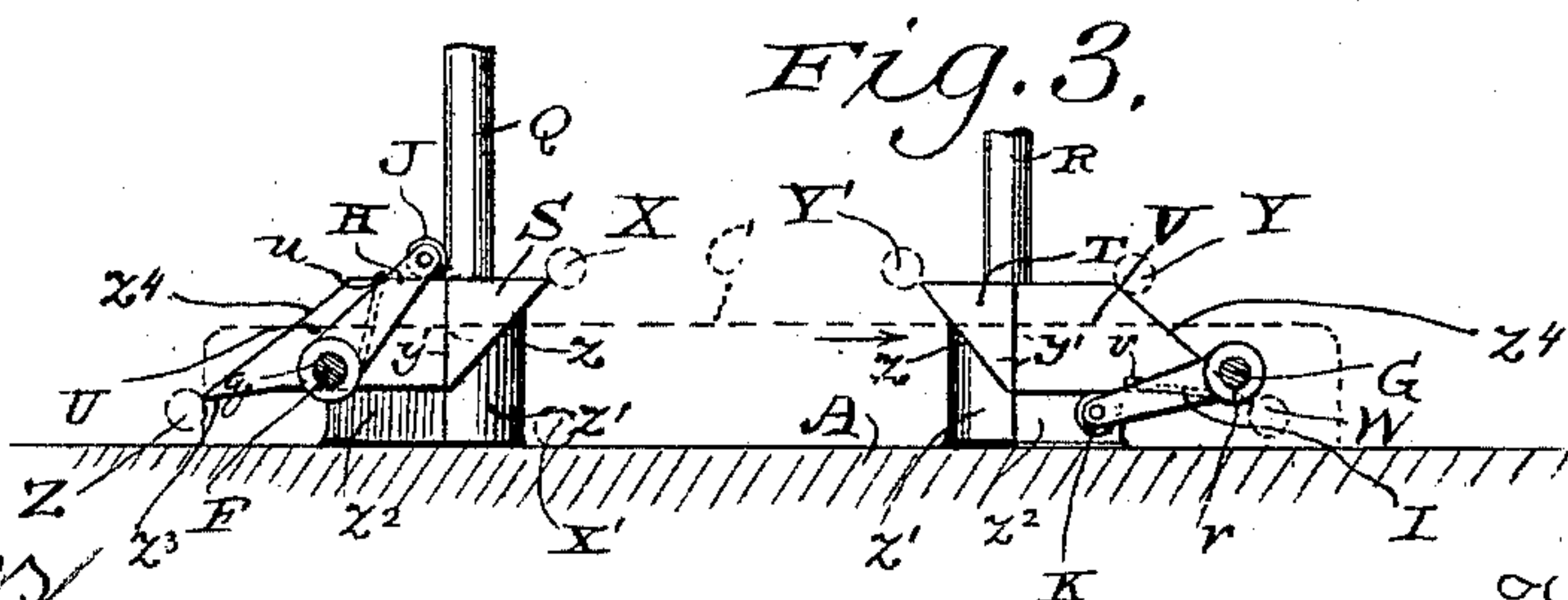
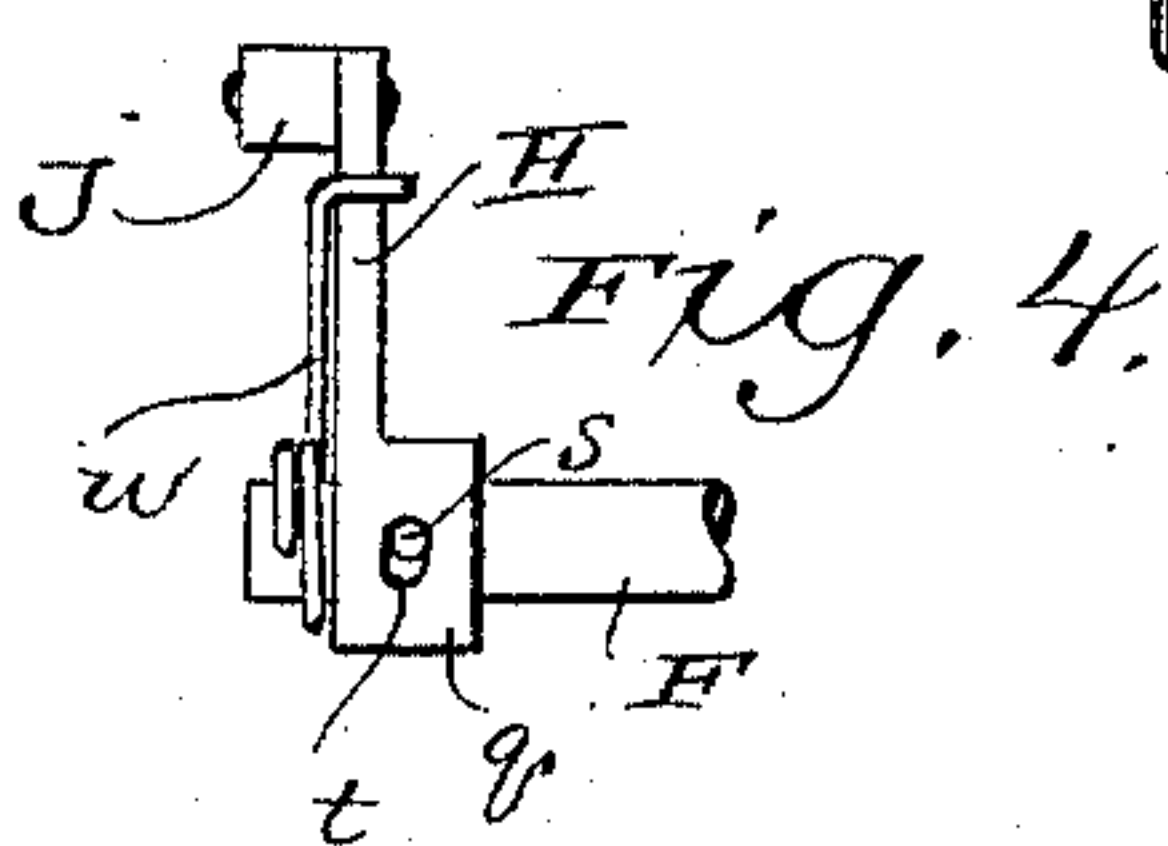
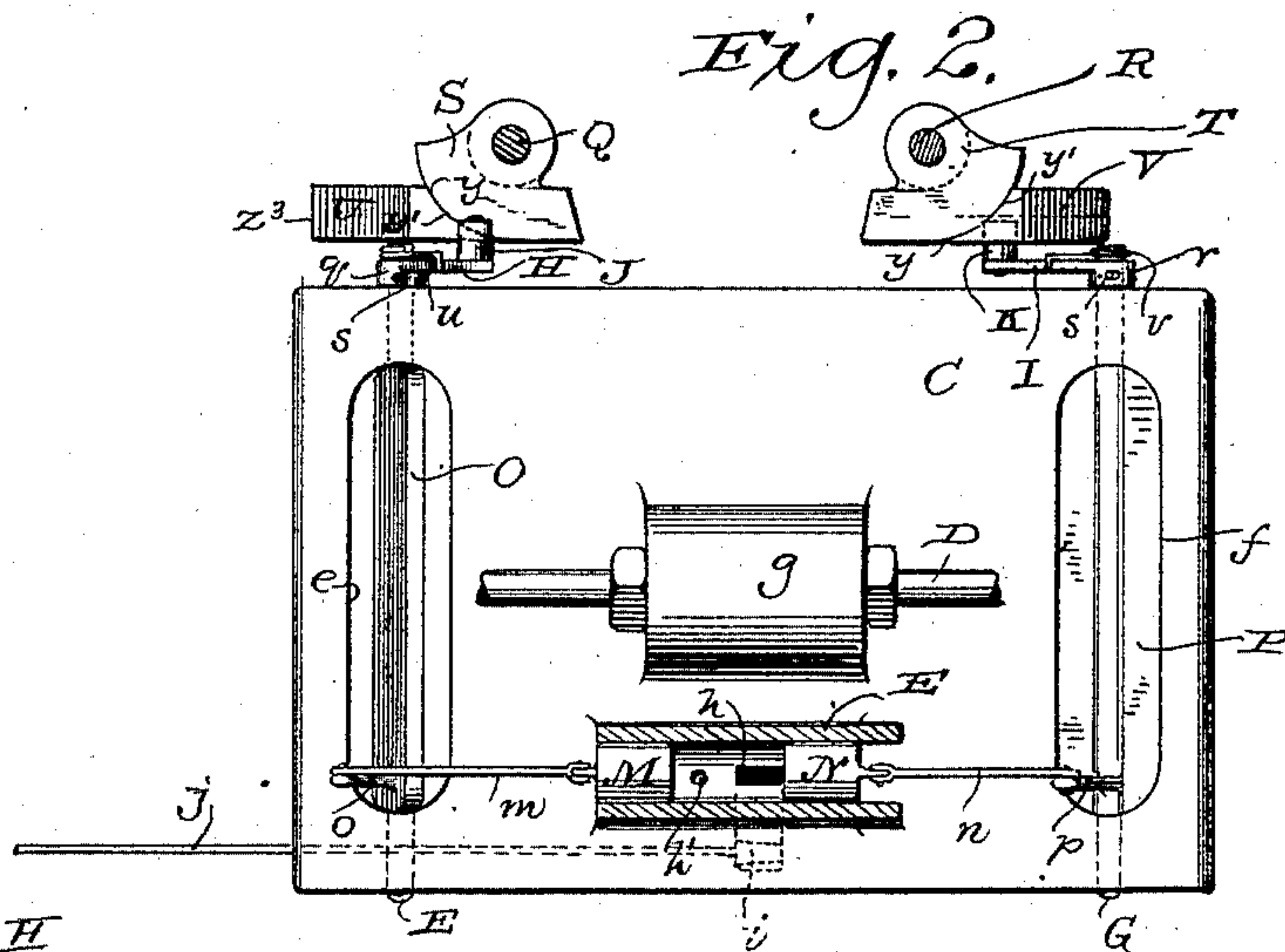
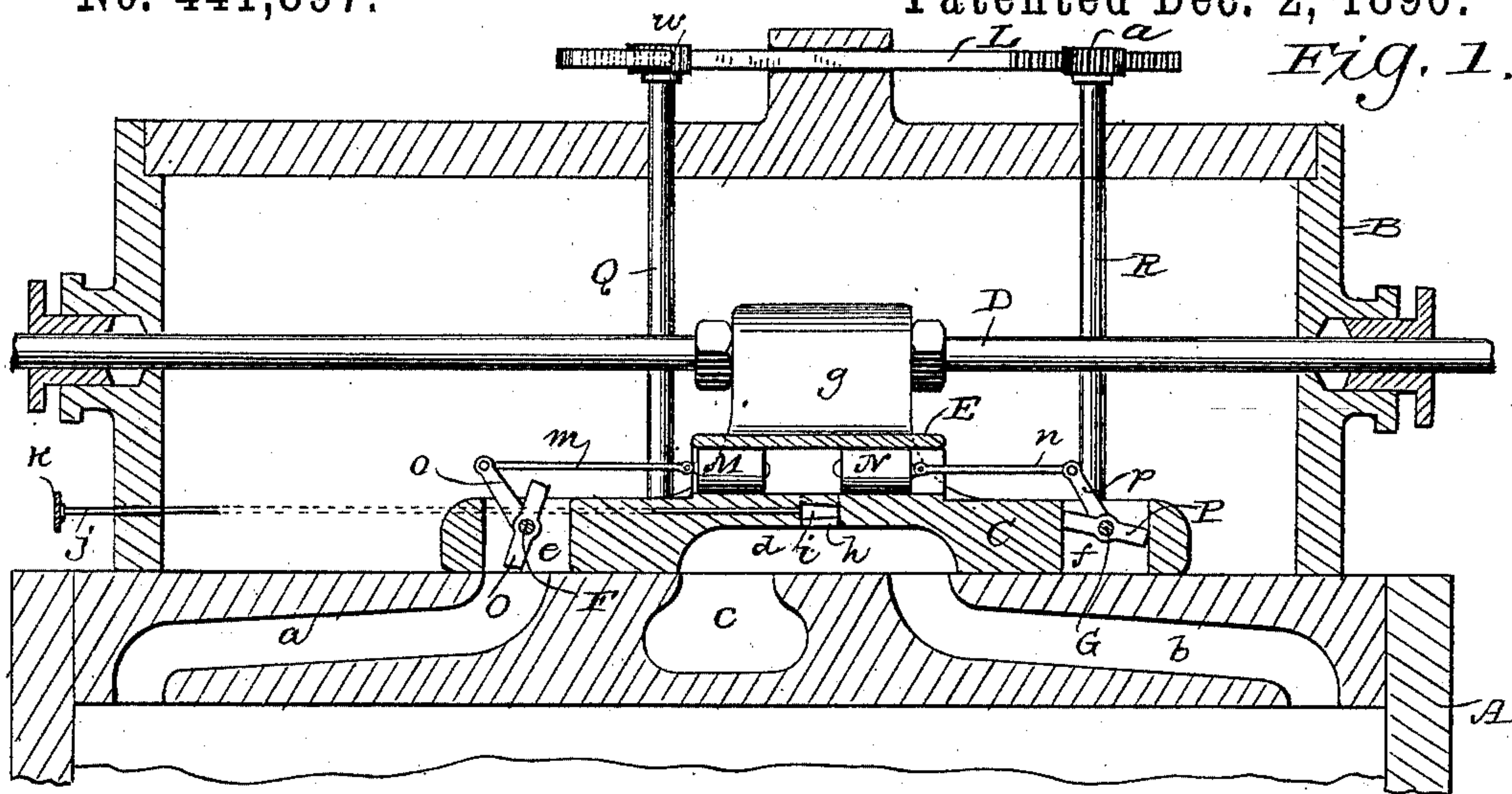


A. F. RADANT.  
STEAM ENGINE VALVE.

Patented Dec. 2, 1890.



Witnesses

Geo. W. Young.

Wm. Kellogg

Inventor

August F. Radant

By Stout & Underwood  
Attorneys



# UNITED STATES PATENT OFFICE.

AUGUST F. RADANT, OF WAUSAU, WISCONSIN, ASSIGNOR OF ONE-HALF TO  
AUGUST BRAATZ, OF SAME PLACE.

## STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 441,897, dated December 2, 1890.

Application filed August 12, 1889. Serial No. 320,498. (No model.)

*To all whom it may concern:*

Be it known that I, AUGUST F. RADANT, of Wausau, in the county of Marathon, and in the State of Wisconsin, have invented certain  
5 new and useful Improvements in Steam-Engine Valves; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to steam-engine valves; and it consists in certain peculiarities of construction, as will be fully set forth hereinafter and subsequently claimed.

In the drawings, Figure 1 is a vertical longitudinal section through a portion of a cylinder and steam-chest with my improved valve attached thereto. Fig. 2 is a plan view, partly  
15 in section, of my improved device. Figs. 3, 4, and 5 are detail views of the cams which control the butterfly-valves.

20 My invention is especially well adapted for the conversion of ordinary slide-valve engines, already in existence, into improved engines containing butterfly-valves, (in combination with said slide-valves, as hereinafter  
25 described,) although of course it will be understood that I propose to build entirely new engines from my present pattern, also; but in view of the well-known construction of slide-valve engines I have only deemed it necessary to illustrate so much thereof as pertains  
30 to my present improvement.

A represents the upper portion of a steam-cylinder, and B a steam-chest, both of ordinary construction, the former having inlet-  
35 ports *a b* and exhaust-port *c*.

C is a slide-valve having a passage *d* connecting the exhaust with either one of the inlet-ports, and openings *e f*, forming communications between the steam-chest and  
40 either one of the said inlet-ports, according to the position of the slide-valve. A bracket *g*, rising from the slide-valve, receives the valve-rod D thereof, which is secured in any ordinary manner, and which passes out of  
45 the steam-chest through ordinary stuffing-boxes, as shown, and on one side of this bracket is a supplementary cylinder E, from which a passage *h* leads to the before-named passage *d* in the slide-valve, and which former  
50 passage is provided with a valve *i*, having an operating-rod *j* extending out through the

steam-chest, and having a hand-wheel *k* to turn the same.

Within the supplementary cylinder E are two plungers M N, pivotally connected to links  
55 *m n*, respectively, which in turn are similarly connected to arms *o* and *p*, rising rigidly from the butterfly-valves O and P, and the shafts or journals E G of these butterfly-valves have suitable bearings in the slide-valve C, their  
60 ends extending beyond the rear wall of said slide-valve and there receiving the hubs *q r* of arms H I, (said hubs fitting loosely on said shafts and being connected thereto by pins  
65 *s*, having limited play in slots *t*, formed in said hubs, as best shown in Fig. 4,) which arms carry anti-friction rollers J K, there being  
70 springs *u v* fast on the ends of the shafts E G, and whose free ends bear on the arms H I and tend to force them and their anti-friction rollers downward, as hereinafter explained.

Q and R are vertical shafts stepped in and rising from the head of the steam-cylinder A back of the slide-valve C, and carrying, in the preferred form shown, pinions *w w* at their  
75 upper ends, by means of which they are united by the yoke L, having rack-teeth formed on its inner surface to mesh with the teeth of said pinions, so that the two vertical shafts shall always revolve or partly rotate together,  
80 (though in opposite directions in the illustration given,) and hence it is obvious that they may be linked together in any manner that will accomplish this result. On these shafts  
85 Q and R are the cams S and T, made fast, as by pin *x*, (shown in Fig. 5,) so as to revolve therewith, and these cams have a rounded front edge *y*, a downwardly-inclined under  
90 inner edge *z*, and a lower reduced rounded hub *z'*.

U V are stationary cams rising from the head of the steam-cylinder A, each having a rounded inner edge *y'* (corresponding to the rounded edge *y* of the movable cams) and a  
95 lower front recess or shoulder *z''*, and a downward and outward incline *z'''* from the lower surface to the end, and above this an upward and inward end incline *z''''* at the same angle as that of the edge *z* of the movable cams, all  
100 as plainly shown in the detail view, Fig. 3.

In the operation of my device the steam in the steam-chest B will everywhere exert an



equal pressure against the butterfly-valves O P in the openings *e f* in the slide-valve and against the plungers M N in the supplementary cylinder E, which cylinder contains a certain amount of steam, (which leaks in past the plungers,) as well as air admitted thereto through the passages *d h* from the cylinder A, governed by the valve *i*, forming a resistance or cushion to the progress of the plungers.

The action of the steam in closing the butterfly-valves is controlled by the hereinbefore-named cams, as follows: The anti-friction rollers J K are on the ends of arms H I, secured, as described, to the shafts E G of the said butterfly-valves O P, and when the parts are in the position shown in the drawings, the roller K is down in position to move along in the recess  $z^2$  of the cam V, the butterfly-valve P being closed, while the roller J is on top of the cam U, the butterfly-valve O being open and moving toward the center of the steam-chest until the roller J reaches the point indicated by the dotted circle X and the roller K reaches the point indicated by the dotted circle W, there being play enough (by reason of slot *t* and pin *s*) to permit said roller K to ride over the downwardly-inclined end  $z^3$  on the lower surface of the stationary cam V, and then the action of the spring *v* will force said roller K upward around the point and just in position to ascend the incline  $z^4$  of cam V, the passage *e* being meanwhile in register with the inlet-port *a* of the steam-cylinder, while the passage *f* is over a portion of the solid head of said cylinder, and hence cut off. At this moment the pressure of the steam in the steam-chest B against the head of the plunger M will force the same inward into the supplementary cylinder E and close valve O, and the roller J will drop down to the point indicated by the dotted circle X'. As the slide-valve O starts to move to the other side, the roller K is thereby pulled up the incline  $z^4$  of cam V to the point indicated by the dotted circle Y, and the arm I of said roller thereby opens the butterfly-valve P, and this action (by means of the arm *p* and link *n*) draws the plunger N out to the end of the supplementary cylinder E against the pressure of the steam in the steam-chest, (the passage *f* and inlet-port *b* being in register,) until the roller K has traveled to the point indicated by the dotted circle Y' and the roller J to the point indicated by the dotted circle Z, when the pressure of the steam against the head of the flange N will force the plunger inward and close the butterfly-valve P, and the roller J will be in position to ride up the incline  $z^4$  of the cam U and repeat the just-described operation.

By means of turning the valve *i* more or less the pressure in the space in the cylinder E between the plungers M N is regulated to a nicety and by reason of the described arrangement of movable and stationary cams the length of travel of the anti-friction rollers

is adjusted, and hence the length of time that the butterfly-valves are held open and closed, respectively, is determined. This adjustment is automatic, as by reason of the attachment of a governor (not shown) of any preferred construction to the yoke L or other connection of the vertical cam-shafts, and as the speed of the engine increases, the path of travel of the rollers on the cams will shorten, (as the cams contract,) and thus permit a quicker movement of the butterfly-valves, and as the engine goes slower the movable cams will spread and increase the length of the path of travel of the said rollers and cause a corresponding slower movement of the butterfly valves.

I have not deemed it necessary to illustrate the attachment of a governor to my cam-shafts, as my cams may be expanded or contracted in any preferred manner.

There may be another passage from the cylinder E to the exhaust, with a check-valve placed therein (indicated by the circle *h'*) to prevent a vacuum in said cylinder each time a plunger is rapidly drawn out at the opening of the butterfly-valves.

My butterfly-valves serve to cut off the steam at any point of the piston-stroke, admitting just the amount of steam required in the cylinder to overbalance the load attached to the engine and keep the same in regular motion.

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

1. In a steam-engine, the combination, with the steam-cylinder having inlet and exhaust ports, and the steam-chest, of a slide-valve having openings adapted to alternately register with said inlet-ports, and a passage connecting either one of said inlet-ports with the exhaust-port, butterfly-valves located in said openings and mounted on shafts extending through said slide-valve, cams located adjacent to said slide-valve, and arms attached to the shafts of the butterfly-valves and adapted to travel over and around said cams, substantially as set forth.

2. In a steam-engine, the combination, with the steam-cylinder having inlet and exhaust ports, and the steam-chest, of a slide-valve having openings adapted to alternately register with said inlet-ports, and a passage connecting either one of said inlet-ports with the exhaust-port, butterfly-valves located in said openings and mounted on shafts extending through said slide-valve, expansible and contractible cams located adjacent to said slide-valve and connected so as to revolve or partially rotate together, and arms attached to the shafts of the butterfly-valves and adapted to travel over and around said cams, substantially as set forth.

3. In a steam-engine, the combination, with the steam-cylinder having inlet and exhaust ports, and the steam-chest, of a slide-valve having openings adapted to alternately register



ter with said inlet-ports, and a passage connecting either one of said inlet ports with the exhaust-port, butterfly-valves located in said openings and mounted on shafts extending  
5 through said slide-valve, cams located adjacent to said slide-valve, arms attached to the shafts of the butterfly-valves and adapted to travel over and around said cams, a supplementary cylinder moving with the slide-  
10 valve and having a valve-controlled passage leading thereto, and plungers working in said supplementary cylinder and linked to said butterfly-valves, substantially as set forth.

4. In a steam-engine, the combination, with  
15 the steam-cylinder having inlet and exhaust ports, and the steam-chest, of a slide-valve having openings adapted to alternately register with said inlet-ports, and a passage connecting either one of said inlet-ports with the  
20 exhaust-port, butterfly-valves located in said openings and mounted on shafts extending

through said slide-valve, expansible and contractible cams located adjacent to said slide-valve and connected so as to revolve or partially rotate together, arms attached to the  
25 shafts of the butterfly-valves and adapted to travel over and around said cams, a supplementary cylinder secured to the slide-valve and having a passage leading to the latter, an adjustable valve in said passage having an  
30 operating-rod extending through the steam-chest, and plungers working in said supplementary cylinder and linked to said butterfly-valves, substantially as set forth.

In testimony that I claim the foregoing I  
35 have hereunto set my hand, at Wausau, in the county of Marathon and State of Wisconsin, in the presence of two witnesses.

AUGUST F. RADANT.

Witnesses:

JOHN LIVERMORE,  
SAM KRIDER.