

(Model.)

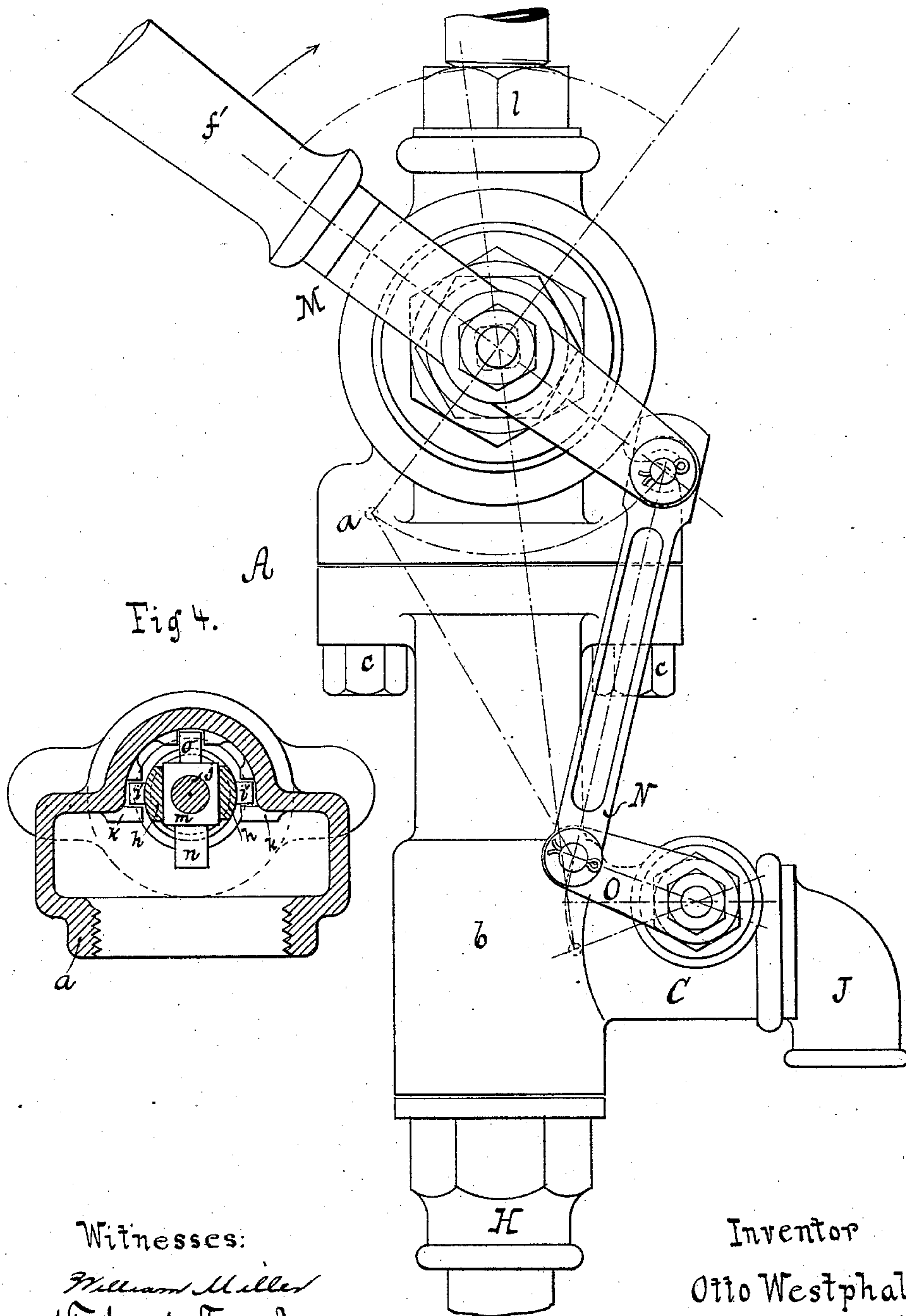
3 Sheets—Sheet 1.

O. WESTPHAL.  
INJECTOR.

No. 312,591.

Patented Feb. 17, 1885.

Fig. 1.



Witnesses:  
*William Miller*  
*A. Faber du Tour. Jr.*

Inventor  
*Otto Westphal*  
by *Van Santvoord & Hauff*  
his Attorneys

(Model.)

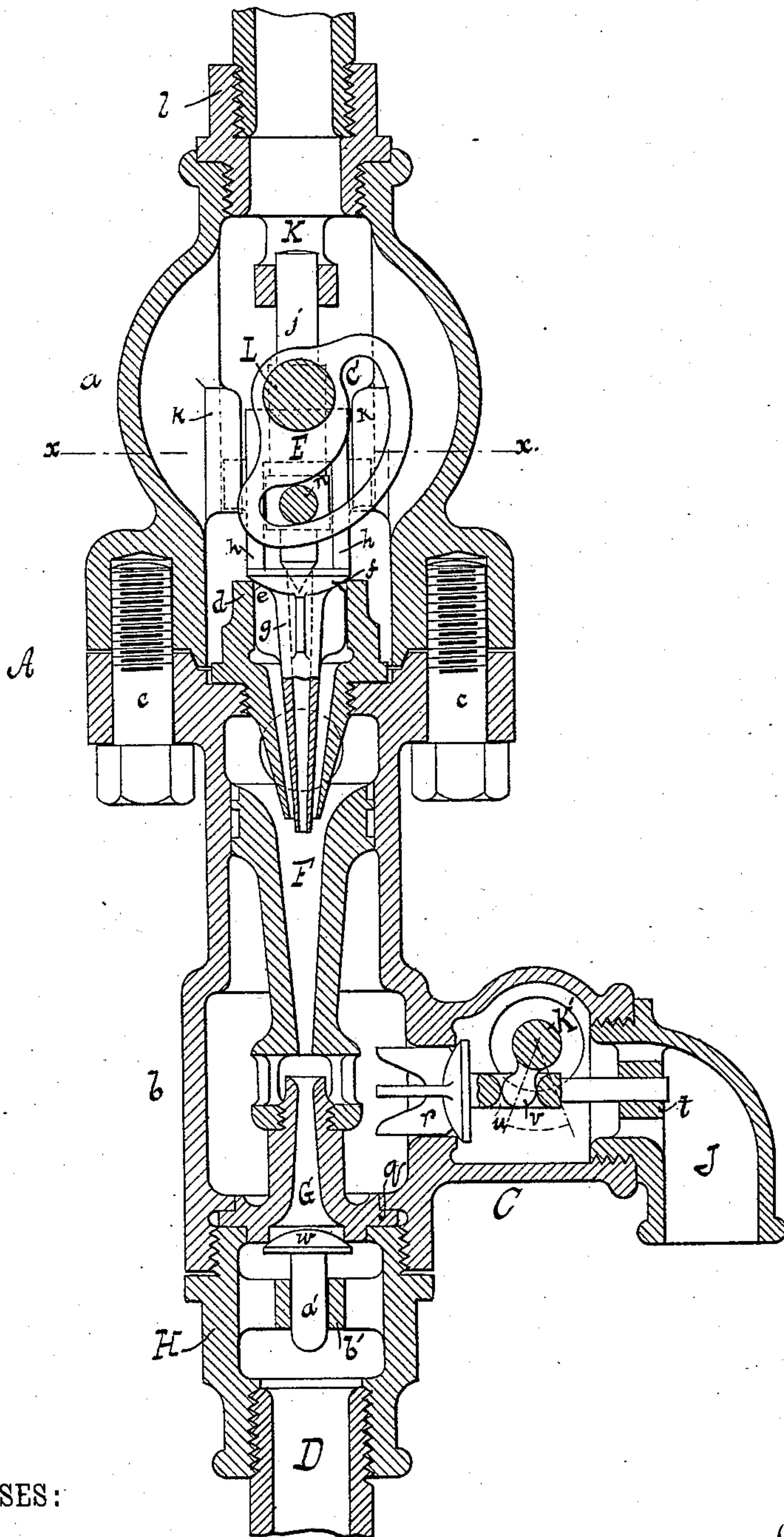
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Fig. 2.



WITNESSES:

*William Miller*  
*Alfred du Faur, Jr.*

INVENTOR

*Otto Westphal.*

BY

*Van Gortvoord & Hauff*

ATTORNEYS

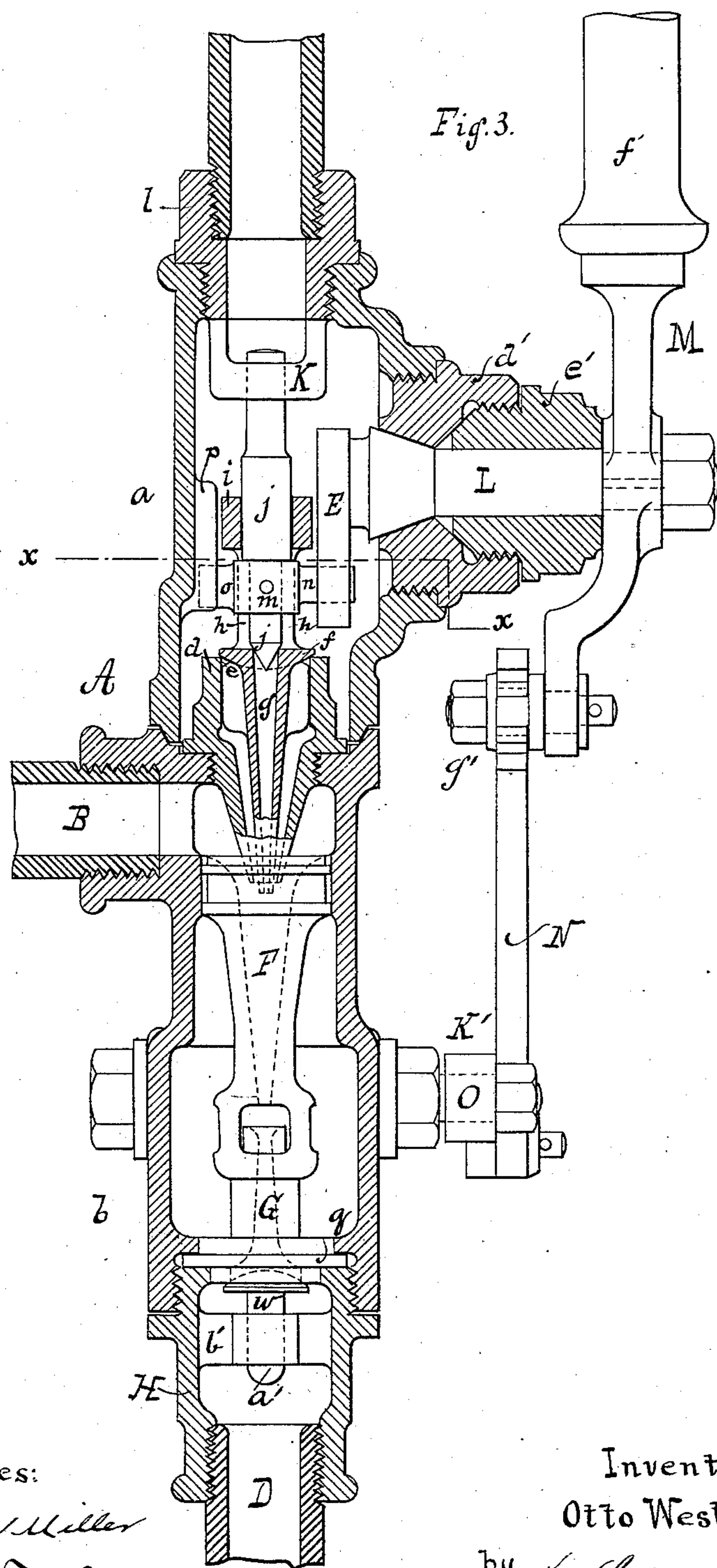
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3 Sheets—Sheet 3.

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his Attorneys.



# UNITED STATES PATENT OFFICE.

OTTO WESTPHAL, OF BUCKAU-MAGDEBURG, PRUSSIA, GERMANY, ASSIGNOR  
TO SCHÄFFER & BUDENBERG, OF SAME PLACE.

## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 312,591, dated February 17, 1885.

Application filed September 8, 1884. (Model.)

*To all whom it may concern:*

Be it known that I, OTTO WESTPHAL, a citizen of Germany, residing at Buckau-Magdeburg, in the Province of Saxony, Prussia, Germany, have invented new and useful improvements in Injectors, of which the following is a specification.

This invention relates to improvements in injectors for steam-boilers; and it consists in certain improved construction whereby is produced an injector exceedingly simple in arrangement, the motion of the steam-valve, the suction-valve, and the overflow-valve all being controlled by a single hand-lever, so connected with said valves that when the lever is moved in one direction the suction-valve begins to rise from its seat, and when clear of its seat the steam-valve begins to rise from its seat, the overflow-valve having begun to leave its seat at the same time as the suction-valve, and when the steam-valve is entirely clear of its seat the overflow-valve has returned to its seat, having traveled over its course twice while the suction and steam valves were rising from their seats.

The novel construction of the valves and nozzles and their connection with the hand-lever to produce this effect will be hereinafter described and claimed, and is shown in the accompanying drawings, in which—

Figure 1 is an elevation of the injector. Figs. 2 and 3 are vertical sections of the same. Fig. 4 is a horizontal section on the plane  $x x$  Fig. 2.

Similar letters indicate corresponding parts.

The letter A designates the casing of the injector, composed of the two parts,  $a$  and  $b$ , secured together steam-tight by screws  $c$ , the part  $b$  being provided with a lateral water-branch, B, a lateral overflow-branch, C, and at its lower end with internal threads to receive the bushing H, into which is screwed the feed-pipe D, leading to the boiler, and provided with a check-valve. (Not shown in the drawings.)

$d$  is the steam-nozzle, secured to the part  $b$  of the casing, its upper part being formed for a valve-seat for the steam-valve  $f$ . The steam-valve  $f$  is cast integral with the suction-nozzle  $g$ , which enters the steam-nozzle  $d$ , the up-rights  $h$ , the head  $i$ , and the slide-blocks  $i'$ .

The head  $i$  and the valve-body of the valve  $f$  are drilled centrally, the hole in the valve being fitted as a seat for the suction-valve  $j$ , which consists of a spindle ground to form a pin-valve, its upper part passing through the head  $i$  and also bearing in the lug  $k$ , cast integral with the bushing  $l$ . The slide-blocks  $i'$  work in slides formed by lugs  $k$ , cast integral with the part  $a$ . By this arrangement of valves a mutual guidance of the valves is procured, and all lateral motion is prevented.

To the suction-valve  $j$  is secured a block,  $m$ , provided with an arm,  $n$ , which is engaged by a slot in the eccentric E, for the purpose which will be hereinafter described, and also with a slide-block,  $o$ , which slides in a slide formed by the lugs  $p$ , cast integral with the part  $a$ , serving to prevent rotation of said slide-block.

F is the combining-nozzle, and G the discharge-nozzle. The discharge-nozzle is provided with a flange,  $q$ , abutting against the part  $b$ , and is secured to the same by the bushing H. The combining-nozzle is provided with internal threads engaging threads in the discharge-nozzle, and on its upper end with rings, rendering the fit steam-tight.

In a valve-seat formed in the overflow-branch C is fitted a valve,  $r$ , cast integral with its stem  $s$ , which is guided by passing through a hole in the bridge  $t$ , cast integral with the elbow J, screwed into the overflow-branch. The valve-stem  $s$  is formed with a slotted hole,  $u$ , the extremities of which form part of teeth engaged by a lobe or cam,  $v$ , secured to the shaft  $k'$ .

$w$  is a clack-valve bearing on a valve-seat in the discharge-nozzle G, and cast integral with the stem  $d'$ , which is guided by passing through a hole drilled centrally in the bridge  $b'$ , secured to the bushing H.

The means used for operating these valves is as follows: The eccentric E, as before mentioned, is provided with an eccentric slot,  $c'$ , and is firmly secured to the shaft L. Said shaft L is formed with a conical surface bearing in the bushing  $d'$  received in the part  $a$ , and passes through the bushing  $e'$ , screwed to the bushing  $d'$ , the whole forming a very efficient form of stuffing-box. To the end of the shaft projecting from the stuffing-box is secured the bent lever M, provided with a han-



dle,  $f'$ , and pivoted at its lower end to the slotted or connecting-link N by a bolt,  $g'$ . The link connects with a crank, O, which is secured to the shaft K'. Said shaft passes into the overflow-branch C, and is provided with a lobe or cam,  $v$ , which engages the valve-stem  $s$  of the valve  $r$ . When the lever M is in the position shown in the drawings, (see Figs. 1 and 2,) the injector is not working, and the steam-valve  $f$ , the suction-valve  $j$ , and the overflow-valve  $r$  are down upon their seats. When the lever is moved forward in the direction of the arrow marked near it in Fig. 1, the slot  $c'$  in the eccentric engages the arm  $n$ , and the suction-valve is gradually drawn from its seat, allowing steam to enter the small steam-nozzle  $g$  through the steam-supply pipe, which produces sufficient suction to draw water into the injector through the water-supply pipe B. When the lever M has been moved through an angle of thirty degrees, owing to the calculated eccentricity of the slot  $c'$ , the suction-valve will be lifted clear off its seat, and at the same time the block  $m$  will engage the head  $i$ , vertically lifting the steam-valve  $f$  gradually from its seat, and as the lever approaches ninety degrees the steam-valve will be lifted clear off the seat.

By the combination of the levers before mentioned while the suction-valve  $j$  is being lifted the overflow-valve  $r$  is being drawn from its seat by the motion imparted to it by the cam  $v$ , allowing the mixed steam and water to pass out through the overflow-branch C. The overflow-valve continues to open until the lever has passed through an angle of about sixty degrees, and on the further motion of the same begins to close on its seat. At ninety degrees it is entirely shut, and the increased pressure of the steam and water forces the clack-valve  $w$ , which had been previously held to its seat by the unbalanced boiler-pressure from the same, and water is forced into the boiler, the injector now being in its maximum working condition. In moving the lever M back the suction-valve is first brought down upon its seat in the steam-valve  $f$ , and then forces the same into its seat on the steam-nozzle  $d$ , while at the same time the overflow-valve first opens, and when the lever is in its end position again closes, and the steam being shut off the in-

jector ceases to work. It is also evident that if at one instant during the throwing of the injector into operation the steam and overflow valves were wide open that at some time during the shutting off of the injector the same will take place, but immediately after the overflow-valve closes up and the water is prevented from passing out; hence it will be left standing by a vacuum so produced in the feed-water pipe to a certain limited height above the level of the water in the tank if the injector be raising the feed-water.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an injector, the overflow-valve  $r$ , formed integral with its stem, said stem being provided with a slotted hole,  $u$ , the ends of which form teeth engaged by the lobe  $v$ .

2. The combination, substantially as herein described, of the steam-valve  $f$ , the suction-valve  $j$ , and the overflow-valve  $r$ , of the lever M, which when moved back and forward causes the steam-valve  $f$  and the suction-valve  $j$  to open and to close once, and the overflow-valve  $r$  to open and close twice and to leave it closed whenever said lever is at either of its end positions.

3. The combination, substantially as hereinbefore described, in an injector, of the suction-nozzle  $g$ , the steam-valve  $f$ , formed at its top, the reciprocating non-rotating valve  $j$ , seated in the valve  $f$ , the uprights rising from the valve  $f$ , and the head  $i$ , formed with and connecting the upper ends of the upright and forming a guide for the stem of the valve  $j$ .

4. The combination, substantially as herein described, with the casing A, the steam-nozzle  $d$ , and the overflow-nozzle  $r$ , of the suction-nozzle  $g$ , the valves  $f$  and  $j$ , the block  $m$ , and slide-block  $o$ , the eccentric E, containing the slot  $i$ , the shafts L, the lever M, the connecting-rod N, the crank O, and the shaft K', provided with the lobe  $v$ .

In testimony whereof I have hereunto set my hand and seal in the presence of two subscribing witnesses.

OTTO WESTPHAL. [L. S.]

Witnesses:

WILLIAM C. FOX,  
JOH. KRACKE.