

No. 629,750.

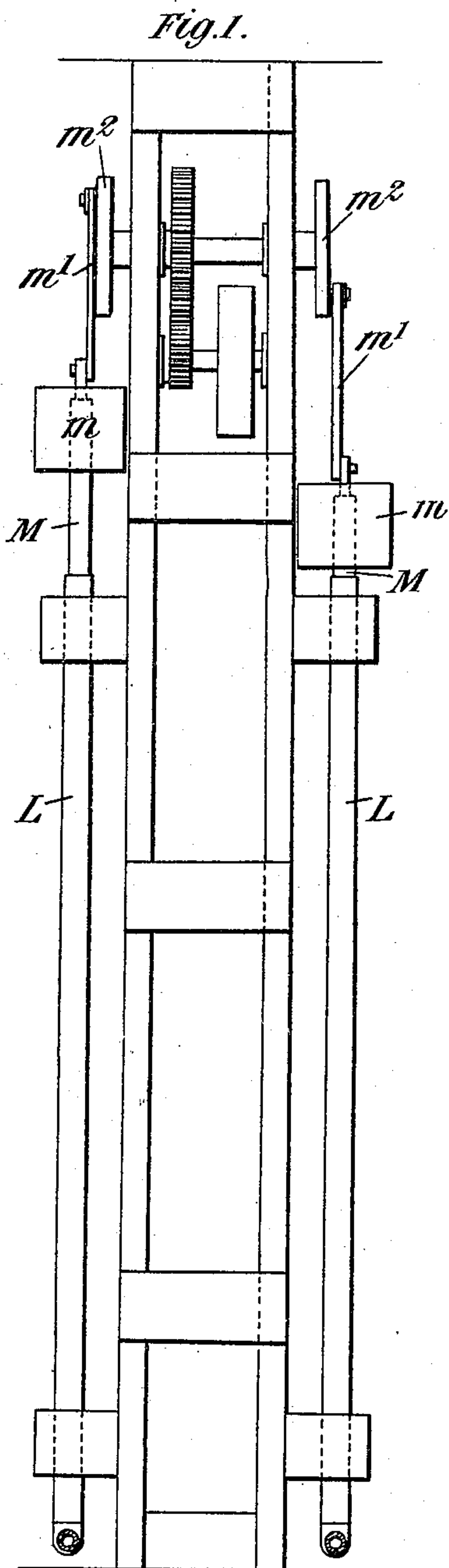
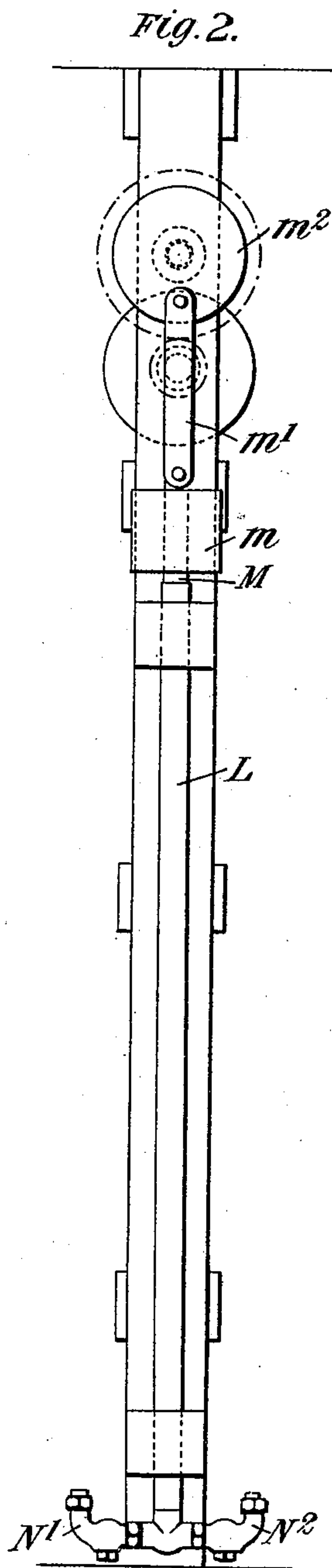
Patented July 25, 1899.

H. S. MAXIM.
PUMP.

(Application filed Nov. 28, 1898.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES
Hillary C. Messinger
Benjamin Miller

Hiram Stevens Maxim
INVENTOR.
By ATTORNEYS
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3 Sheets—Sheet 2.

Fig. 3.

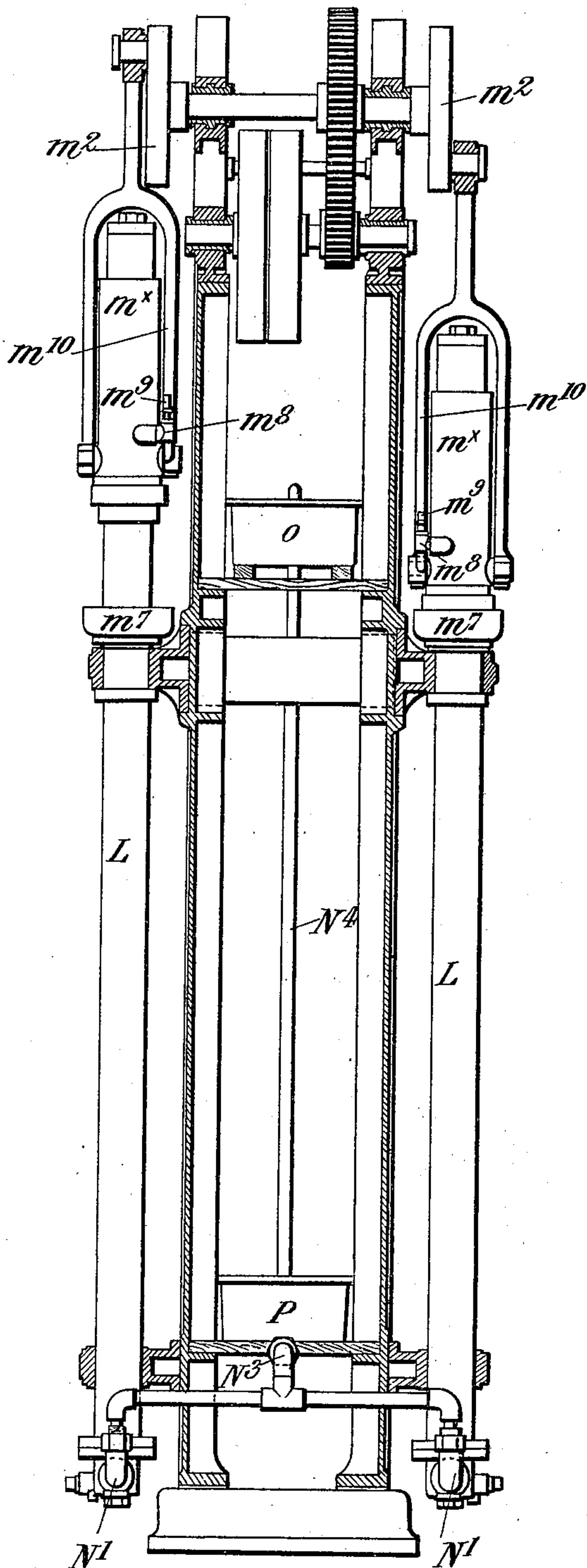
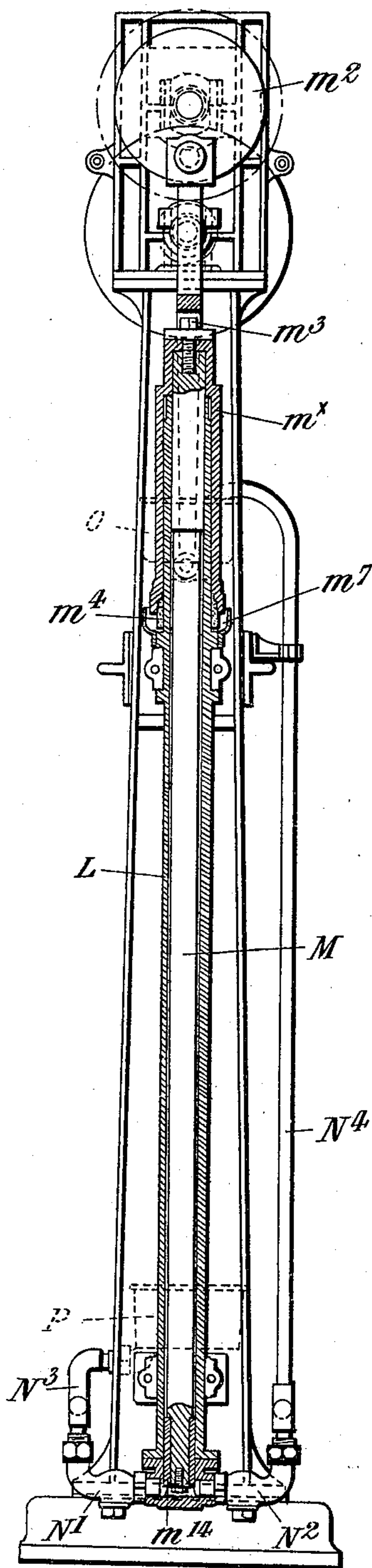


Fig. 4.



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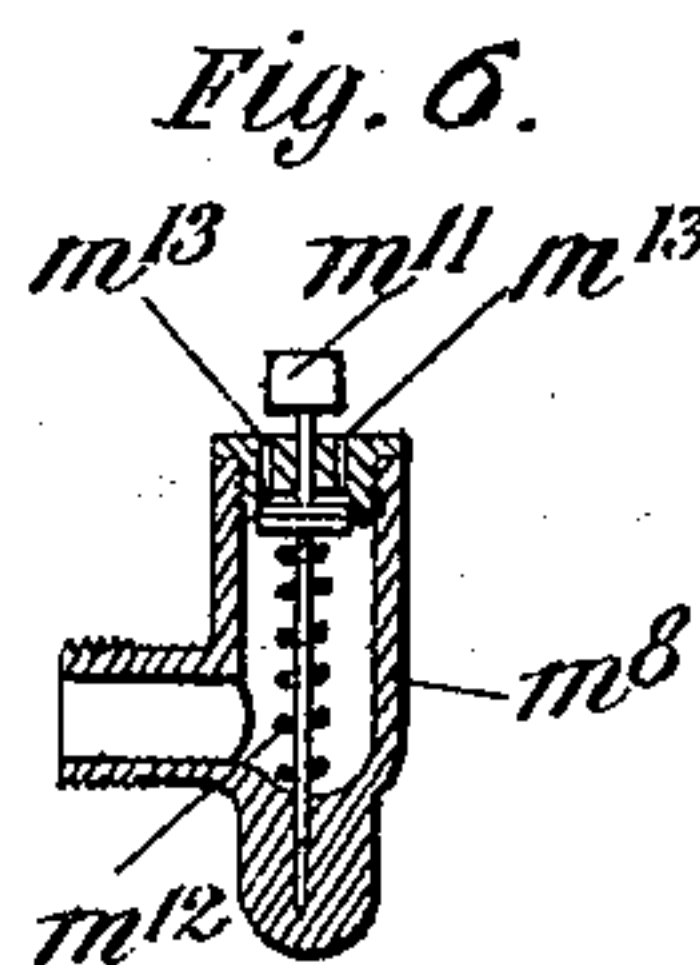
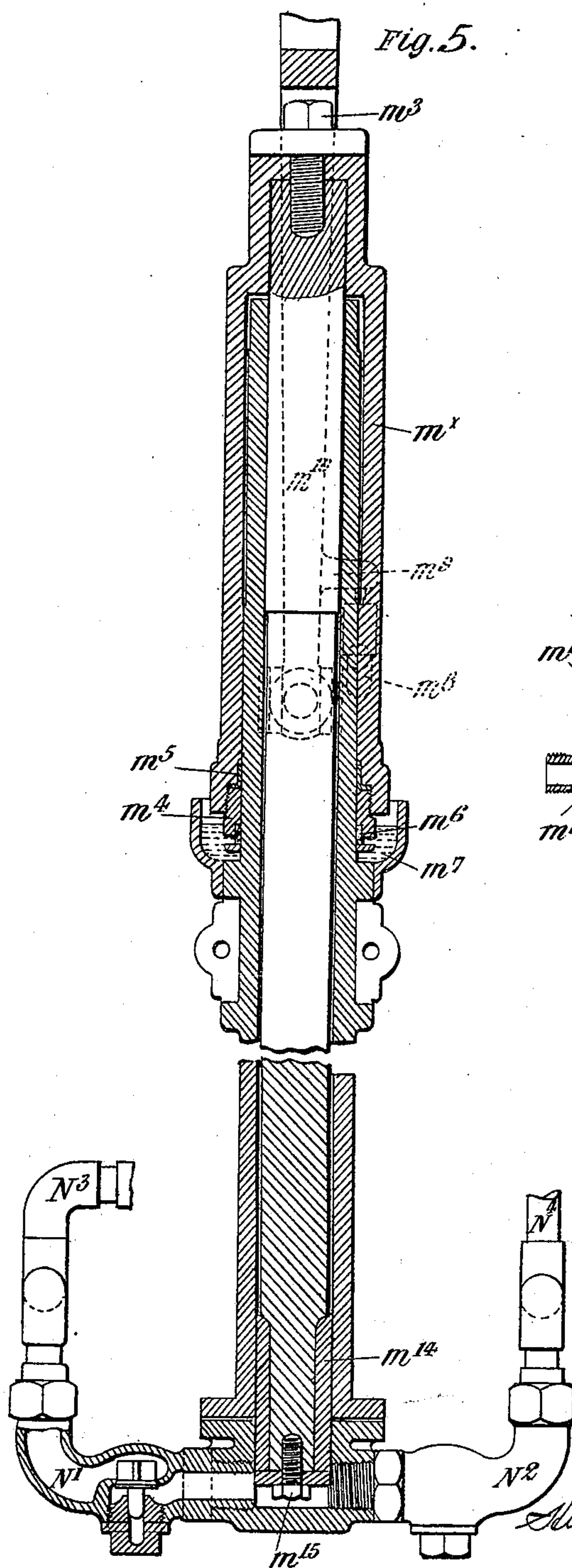
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INVENTOR.

UNITED STATES PATENT OFFICE.

HIRAM STEVENS MAXIM, OF LONDON, ENGLAND.

PUMP.

SPECIFICATION forming part of Letters Patent No. 629,750, dated July 25, 1899.

Application filed November 28, 1898. Serial No. 697,604. (No model.)

To all whom it may concern:

Be it known that I, HIRAM STEVENS MAXIM, chevalier of the Legion of Honor, civil and mechanical engineer, a citizen of the United States, residing at 18 Queen's Gate Place, London, in the county of Middlesex, England, have invented an Improved Method of and Apparatus for Obtaining a High Vacuum, of which the following is a specification.

10 This invention is an improvement in apparatus for obtaining a high vacuum, and has special reference to a specially-constructed mercury-elevator for use in conjunction with a mercurial pump of the Geissler or Sprengel
15 type for raising and returning mercury to a reservoir after it has passed through the mercurial air-pump ready for reuse in the said pump. The said mercury-elevator comprises long steel tubes or pump-barrels in which operate plungers, but which are unprovided with the ordinary stuffing-boxes for the plungers. The outer end of each of the plungers extends through the upper ends of the barrels and is furnished with a block of metal or is otherwise
25 weighted, so as to be sufficiently heavy to keep in a state of tension the rod by which each plunger is connected to the crank-shaft and so prevent chattering of the parts. As no stuffing-boxes or greasy packings are employed at
30 a point where the mercury can reach them, the mercury remains in a pure condition, with the exception of the slight amount of contamination thereof which takes place by its contact with the air and with the steel pump-barrels and the valves.

35 In order that my said invention may be clearly understood and readily carried into effect, I will proceed to describe the same more fully with reference to the accompanying drawings, in which—
40

Figure 1 is a front elevation, and Fig. 2 an end elevation, of one form of mercury-elevator. Fig. 3 is a sectional elevation, and Fig. 4 a sectional end view, of another form of the
45 mercury-elevator. Fig. 5 is a vertical section, on a larger scale, of one of the pump-barrels and plungers of the mercury-elevator. Fig. 6 is a vertical section of an air-valve, with which each of the plungers is provided, as hereinafter described.
50

Like letters of reference indicate similar parts throughout the drawings.

L L are the pump-barrels, and M M are their pistons or plungers. These plungers extend through the upper ends of the pump-barrels 55 and are unprovided with ordinary stuffing-boxes, so as to avoid the contamination of the mercury by its contact with greasy packings.

m m are blocks of metal applied to the upper ends of the plungers for increasing their 60 weight and insuring that the connecting-rods m', by which said plungers are coupled to the crank-disks m², shall always be kept in a state of tension during working. Without weighting the plungers they would have a tendency 65 to float on the mercury as it entered the barrels and would give rise to chattering of the parts during the working of the elevator.

N' and N² are valves located at the lower end of the pump-barrels L, one of such valves 70 acting as the inlet-valve, past which the mercury flows by gravity from the mercurial air-pump (or a tank connected therewith) as the plungers rise, and the other acting as the outlet-valve for the mercury as the plungers descend. 75

In Figs. 3 to 6 I have shown a modified construction of the mercury-elevator in which the blocks of metal m are substituted by weights in the form of caps or sleeves m^x, 80 connected by screws m³ to the upper ends of the plungers, which at their ends are made to fit the barrels, as is best seen in Fig. 5. The lower end of each of these caps or sleeves is furnished with a stuffing-box m⁴ and a 85 leather packing-ring m⁵, which it will be observed occupies a position entirely out of reach of the mercury, so that the latter cannot become contaminated by contact therewith. The said sleeve is also provided with 90 an absorbent ring m⁶, which at each downward stroke of the plunger enters an oil-cup m⁷ on the pump-barrel, thereby becoming charged with oil and supplying the same to the outside of the barrel, thus lubricating it. 95 The leather packing m⁵ forms an air-tight joint. When the plunger descends, the air contained in the space between the sleeve m^x and the barrel L is compressed, thereby creating a pressure in the said space which serves 100

to prevent the mercury from rising between the plungers and the barrel to such an extent as to escape over the top edge of the barrel. In order to release the compressed air in the
 5 said space as the sleeve and plunger complete their downward stroke, I provide a valve m^8 , Fig. 6, which is opened each time the plunger descends by a finger m^9 on the oscillating connecting-rod m^{10} . This finger acts
 10 on the outer end or head of the stem m^{11} of the valve each time the said connecting-rod oscillates during the downward stroke of the plunger, thereby depressing the valve against the resistance of a spring m^{12} and uncovering
 15 outlet-apertures m^{13} in the valve-casing and allowing the air to escape. The lower end of the plunger is provided with a hardened-steel sleeve m^{14} , which is held in place by a collar and screw m^{15} , such sleeve being of a diameter
 20 to fit the lower end of the pump-barrel. The portion of the plungers between the ends thereof is of less diameter than the barrels to reduce friction in the working of the said plungers.

25 O and P are tanks for containing the mercury. The tank O is arranged at a level above the mercury-reservoir of the mercurial air-pump and receives the mercury as it is raised by the elevator, and the tank P is arranged
 30 at a lower level than the mercurial air-pump, so that the mercury will flow therefrom into this tank by gravity. The lower tank P is connected with the inlet-valve N' by a pipe N^3 , and the upper tank O is connected with
 35 the outlet-valve N^2 by a pipe N^4 .

What I claim is—

1. A mercury-elevator consisting in the combination of pump-barrels open at their upper ends and unprovided with ordinary
 40 stuffing-boxes, plungers working in said barrels, a crank-shaft and connecting-rods between the same and the plungers, inlet and outlet valves at the lower ends of the barrels, mercury-receptacles connected with the said
 45 valves by piping, one of said receptacles being located at a low level while the other is located at a high level to supply the mercury to the head of a mercurial air-pump, and weights attached to said plungers, such
 50 weights being hollow and fitting the exterior of the upper ends of the barrels to constitute

chambers in communication with the interior of the barrels, wherein air is compressed at each downward stroke of the plungers, substantially as and for the purpose set forth. 55

2. In a mercury-elevator the combination with the pump-barrels unprovided with ordinary stuffing-boxes, the plungers working in said barrels and the crank-shaft for working
 60 said plungers; oscillatory rods connecting said plungers with the crank-shaft, hollow weighted heads embracing and sliding on the upper portion of the barrels, stuffing-boxes at the lower ends of said heads for making a
 65 tight joint between these ends of the heads and the portion of the barrels on which they slide, air-inlet valves on said heads, fingers on the oscillatory rods that connect the plungers with the crank-shaft, and prolongations on
 70 said valves with which the said fingers engage as the plungers descend, whereby the said valves are opened and permit the compressed air within the heads to escape, substantially as described.

3. In a mercury-elevator, the combination 75 with the pump-barrels unprovided with ordinary stuffing-boxes, the plungers working in such barrels, and the crank-shaft for operating the plungers; oscillatory rods connecting
 80 said plungers with the crank-shaft, of hollow weighted heads sliding on said barrels, stuffing-boxes at the lower ends of said heads for making a tight joint, air-inlet valves on said heads, fingers on the oscillatory connecting-
 85 rods for operating the air-valves as the plungers complete their downward stroke and thereby liberating the air which has become compressed within the heads, absorbent rings on the said heads, oil-cups on the barrels, into which cups the said absorbent rings dip
 90 as the plungers descend, thereby becoming charged with oil to lubricate the portion of the barrels on which the heads slide, substantially as described.

In testimony whereof I have hereunto set 95 my hand, in presence of two subscribing witnesses, this 25th day of November, 1898.

HIRAM STEVENS MAXIM.

Witnesses:

DRURY W. COOPER,
 M. LAWSON DYER.