(Model.)

W. T. MESSINGER.

INJECTOR.

No. 281,385. Patented July 17, 1883.

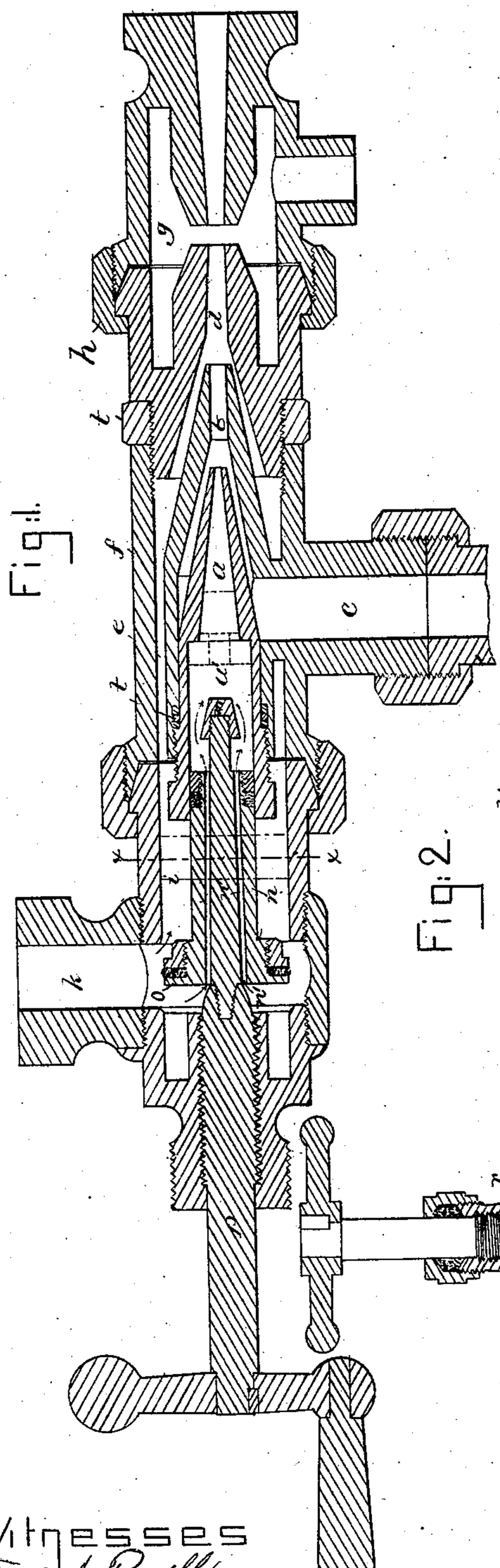

Fig. 1.

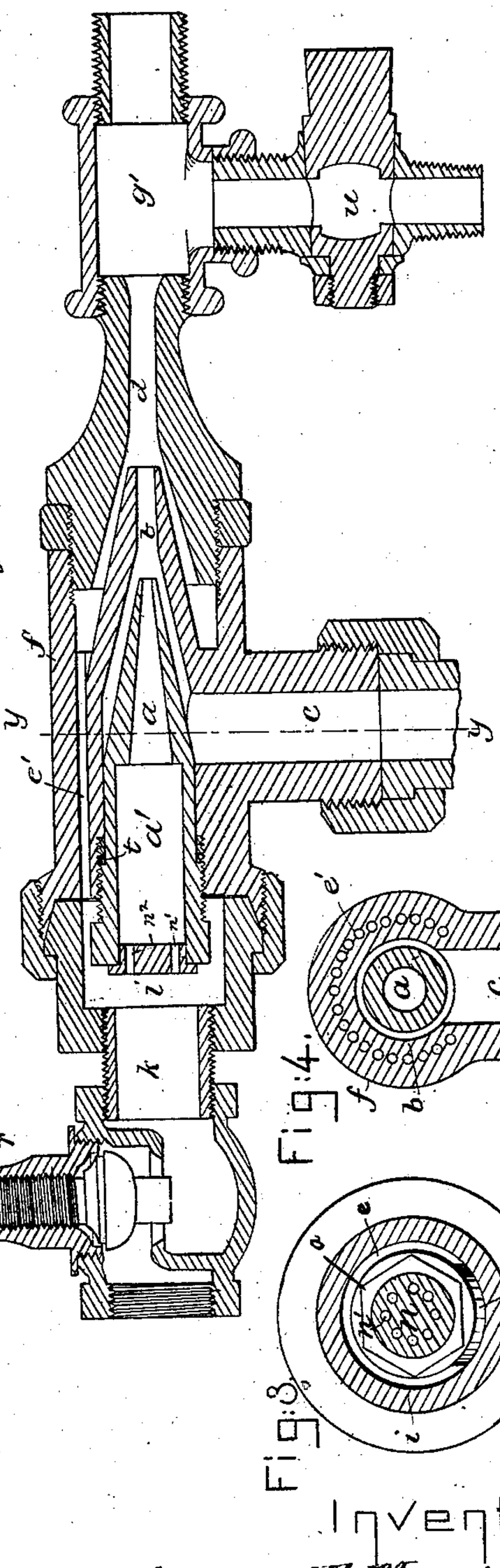

Fig. 2.

Fig. 4.

Fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

WILLIAM T. MESSINGER, OF CAMBRIDGE, MASSACHUSETTS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 281,385, dated July 17, 1883.

Application filed November 6, 1882. (Model.)

To all whom it may concern:

Be it known that I, WILLIAM T. MESSINGER, of Cambridge, county of Middlesex, State of Massachusetts, have invented an Improvement in Injectors, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention, relating to injectors, has for its object to produce an injector that is certain in operation, and at the same time is simple and inexpensive in construction.

The invention is embodied in an injector having three nozzles or cones in line with one another, the intermediate one of which communicates with the water-supply, and the other two with the source of steam, the one at the forward end of the intermediate or combining tube having its inlet-passage around the said jet or tube, and thus being connected with the same steam-chamber or supply of steam as the steam-nozzle at the rear of the intermediate or combining tube or nozzle. In case it is not necessary to raise the water from a lower level, the injector consisting of three tubes thus constructed is sufficient, it being employed either with or without the usual overflow-chamber. When, however, it is necessary to raise the water before forcing it into the boiler, it is desirable in first setting the injector in operation that the rear steam-cone should be first open and allowed to operate a sufficient time to exhaust the second cone and water-inlet passage of air, causing it to be filled with water before steam is admitted to the second or forward steam-cone. The inlet-passage to the second steam-cone is cylindrical, inclosing the whole or a portion of the other two cones, and a valve is employed having a portion seating within the first steam-cone, and a piston-like portion operating within the cylindrical inlet to the second steam-cone, and requiring a considerable longitudinal movement therein before the steam is admitted into the second steam-cone. The first movement of the valve opens the first steam-cone, and the said valve is operated by a threaded stem similar to that of a common globe-valve, so that its longitudinal movement is quite slow, and the first steam-jet is thus permitted to operate a sufficient length of time to exhaust the water-inlet passage of air before the second steam-inlet is opened in the last part of the movement of the valve. The first steam-nozzle extends into the rear end of the water-delivery nozzle, the effective area of which thus depends on the distance to which the first steam-jet is inserted therein; and in the same manner the water-delivery nozzle extends into the rear end of the second or front steam-delivery nozzle, and determines its effective area by the distance to which it is inserted therein. The three nozzles are made in separate pieces, and it is thus possible with pieces or castings of exactly the same size to make injectors varying widely in capacity by adjusting the distance to which each nozzle is inserted into the one in front of it in putting said parts together. When, however, the parts are put together, they are intended to remain fixed relative to one another, there being no adjustment in the operation of the apparatus, which therefore does not depend in any degree upon skill on the part of the operator.

Figure 1 is a longitudinal section of an injector embodying this invention; and Fig. 2, a longitudinal section of a simpler form of injector, showing the construction used in making the smaller sizes and where it is not necessary to raise the water to be delivered from a lower level. Fig. 3 is a transverse section on the line *x x*, Fig. 1; and Fig. 4, a transverse section on line *y y*, Fig. 2.

The injector consists of a first or rear steam-nozzle, *a*, an intermediate nozzle or combining-tube, *b*, having an inlet-passage, *c*, near its base, connected with a water-supply, and a second or foremost steam-nozzle, *d*, having an inlet-passage, *e*, extending along the outside of the second nozzle, *b*, into the rear end of which the first steam-nozzle, *a*, is inserted and held, as by screw-threads. The water-receiving nozzle *b* and its inlet-passage *c* are made in a single piece, with an outer casing or cylinder, *f*, between which and the outside of the nozzle *b* is formed the inlet-passage *e* for the second steam-nozzle, *d*.

In larger-sized injectors the passage *e* may be made by an annular core surrounding the water-cones *b*; but in the smaller sizes, in which it would be difficult to make such a core, the metal may be cast solid from the interior of the tube *b* to the exterior of the cylinder *f*,

and a series of passages, *e'*, will then be bored through the said metal, as shown in Figs. 2 and 4. The cylinder *f* is provided at its forward end with suitable threads or a coupling device to receive the nozzle *d*, which is shown in Fig. 1 as opening into the usual overflow-chamber, *g*, connected thereto by a coupling, *h*. The rear end of the cone *a* projects from the cone *d* within the end of the cylinder *f*, so as to enable it to be easily engaged by a wrench and turned into the said cone *b*. The cylinder *f* is connected by a coupling or screw-thread with a steam-chamber, *i*, shown in Fig. 1 as cylindrical in shape, and having a steam-inlet passage, *k*, entering at the side of its rear portion. The steam-chamber *i* and passage *k* form a common inlet to both the steam-nozzles *a* and *d*. A valve, *m*, controls the admission of steam to the nozzle *a*, the said valve having a cylindrical stem, *n*, fitting in the rear cylindrical portion, *a'*, of the nozzle *a*, and having longitudinal passages *n'* through it, as shown in Figs. 1 and 3. The said stem *n* is provided with a piston, *o*, having a working fit in the cylindrical steam-chamber *i*, so that while in the said chamber it prevents the passage of steam therethrough to the forward steam-nozzle, *d*, although the steam can then pass through the passages *n'* into the cone *a* and through the said cone, except when the valve *m* is seated therein, at the end of its extreme forward movement, as shown in dotted lines, Fig. 1.

The valve *m*, its stem *n*, and piston *o* thus constitute a steam-inlet-controlling device which is operated by means of the threaded rod or stem *p*, like a globe-valve of ordinary construction, the longitudinal movement of the said inlet-controlling device thus being somewhat slow, as it requires a large number of rotations of the said stem *p*.

When desired to set the injector in operation, the said controlling device being in its extreme forward position, (shown in dotted lines,) it is moved backward by the operator rotating the stem *p* by means of its handle, and in the first movement the valve *m* is unseated from the cone *a*, thus permitting the steam to flow through the passage *n'* and the said cone, although the piston *o* prevents the steam from flowing into the passage *e* and cone *d*. The injector thus operates for a considerable length of time with the steam flowing only through the cone *a* and operating to exhaust the air from the cone *b* and connected inlet-passage *c*, to raise the water in the usual manner, and it is not until the piston *o* is removed from the cylindrical chamber *i*, as shown in full lines, Fig. 1, that steam is admitted to the second steam-nozzle, *d*, by which time the water will have begun to flow through the nozzle *b*, combining with the steam from cone *a*. When it is not necessary to raise the water from a lower level to the injector, both the steam-cones may receive steam simultaneously, the injector at once beginning to operate; and in this case the devices *m* and *o* need not be employed. An ordinary stop-cock or valve, *r*, in the steam-pipe leading to the injector, as shown in Fig. 2, is then sufficient.

It will be seen that after the valve *m* has moved a short distance the effective area of the orifice of the first steam-cone, *a*, is fixed and determined; but the area of the passage for water to the orifice of the cone *b* depends on the distance to which the nozzle *a* is inserted into the rear of the said cone *b*, the effective orifice being smaller the farther the nozzle *a* thus enters the nozzle *b*. In a similar manner the effective area of the orifice of the nozzle *d* depends upon the distance to which the nozzle *b* is inserted into the rear end thereof, or, in other words, the distance to which the piece *d* is screwed into the end of the cylinder *f*.

As an injector of this construction will operate with widely-different proportions of steam and water, it is possible to greatly vary the capacity of an injector without changing the shape or size of the pieces of which it is made, the capacity being regulated by the distance to which each nozzle is inserted into the one in front of it. This can be accomplished by merely screwing one piece a greater or less distance into the other; but in order to definitely regulate this distance and to permit the piece to be screwed up tightly, it is desirable to employ washers or packing, as shown at *t*, for determining the relative position of the cones and the consequent area of the orifice *b* and *d*.

It is not intended to vary the relative position of the cones or the effective area of the orifices while the apparatus is in operation, and consequently the operation of the injector does not depend upon the judgment of the person in charge.

The herein-described injector may be used either with or without the usual overflow, *g*. When the said overflow-chamber is omitted, the nozzle *d* may be fitted to screw into an ordinary T-fitting, *g'*, one of the other openings of which is provided with a stop-cock, *u*, while the third is connected directly with the pipe leading to the boiler or point to which it is desired to convey the liquid. In operation, it is merely necessary to open the cock *u*, and afterward open the valve *r* or steam-controlling device *m n o*, as before described, after which, when the combined jet is properly formed, the stop-cock *u* is closed.

By making the passages *e* or *e'* in the annular space between the cylinder *f* and the tube or cone *b*, the said passages, as well as the passages *n'*, leading to the first nozzle, are so narrow as to operate effectually to arrest any solid particles which might otherwise pass through and clog the orifice, although the aggregate sectional area of the said passages is much greater than the orifice to which they lead, so that portions of the said passages might be clogged by solid matter thus arrested without appreciably affecting the operation of the injector.

When the inlet-controlling device *m n o* is omitted, as shown in Fig. 2, a perforated plug,

n^2, may be inserted in the end of the cone *a*, to arrest the solid particles, as just described. Any particles small enough to pass through the said inlet-passages would also pass freely through the smallest portion of the orifice. When an overflow-chamber is employed, it is desirable to use a union-nut at the junction of the said chamber with the nozzle of the injector, so that the direction of the overflow-opening may be readily changed at any time by loosening the said nut without changing the relative position longitudinally of the different nozzles.

It is obvious that any suitable means may be employed for connecting the parts together and with the water, steam, and delivery pipes, ordinary screw-threads or coupling-nuts having been shown as a simple and convenient means of accomplishing this.

The relative size, shape, and taper of the nozzles can be greatly varied without departing from this invention, and the injectors may be employed for feeding boilers or elevating and injecting or ejecting fluids, or for any purpose for which such instruments may be applied.

I claim—

1. In an injector, the three concentric nozzles, the first of which enters and closes the rear or base of the second, which enters the base or rear of the third, combined with a cylinder connected with the base of the third nozzle and inclosing the other two, the space between the said cylinder and second nozzle forming the inlet-passage for the third nozzle and communicating with the first nozzle, whereby an inlet-pipe connected with the said cylinder affords a common supply for the first and third nozzles, substantially as described.

2. The three nozzles and steam-inlet chamber communicating with the first and third, combined with the steam-inlet-controlling device, consisting of a valve seating in the first nozzle, a piston operating in the said inlet-chamber, and a stem connecting the said valve and piston, and provided with passages through which steam is admitted to the first nozzle as soon as the valve is unseated, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WM. T. MESSINGER.

Witnesses:

JOS. P. LIVERMORE,

B. J. NOYES.