2 Sheets--Sheet 1.

N. YAGN.

Feeding-Apparatus for Steam-Boilers.

No. 165,435. Patented July 13, 1875.

Fig. 1. Fig. 2.

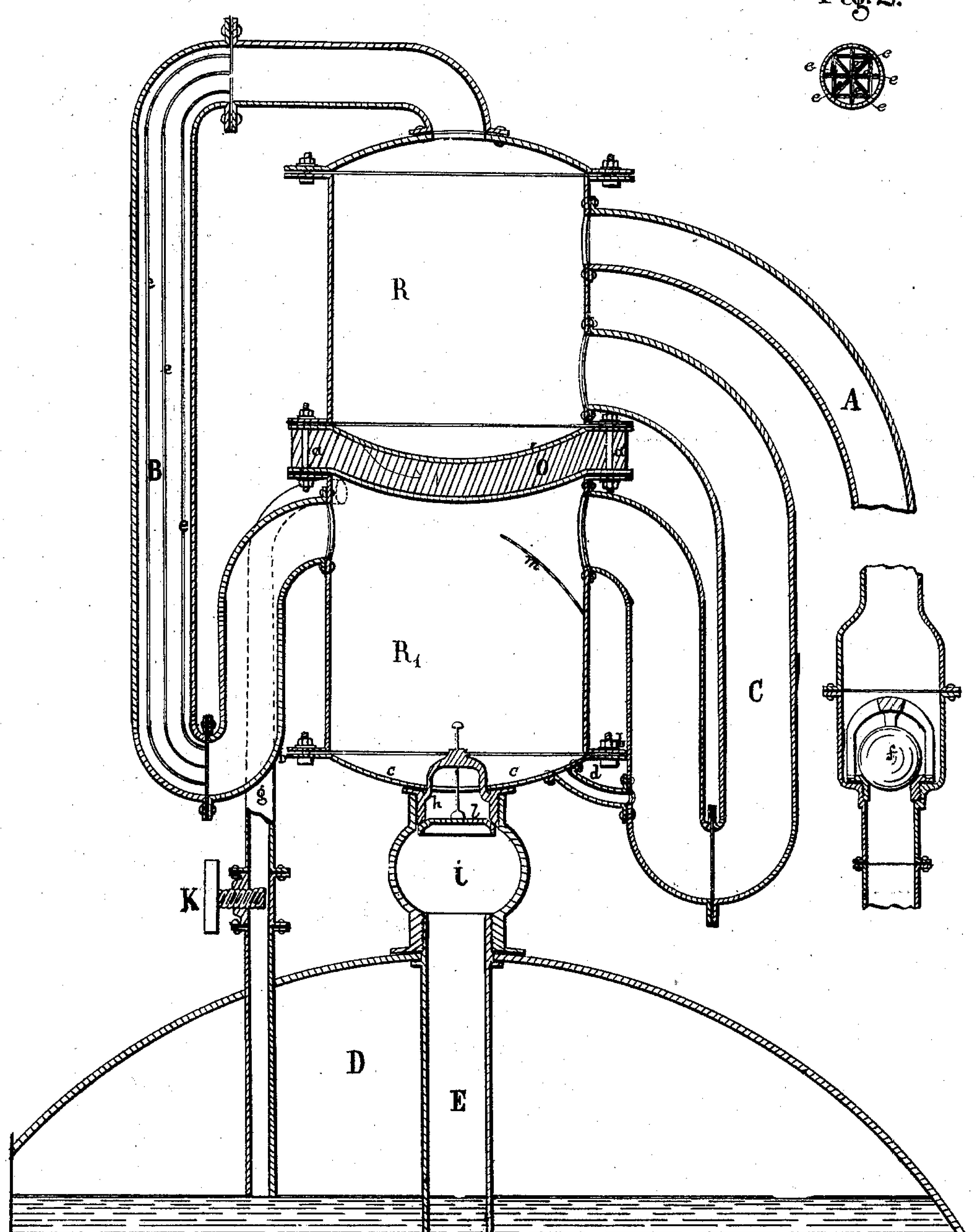

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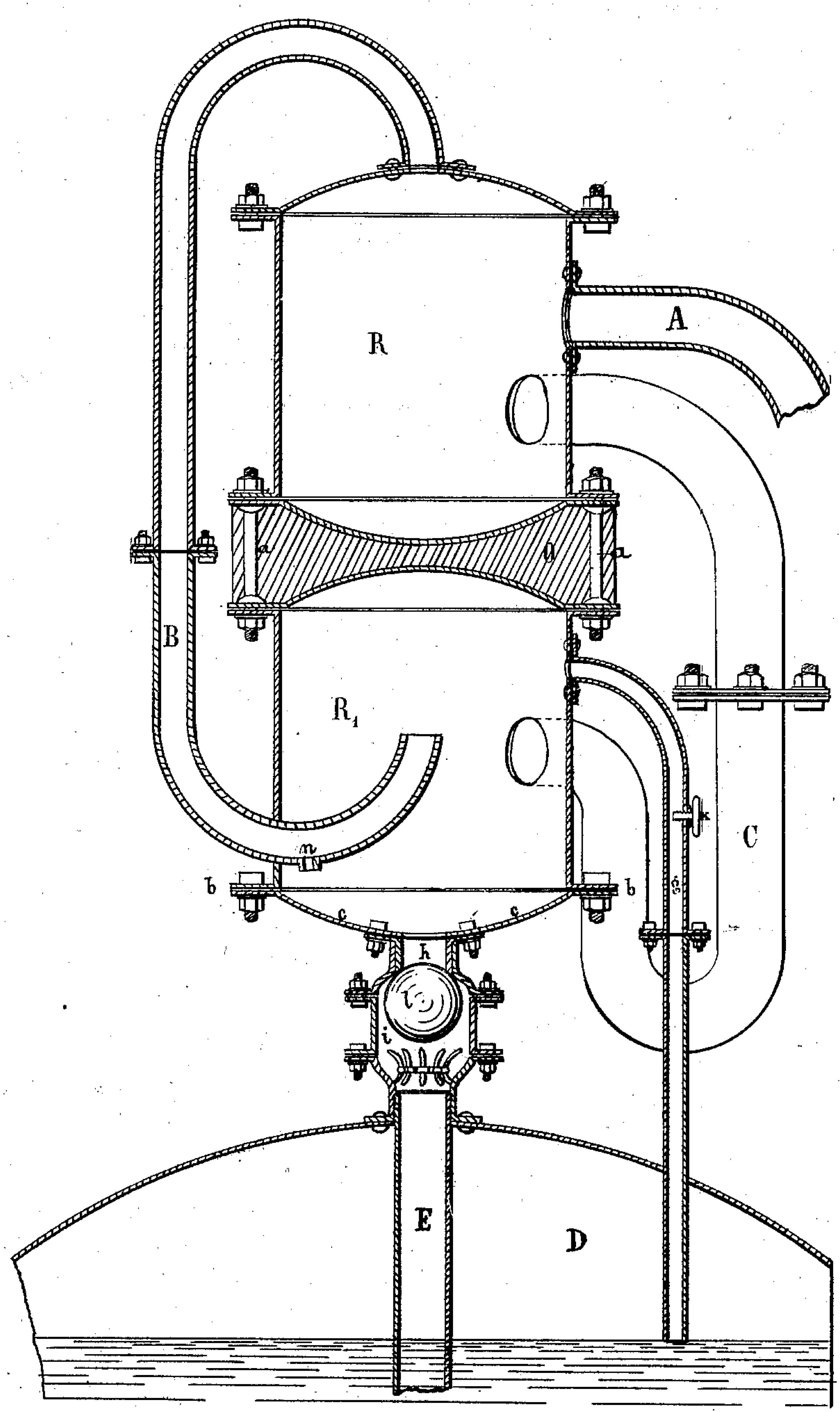
Fig. 3.



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UNITED STATES PATENT OFFICE.

NICOLAS YAGN, OF SYZRAN, RUSSIA.

IMPROVEMENT IN FEEDING APPARATUS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **165,435**, dated July 13, 1875; application filed August 11, 1874.

To all whom it may concern:

Be it known that I, NICOLAS YAGN, of Syzran, in the government of Simbirsk, Empire of Russia, have invented certain Improvements in Feeding Apparatus for Steam-Boilers, of which the following is a specification:

The first part of my invention relates to a self-acting apparatus for feeding steam-boilers with water, which shall advantageously supply the place of all apparatus hitherto used for the same purpose, such as manual and steam pumps, injectors, &c., of which the principal defect is not only susceptibility of being spoiled, and wearing out comparatively very quickly, but also requiring continual and attentive looking after by the machinist and stoker, in default of which the feeding becomes irregular, and sometimes leads to serious consequences.

The apparatus which I propose is shown in vertical section on Figure 1 in annexed drawings.

It is composed of two cylindrical or otherwise shaped reservoirs, R R^1, of sheet-iron or other suitable material. The capacity of each of these is about four hundred and thirty cubic inches. The reservoirs R R^1 are placed vertically one above the other, and strongly fastened, by means of screw-bolts *a a*, to the cushion O, of wood or other material, which is a non-conductor of heat. The two reservoirs R R^1 communicate with each other by means of the bent pipes B C, as shown in the annexed drawings. The lower bend of the pipe B is placed at the height of the lower flanges *b b* of the reservoir R^1, and the lower bend of the pipe C about two inches below the bottom *c* of the same reservoir. Besides, it is shown in Fig. 1 that the pipe C communicates with the lower part of the reservoir R^1 by means of the short pipe *d*.

Instead of placing this pipe or tube *d* as described, and shown in Fig. 1, it may be placed between the under part of the lower bend of the pipe B and the lower part or bottom of the reservoir R, or even between the under part of the lower bend of the pipe B and the coupling-box *i*.

It is preferable that the middle part of the pipe B be removable, and provided with longitudinal partitions of metal *e e*, which subdivide the principal conduit of this pipe into several narrow conduits, which essentially accelerate the initial movement of the steam along the pipe B; for the water, by virtue of its adhesion to the sides of the narrow tubes, will not let the steam pass through in bubbles, but will all be forced along by the steam.

The transverse section of the pipe B, with its partitions *e e*, is shown on Fig. 2. The reservoir R communicates, by means of the pipe A, with the well, tank, or cistern which contains the alimentary water. As near as possible to this well the pipe A is provided with a valve, (spherical or of any other suitable shape,) giving way to the water from the well to the reservoir, but preventing its passing vice versa. Besides the pipes B and C, the reservoir R^1 is provided with a pipe, *g*, which passes through the side of the boiler D, and terminates there at the height at which the water is to be kept in the boiler. Furthermore the reservoir R^1 is provided with a valve-box, *h*, which is connected, by means of a coupling-box, *i*, with the pipe E descending into the boiler about two-thirds of its depth, so that the lower end of the pipe is continually under water. The pipe *g* is furnished with a screw, *k*, used to diminish or regulate at will the passage of the water through it. The box *h* contains a valve, *l*, which lets the water pass freely from the reservoir R^1 into the boiler D, but prevents it passing in the contrary sense, for reasons described below.

The whole apparatus is mounted vertically. The joints of all its parts must be perfectly air-tight. The apparatus may be placed immediately above the boiler, or at its side, at some distance from it, which is preferable, as so placed it will not be exposed to the influence of hot air, which always exists above boilers. In this case, the whole length of the pipe *g* must incline toward the boiler.

The apparatus works as follows: Supposing the whole of the apparatus—that is to say, the two reservoirs and all the pipes—be filled with cold water, and that the level of the water in the boiler be a little above the lower extremity of the pipe *g*. It is evident that the apparatus being in that state the water cannot flow from the reservoirs R R^1, which will remain full till the level of the water in the boiler lowers itself below the lower extremity of the pipe *g*. At this moment the steam begins to displace the water of the tube *g*, which flows into the boiler, while the steam goes into the reservoir R[1]. At the same time the water in this reservoir opens the valve *l* and begins to flow into the boiler, which it continues to do until the level of the water in the boiler rises and reshuts the end of the pipe *g*. When this end opens again the same operation is repeated, and so on until the water in the reservoir R[1] falls to the level of the lower bend of the pipe B. As the pipe *c* communicates with the reservoir R[1] by means of the tube *d* it is easy to understand that the water in the reservoir R[1] and in the short branches of the pipes B and C will always be level, and that the emptied spaces of these branches will fill with steam. When the water falls below the lower bend of the pipe B the steam passes into the long branch of this pipe, and by its pressure forces up the water contained in this branch. Then the equilibrium of the water in the upper reservoir R ceases and the water empties itself into the reservoir R[1] by the pipe C. On coming into the reservoir R[1] the cold water meets the steam, which condenses instantly, vacuum is produced in the apparatus, and, consequently, the valve *l* presses strongly against its seat, obstructing the passage of the water from the boiler D to the reservoir R[1], and soon the whole apparatus fills with cold water, which rises from the well by the pipe A, forced up by the atmospheric pressure. Thus the apparatus continues to work as above described, *i. e.*, the water of the reservoir R[1] will constantly flow into the boiler, and when the reservoir R[1] is empty the water of the reservoir R will transfer itself into the reservoir R[1] and condense the steam. The apparatus will then fill itself with water from the well, and so on. The boiler will thus continue to feed itself, and the greater the dispense of steam the more easily will it pass into the pipe *g* and the oftener will the apparatus fill with water from the well, and vice versa; but if the dispense of steam cease, the working of the apparatus will cease at the same time, and recommences of itself when the boiler begins to work again. It is evident that in consequence of the working of my apparatus, as above described, the level of the water in the boiler will always be at the height fixed by the position of the pipe *g*. For the regular working of the apparatus the temperature of the water in the reservoir R ought not to be high, *i. e.*, the apparatus must be as little subject to heat as possible. For this object a cushion, O, is placed between the reservoirs R and R[1], either of wood or of any other non-conductor of heat. The trials have proved that (which was, moreover, easy to foresee) the water in the reservoir R receives no heat through the pipes B and C, and that the regular circulation of the water in them cannot take place. They have also proved that even the growing heat of the reservoir R[1] is very little. In the same way theory proves that notwithstanding the constant entrance of steam into the reservoir R[1] by the pipe *g* the water enters the reservoir R[1] by the pipe C in sufficient quantity to condense it, and forms a vacuum in the apparatus which is sufficient to suck in the water from the well.

It is said above that the screw *k* (instead of which a tap or valve may be used) serves to diminish or regulate at will the passage of the steam through the pipe *g* into the reservoir R[1] dependent on the pressure of the steam in the boiler. The greater the pressure of the steam the more the passage of the pipe *g* should be limited. Before the aperture of the pipe C it would be advisable to place in the reservoir R[1] a perforated plate, *m*, to divide the water into thin streamlets. To fill the apparatus beforehand with water it is made to communicate with a forcing-pump, which is placed, preferably, between the well and the pipe A; but it is evident that this pump may be placed apart in any convenient place. This pump, which may also be employed to clean the boiler, can easily fill the apparatus with water, in case, by some defect, it should fail to suck in the water from the well.

Fig. 3 shows a modification in the construction of the above-described automatic feeding apparatus. The corresponding parts in these two apparatus are marked by the same reference-letters. The difference mainly consists in that, first, the lower bend of the pipe B enters the reservoir R[1] at the lower part, and not upper, as before, and rises vertically to the interior of the reservoir R[1] half its height, having an aperture in *n*; second, the lower bend of the pipe C does not communicate with the reservoir R[1] by a separate tube, but enters it at half its height. Thus modified, this apparatus works in the same way as the former. While the level in the reservoir R[1] is falling, the pressure on the apertures of the pipes B and C being equal, the water of the reservoir R cannot pass into the reservoir; but when the reservoir R[1] is half empty, and the apertures of the pipe S B and C uncovered, the steam, acting upon the apertures, makes the water descend into the pipes B and C. From this last pipe the water passes through the reservoir R, pipe B, and aperture *n* into the reservoir R[1], until the level of the water in the reservoir R[1] and in the pipes B and C be at the same height. When the level in the reservoir R[1] falls below the aperture *n* of the pipe B, the equilibrium can no longer take place, for the steam, passing into the long branch of the pipe B forces the water of this pipe into the reservoir R, in consequence of which the water in the reservoir R empties itself by the pipe *c* into the reservoir R[1], and there meets the steam which, it condenses. A vacuum is then produced in the apparatus, and therefore the water of the well, forced by the pressure of the atmospheric air, enters the pipe A, and very soon fills the whole apparatus. The working of the apparatus afterwards continues, as already described.

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

1. A self-acting feeding apparatus having two reservoirs, R R^1, placed one above the other, and communicating with each by means of pipes B C, with the boiler by pipes *g* E, and with a well or cistern by means of a pipe, A, substantially as herein described.

2. The combination, with the chambers R R^1, of the pipe B, provided with partitions *e e*, as and for the purpose described.

3. The combination, with a pair of reservoirs, R R^1, supported one above the other, with an intervening cushion, O, as described, of the pipes A B C *d* E *g*, when constructed and operating substantially as described.

4. In feed-water apparatus for steam-boilers a feed or supply pipe or conduit, B, provided with radial partitions *e e*, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of June, 1874.

NICOLAS YAGN.

Witnesses:

FREDERICK KAUPE,

NICOLAS CHEVALOFF.