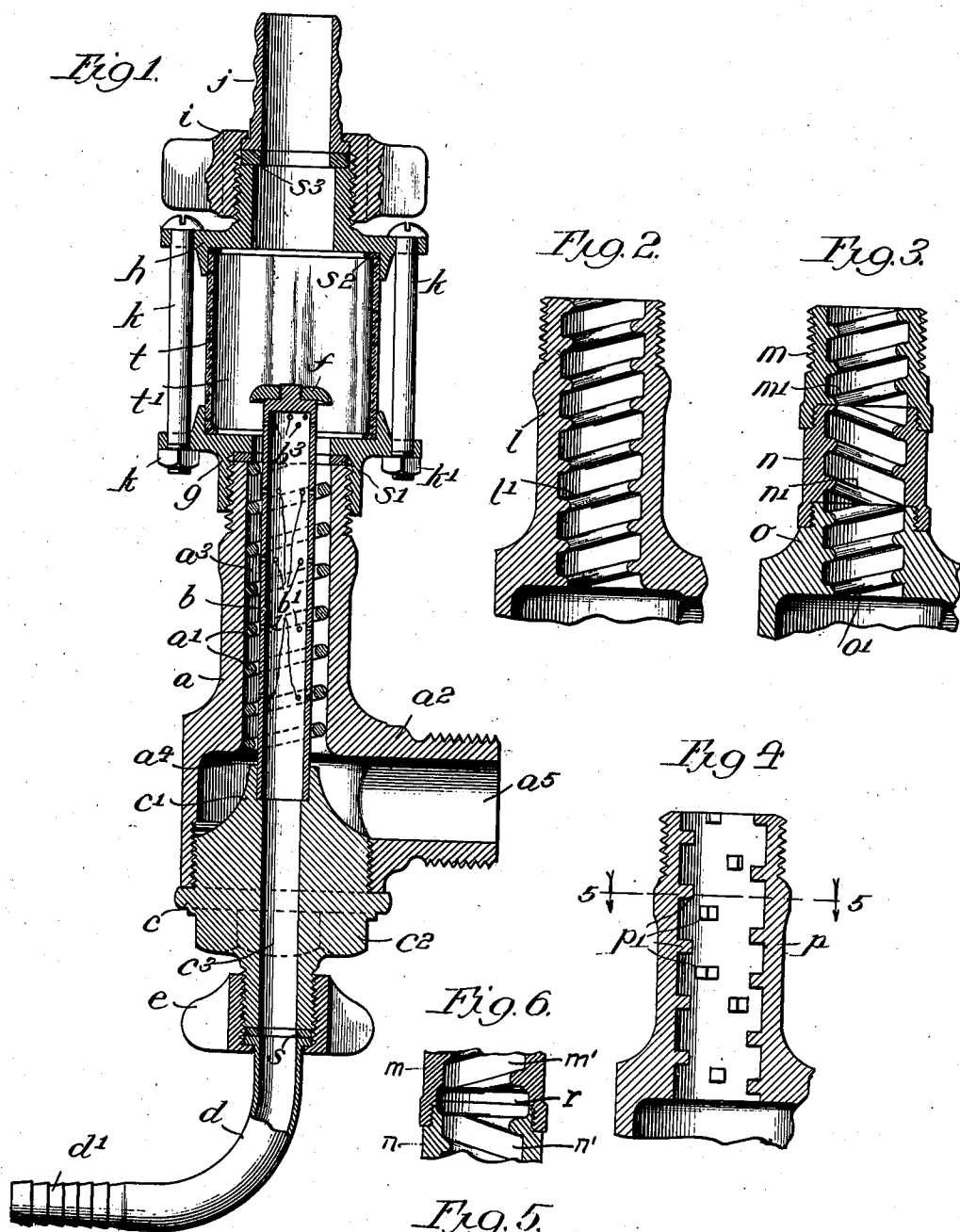


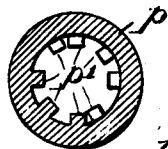
No. 847,552.

PATENTED MAR. 19, 1907.

C. A. CARLSON.
 APPARATUS FOR MIXING FLUIDS.
 APPLICATION FILED AUG. 4, 1906.



Witnesses:
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MIXING FLUIDS.

No. 847,552.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed August 4, 1905. Serial No. 272,790.

To all whom it may concern:

Be it known that I, CHARLES A. CARLSON, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented a new and useful Apparatus for Mixing Fluids, of which the following is a specification.

My invention relates to the mixing of fluids, as liquids and gases, and has more particularly to do with the mixing of gases with liquids, as is done, for instance, in the "carbonating" of liquids to produce effervescent beverages, although my method and apparatus are equally well adapted for use in bringing about the admixture of liquids with liquids and gases with gases.

The object of my invention is to provide a simple and efficient apparatus for effecting a particularly intimate admixture of fluids, and one form of apparatus which I have designed for and have found particularly efficient in accomplishing this end is illustrated in the annexed drawing and described in the succeeding portions of the specification.

In the drawing, Figure 1 is a cross-sectional elevation of a mixing apparatus embodying my invention. Fig. 2 is a cross-sectional elevation of a modified arrangement of one of the parts of the mixer. Fig. 3 is a view in cross-section of another modification of said part. Fig. 4 is a cross-sectional view of still another modification. Fig. 5 is a cross-section taken on the line 5 5 of Fig. 4, and Fig. 6 is a view in cross-section of a modified arrangement of the form shown in Fig. 3.

In the particular form of apparatus illustrated the mixing apparatus comprises, primarily, an outer tube *a* and an inner tube *b*, concentric with the outer tube. Between the two tubes is formed an annular channel *a*³, which communicates at its lower end with a chamber *a*⁴, formed in the base of the outer tube *a*, and at its upper end with the chamber *t*¹, formed within a cylindrical casing *t*, secured to the top of the outer tube *a* by means of a screw-threaded connection. The lower chamber *a*⁴ is in communication with an inlet-passage *a*⁵, formed in a right-angle extension *a*² from the base of the outer tube *a*. This extension is adapted to be connected with a supply-pipe in any suitable manner—as, for instance, by an external screw-thread cooperating with an internal screw-thread on the end of the supply-pipe.

The inner tube *b* is in the present instance seated in a plug *c*, having screw-threaded connection with an opening at the end of the outer tube *a*, and is also preferably provided with exterior plane faces *c*², adapted to be engaged by a wrench in screwing the plug into place. The plug is provided with a passage *c*³, leading centrally through its interior and communicating directly with the interior of the inner tube *b*. At its other end the central passage *c*³ communicates with a supply-pipe *d*, provided at one end with a series of annular flanges or corrugations *d*¹ for holding the supply-pipe connected with it firmly in place and at the other end with a flange which abuts against a washer *s*, interposed between it and an externally-screw-threaded nipple or tailpiece projecting from the base of the plug *c*, the supply-pipe *d* being held to the nipple in the present instance by a sleeve *e*, having a flange cooperating with the terminal flange of the inlet-pipe and having wings to aid in turning it. The upper end *c*¹ of plug *c* is made substantially in the form of a truncated cone, tapering from its base toward the point where the inner tube is seated. This formation causes the fluid which flows in through the passage *a*⁵ to be deflected upwardly in a hollow stream into the passage *a*³ between the inner and outer tubes.

In the passage *a*³ are placed projections which break up the stream of fluid and cause it to flow in a tortuous path. In Figs. 1 and 2 the projections are in the form of a continuous ridge of helical form, extending from one end of the channel to the other. In the form illustrated in Fig. 1 the ridge consists of a separate helix *a*⁷, of wire or other suitable material, secured in position in the channel. The ridge, however, may preferably be in the form of a thread *l*¹, cut in the inner wall of the outer tube *l*, as shown in Fig. 2. In Fig. 3 the outer tube is shown to consist of sections *m n o*, of which there may be any desired number, each having in its interior a thread *m' n' o'*, respectively, the threads of the various sections being alternatively right and left handed to bring about in each section a reversal of the direction of flow of the fluid in the channel.

As illustrated in Fig. 6, the internal diameter of the sections *m n* may be increased at their ends to form chambers *r*, which serve to connect the alternately right and left handed

channels $m' n'$ and within which the reversal of flow takes place. In Fig. 4 the means illustrated for breaking up the flow and causing the fluid to travel in a tortuous path consists of a number of lugs p' , projecting from the interior wall of the outer tube p , this tube, with its interior projections, being shown in plan in Fig. 5.

Although in the various modifications shown in the drawing the projections or ridges have been illustrated as being carried upon or formed integrally with the inner wall of the outer tube, it will of course be understood that they might equally well be carried upon or formed integrally with the outer wall of the inner tube so long as they are located in a position to be interposed in the path of flow in the channel. It will also be understood that the tubes may be made of any desired length sufficient to bring about the required degree of admixture of the fluids. In practice I have found that very satisfactory results are obtained with parts having approximately the dimensions of those shown in the drawing.

The upper end of the inner tube b may be closed, as shown in the present instance, the side wall, however, being perforated at a number of points b' to permit the flow of fluid from the inner tube to the channel a^3 of the outer tube. The perforations or passages b' are placed at frequent intervals along the path of flow of the fluid in the channel a^3 and may consist of several series of holes drilled radially in the outer wall or shell of the inner tube b .

In the chamber t' at the end of the channel a^3 I prefer to provide a deflecting device f , which may be in the form of a disk having a concaved face presented toward the end of the channel a^3 and which may be suitably secured to the upper end of the inner tube b . The office which this part performs is to intercept the fluid as it passes from the channel a^3 and to spread it out and throw it back upon itself and into proximity to a series of holes or passages b^3 in the upper end of the inner tube b .

The chamber t' is formed by the cylinder t , which in the present instance is shown of glass as used in sight-feed devices, but which may be of any suitable material. This cylinder is clamped by means of bolts k , provided with nuts k' , between the flanges of the two pieces g and h , the first mentioned of which screwed to the top of the outer tube a , with a washer s' , of suitable material, interposed between the abutting portions, while the piece h has a hollow externally-screw-threaded extension which is secured to the nozzle j , adapted to connect with the delivery-pipe by means of a winged and internally-screw-threaded sleeve i , a washer s^3 be-

ing interposed at the point where the nozzle j and the extension of the piece h abut.

In practicing my invention by means of the apparatus illustrated and described one of the fluids is led in a suitable manner to the extension a^2 of the outer tube a , whence it flows by way of channel a^5 into channel a^3 , lying between the outer and the inner tubes. The other fluid is caused to flow by way of supply-pipe d into the inner tube b , whence it escapes into the channel a^3 by way of the perforations or passages b' and there mingles with the other fluid. Both fluids are supplied, preferably, at substantially the same pressure, which may, if desired, be varied to secure any required degree of admixture, and by preference the pressure is sufficient to cause a rapid flow of the fluid in the channel a^3 , the rapidity being also dependent upon the rate of outflow as permitted by the operator. On account of the projections in this channel—the helical ridges of Figs. 1, 2, and 3 and the lugs of Figs. 4 and 5—the stream of fluid is broken up and caused to flow in a tortuous path, and into the agitated stream thus produced and at a number of points along its path the other fluid is projected as jets from the inner tube b by way of the passages b' . The nature of the channel in which the fluid in the outer tube flows is such as to put it in a condition to be rapidly, intimately, and uniformly mixed with the portion of the other fluid that is projected into it at each of the many points along its channel, with the result that it is speedily saturated with the fluid supplied by way of the inner tube. As the stream leaves the channel a^3 and strikes the deflector f it is broken up and thrown back into proximity to the holes or passages b^3 at the top of the inner tube b , where it receives its final charge of the fluid supplied by that tube. The intimate mixing of two fluids by the method and apparatus of my invention is so rapid as to be practically instantaneous, and as a result the mixture may immediately be drawn off for use, or it may, if desired, be conducted to a reservoir, which, however, plays no part in the mixing operation.

By so disposing the ridges or projections in the channel a^3 that the direct longitudinal channel is not entirely closed, as by arranging the ridge so that it is slightly separated from the inner tube, as shown in Fig. 1, a certain portion of the fluid will tend to flow directly through the channel from one end to the other, and this portion will interfere to a certain extent with the helical flow, and thus tend to further increase the agitation of the fluid.

In employing the particular apparatus described and illustrated for the purpose of carbonating water I connect the water-

supply with the extension a^2 of the outer tube a and the supply of carbonic-acid gas with the corrugated end d' of the extension d of the inner tube b .

5 Although in describing one manner in which my invention may be practiced I have described more or less precise forms and details of construction, I do not intend to limit myself thereto, as I contemplate changes in
10 form, proportions of parts, and the substitution of equivalents as circumstances may suggest or render expedient without departing from the spirit or scope of my invention and claims.

15 My invention involves the novel method or process of mixing fluids, as well as the novel apparatus described herein for effecting this result, but the claims upon the method or process I reserve for another application.

20 I claim—

1. A mixing apparatus comprising a body having a bore or passage for the water, a gas-tube arranged concentrically within such passage, and means for providing for the water a narrow straight path adjacent the tube
25 and a spiral path therebeyond.

2. A mixing apparatus comprising a body having a bore or passage for the water, a gas-tube arranged concentrically within such
30 passage, and means for providing for the water a narrow straight path adjacent the tube and a spiral path therebeyond, said tube having a series of openings in position to direct gas into the body of water circulating in
35 said spiral path.

3. A mixing apparatus comprising a part having two channels communicating with each other through a plurality of passages, one of said channels which is a water-passage
40 being tortuous and the other which is a gas-passage being straight, and a mixing-chamber arranged to communicate with one of said channels at a point beyond the initial commingling of the water and gas.

45 4. A mixing apparatus, comprising a part provided with two concentric channels communicating with each other through a plurality of passages, the outer one of said channels being in the form of an alternately right
50 and left handed helix.

5. In a mixing apparatus, the combination with an outer tube adapted to be connected with a supply of fluid, of an inner tube adapted to be connected with a supply of another fluid, a helical ridge lying between the two tubes and adapted to cause the fluid in the outer tube to flow in a circuitous path, a plurality of perforations in the wall of the inner tube, and a part at the end of the outer
55 tube-passage adapted to spread the fluid flowing therethrough.

6. In a mixing apparatus, the combination

with an outer tube provided with a tortuous passage on its inner wall, and an inner tube communicating with said passage through a
65 plurality of perforations along its length, of a chamber at one end of the passage of the outer tube adapted to communicate with a source of fluid-supply, and provided with a substantially conical projection concentric
70 with the inner tube and having its apex presented toward the channel in the outer tube.

7. In a mixing apparatus, the combination with an outer tube provided with a tortuous passage on its inner wall, and an inner
75 tube communicating with the passage in the outer tube through a plurality of perforations along its length, of a chamber at one end of the passage of the outer tube adapted to communicate with a source of fluid-supply, and provided with a substantially conical projection concentric with the inner
80 tube, and having its apex presented toward the channel in the outer tube, and a chamber at the other end of the passage in said outer
85 tube and in communication with the delivery-pipe, said chamber containing a part adapted to deflect and spread the fluid as it is delivered from the end of the channel in the outer tube.

8. In a mixing apparatus, the combination with an outer tube having a channel in its inner wall, of an inner tube communicating with the channel in the outer tube through a plurality of passages, and a device
95 beyond the end of the channel in the outer tube adapted to cause fluid passing through said channel to be deflected back into proximity to the passage in the inner tube.

9. In a mixing apparatus, the combination with a part having a channel for the flow of a fluid, of a deflector f arranged at the outer side of said channel to break up and turn back the flow and a tube having a perforation adjacent to said deflector and adapted
105 to deliver a stream of another fluid into the stream of the first-mentioned fluid where it is broken up and turned back.

10. In a fluid-mixing apparatus, the combination with an outer tube a and an inner
110 tube b having a channel a^3 therebetween, said inner tube being perforated at a number of points along said channel, of an extension a^2 of said outer tube carrying an extension a^5 of said channel, and a part c' of truncated
115 conical form arranged at the bottom of said channel a^3 with its apex directed toward said channel.

11. In a fluid-mixing apparatus, the combination with an outer tube a , and an inner
120 tube b concentric therewith and provided with a number of perforations b' , of a helical ridge arranged in the space between said tubes, a deflector f arranged at the end of the

inner tube, said inner tube being provided with perforations b^3 adjacent to said deflector.

12. A mixing apparatus comprising a tubular portion made in separate sections, the inner walls of such sections respectively being in the form of alternately right and left hand helices, and a gas-tube arranged concen-

trically within said tubular portion and having a plurality of openings through which gas is discharged into the water passing through such tubular portion.

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