

July 14, 1942.

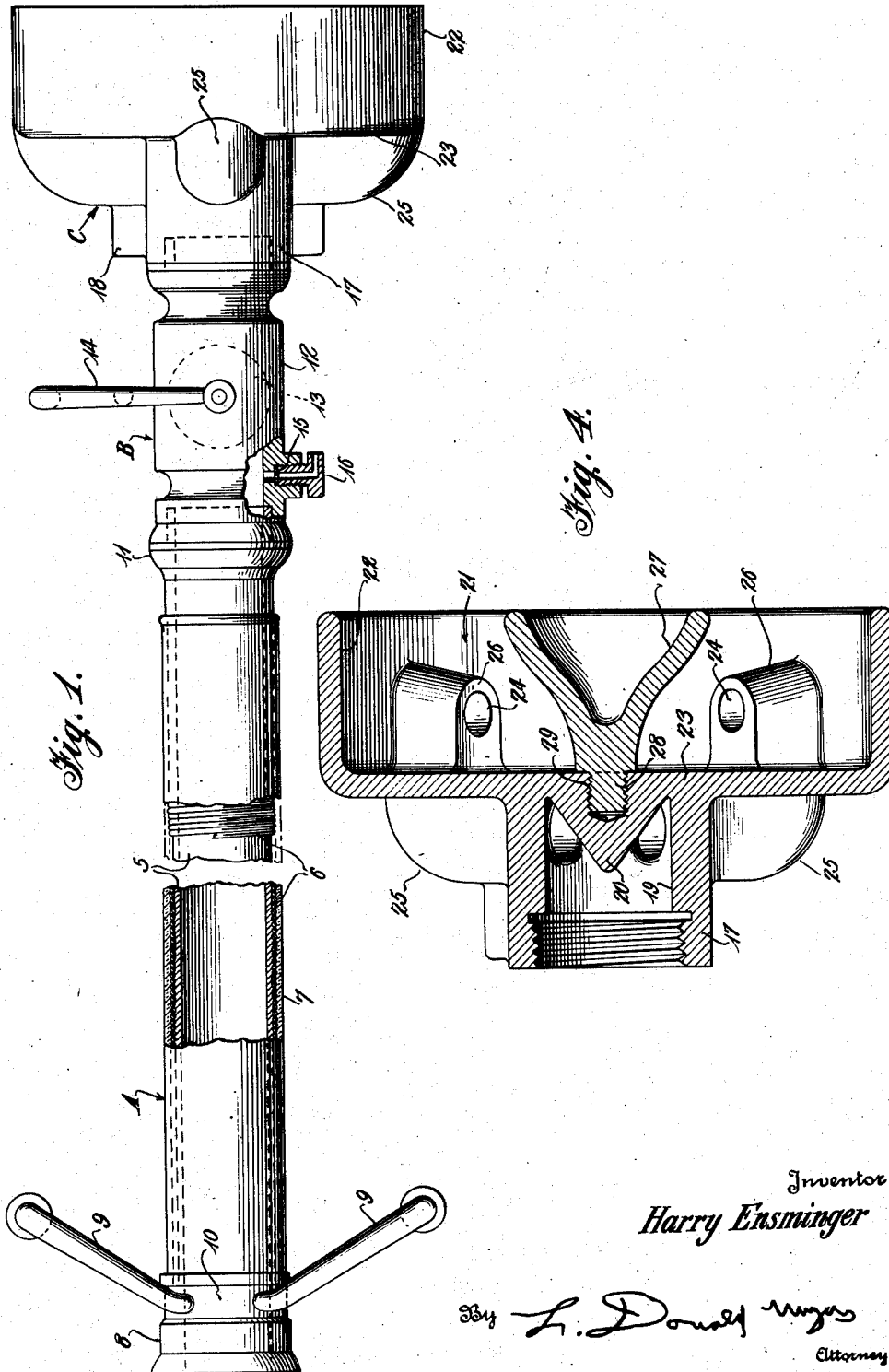
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2,289,352

FIRE EXTINGUISHER DISCHARGE APPARATUS

Filed Dec. 22, 1938

2 Sheets-Sheet 1



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Fig. 3.

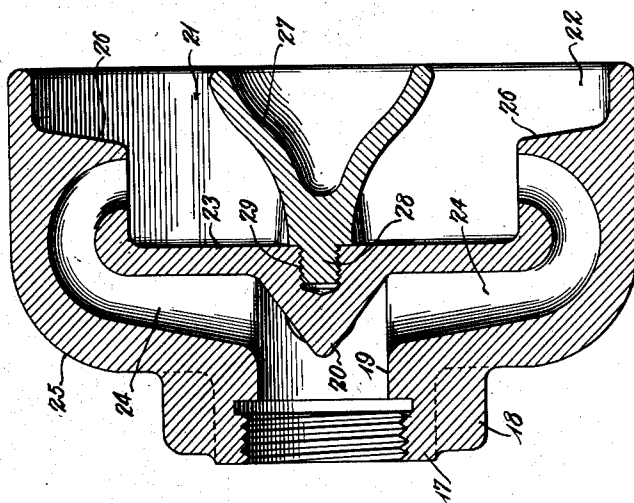
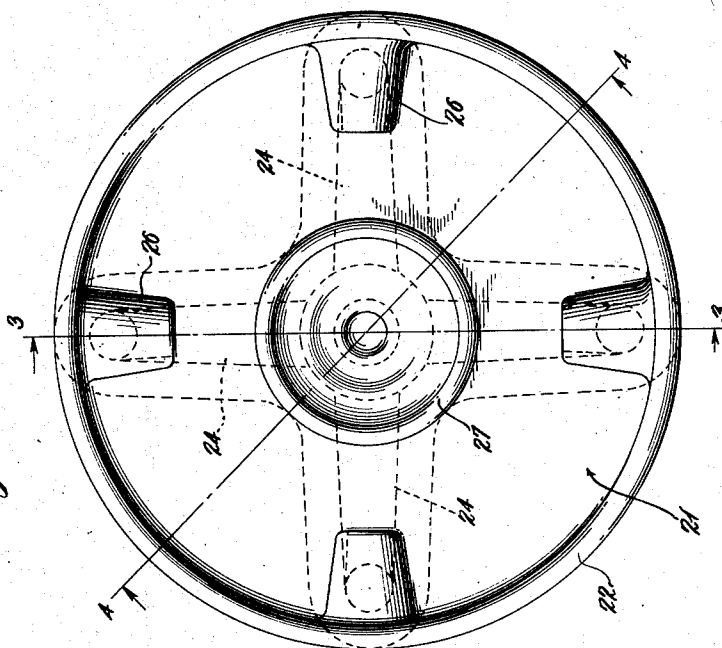


Fig. 2.



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UNITED STATES PATENT OFFICE

2,289,352

FIRE EXTINGUISHER DISCHARGE
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Application December 22, 1938, Serial No. 247,268

14 Claims. (Cl. 169—11)

This invention relates to new and useful im-
provements in discharge apparatus for carbon
dioxide when it is used as a fire extinguishing
medium.

The primary object of this invention is to pro-
vide apparatus which may be satisfactorily em-
ployed for discharging carbon dioxide from hose
lines, due to its ability to dampen both axial
and radial recoil, and for effecting application
of the extinguishing medium on the burning ma-
terial at the most effective density and velocity
and in such a manner as to cause the medium
to completely encase and blanket the material,
preventing the continuance of combustion.

A further important object of the invention is
to provide discharge apparatus, for liquid carbon
dioxide, which may be used with a hose line
and which will be effective in maintaining the
liquid at the desired pressure right up to the dis-
charge nozzle during temporary shut-off periods,
thereby avoiding the difficulties which arise from
a drop in pressure below the triple point of car-
bon dioxide, which is 75 pounds per square inch.

Another object of the invention is to provide
a nozzle for liquid carbon dioxide discharge
apparatus which will maintain the extinguish-
ing medium in liquid form until it reaches the
point or points of discharge; which will pre-
vent freezing and will permit free flow of the
medium at all times, and which will discharge
a thoroughly mixed combination of gas and snow
that includes an unusually high percentage of
snow.

Still another object of the invention is to
provide a play-pipe arrangement for connect-
ing a discharge nozzle to a hose line which is
light in weight; which will prevent frosting on
the exterior surface of the same; and which
will guard against any static electrical condi-
tion arising.

Other objects and advantages of the inven-
tion will be apparent during the course of the
following description.

In the accompanying drawings forming a part
of this specification and in which like numerals
are employed to designate like parts through-
out the same,

Figure 1 is a side elevational view, partly bro-
ken away, of fire extinguisher discharge appa-
ratus embodying this invention,

Figure 2 is a front elevational view of the
discharge nozzle portion of the apparatus dis-
closed in Fig. 1.

Figure 3 is a transverse sectional view of the

nozzle disclosed in Fig. 2 and taken on line 3—3
of that figure, and

Figure 4 is a transverse sectional view of the
nozzle taken on line 4—4 of Fig. 2.

In the drawings, wherein for the purpose of
illustration is shown the preferred embodiment
of this invention, and particularly referring to
Fig. 1, the reference character A designates in
its entirety a play-pipe which is intended to be
directly connected to the discharge end of a
hose line, or the like, through which liquid car-
bon dioxide is fed from a suitable source of
supply. This discharge apparatus is primarily
designed for discharging carbon dioxide stored
at a high pressure. Preferably, the appa-
ratus is to be employed for discharging carbon
dioxide stored at a subatmospheric temperature
which, for example, will not exceed 32° F. The
apparatus has been found to be extremely effec-
tive in extinguishing fires when employed in
connection with a source of supply of liquid
carbon dioxide which is maintained at 0° F. and
its corresponding 300 pounds per square inch
pressure.

Suitably connected to the outer end of the
play-pipe A is a manually controlled shut-off
valve unit B. This valve unit functions to con-
nect to the play-pipe A the discharge nozzle
which is designated in its entirety by the refer-
ence character C.

Referring first to the play-pipe A, it is formed
of a light-weight metal tube 5 which is covered
and reinforced by a spiral wrapping of cord 6.
Surrounding the cord and completely encasing
the same is a non-frosting insulation covering
7 which may be formed of rubber, or the like.
This construction is extremely light in weight
and permits the play-pipe to be readily and
quickly transported. The construction is such
that frost will not form on the exterior sur-
face of the same, during the feeding of liquid
carbon dioxide therethrough, and will also guard
against any static electrical condition that might
arise. The inner end of the play-pipe is formed
with a suitable metallic coupling member 8
by means of which the play-pipe A may be
suitably connected to a hose line leading from an
appropriate source of supply. A pair of handle
members 9 is suitably attached to the coupling
8. These handles may either be fixed to the
coupling or connected thereto by a band 10 which
is adapted for swiveling or partaking of angu-
lar movement relative to the coupling. These
handles 9 may be made of metal or any suitable
non-conducting material.

The remaining end of the play-pipe A is provided with a coupling member 11 to which is connected the casing 12 of the valve B. This valve includes a quarter-turn, rotatable plug body 13 which is manipulated by means of the handle 14. In other words, a one-quarter rotation of the plug 13 in opposite directions functions to turn on and shut off the flow of liquid carbon dioxide through the valve casing. As the temperature of the carbon dioxide in the supply hose and play-pipe up to the valve B may vary with temperature changes of the surrounding atmosphere, or due to other causes, a safety blow-off valve is provided in the manual valve B. This safety blow-off valve consists of a rupturable disc 15 held in place by a bored discharge plug 16. The disc 15 should be of proper strength to withstand a certain pressure within the bore of the valve casing 12, but should rupture or blow out when the pressure exceeds a predetermined safe maximum.

The discharge nozzle C is provided with a stem or shank 17 which is adapted to be threadedly connected to one end of the valve casing 12. To assist in threading the discharge nozzle onto the valve casing, the stem or shank 17 is provided with a pair of diametrically arranged ears or lugs 18 which may be engaged by a suitable tool.

The discharge nozzle is disclosed in detail in Figs. 2 to 4, inclusive. With the exception of a detachable diffuser element, which will be described at a later point, the nozzle, preferably, is cast or formed in one piece. The stem or shank 17 is bored to provide an inlet passage 19 which is closed at its inner end by the conical projection 20. This conical projection functions to split or deflect the stream of fluid flowing into and through the inlet passage 19, for a purpose to be explained at a later point. A discharge chamber 21, which also functions as an expansion chamber, is formed by a cylindrical peripheral wall 22 and a flat end wall 23. The end wall, as is clearly shown in Fig. 4, joints with the stem or shank 17 of the nozzle and directly supports the cone 20. The remaining side of the discharge nozzle 21 is left open or is unobstructed to allow for the discharge of the carbon dioxide onto the fire.

Figs. 2 and 3 clearly disclose four ducts 24 which are of hook shape in longitudinal section and are arranged to extend radially outwardly from the inlet passage 19 and radially inwardly of or into the discharge and expansion chamber 21. These ducts are provided by coring the external rib portions 25, best shown in Figs. 1 and 4, and the inwardly projecting tip formations 26, best shown in Figs. 3 and 4.

Fig. 2 clearly illustrates the fact that these ducts 24 are positioned in diametrically arranged pairs so that the respective ducts of each pair oppose or counteract each other to dampen radial recoil resulting from discharge of the carbon dioxide into the discharge and expansion chamber 21. Fig. 3 clearly illustrates that the ducts 24 continuously taper from their inlet to their outlet ends. The combined area of all of the inlet ends of the ducts 24 preferably should equal the area of the inlet passage 19. However, the combined area of the inlet ends of the ducts may vary between 75% and 100% of the area of the inlet passage 19. The maximum discharge is obtained when the ducts 24 are formed so that the combined area of their inlet ends equals 100% of the area of the passage 19.

Due to the tapered formation of each one of the ducts, the discharge end, naturally, is smaller than the inlet end. For most efficient operation, it has been determined that the area of each discharge end of a duct should be from 40 to 60% of the area of the inlet end.

Centrally positioned in the discharge chamber 21 is a bell shaped diffuser 27. This diffuser is detachably connected to the flat end wall 23 by means of the threaded shank 28 which is mounted in the internally threaded socket 29. Due to the detachable form of connection, the diffuser 27 may be replaced as desired or diffusers of different profile or contour may be employed.

As has been stated, this discharge apparatus is especially intended for use with liquid carbon dioxide. Due to the extremely high pressure and low temperature, and also to refrigeration encountered in employing carbon dioxide, it is essential that the apparatus be of light construction; that the handling portion of the apparatus be insulated against the formation of frost on its exterior surface; that a safety device be employed which will operate to reduce the pressure in the event of an abnormal rise in temperature of the confined carbon dioxide liquid; that the pressure of the liquid be maintained above the triple point of carbon dioxide right up to the discharge nozzle portion of the apparatus; that discharge of the fire extinguishing medium may be accomplished without an appreciable amount of recoil, and that the discharge nozzle will operate to effect discharge of the medium without clogging or freezing up. The various structural features which have been described above take care of all of these operating conditions.

To further explain the operation of the discharge nozzle, it will be appreciated that the valve device B may be manipulated to turn on and off the supply of liquid carbon dioxide to the nozzle. The location of this valve device in close proximity to the nozzle permits a user of the apparatus to turn off the supply at desired intervals, to allow for inspecting the condition of the fire being extinguished, without encountering difficulties resulting from a drop in pressure in the supply line. The liquid carbon dioxide will flow through the play-pipe A and through the valve device B when the valve plug 13 is open and into the inlet passage 19 of the nozzle C under pressure. The deflecting cone 20 will split or divide the stream of liquid carbon dioxide and direct it into the plurality of ducts 24. The ducts are so shaped and so arranged that an inward radial discharge is obtained. The liquid flowing through the inlet passage 19 is split by the cone 20 and this smooths out the flow as it enters the ducts. The ducts all discharge radially inwardly at a direction which forms a 90° angle to the direction of flow entering the inlet passage 19. The various discharge ends of the ducts are diametrically arranged so that they will balance each other. As a result of all of these structural features, axial and radial recoil is eliminated or reduced to a point where the discharge of carbon dioxide supplied by a hose line is made possible and practical. The design of the ducts with their discharge ends or ports is such that freezing up does not occur and the carbon dioxide will be permitted to flow freely at all times.

It will be appreciated that the carbon dioxide remains in liquid form up to the time it is discharged from the ends of the several ducts. Dis-

charge of the liquid carbon dioxide into the chamber 21 naturally permits the carbon dioxide to suddenly expand with the result that it will be converted into a mixture of gas and fine particles of snow. The plurality of discharging streams impinge radially upon the periphery of the diffuser 27 with the result that the velocity of the flowing streams is materially reduced and turbulence is created. The discharged material, also, is compelled to suddenly change its direction of flow. This impingement, the resultant turbulence, and the sudden change in direction of flow, all materially contribute in converting the fine snow particles into larger snow flakes, thereby slowing up the process of gasification. This discharged mixture of gas and snow flakes has been found to be much more effective as a fire extinguisher than a mixture of gas and fine snow particles.

This discharge nozzle structure results in the delivery of the extinguishing medium at the most effective velocity and density and it is found that the materials being consumed by fire are completely encased and blanketed by the discharge medium.

It is to be understood that the form of this invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. Fire extinguisher discharge apparatus for use with carbon dioxide comprising a discharge nozzle having an inlet passage, a co-axially arranged discharge chamber, and a plurality of radially extending hook shaped ducts connecting the passage to the chamber and forming the sole discharge paths from the said passage, the shape and arrangement of the ducts causing their discharge ends to extend in a radial inward direction with respect to the chamber.

2. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged cylindrical discharge chamber having an open side and being of considerably greater diameter than the inlet passage, and a plurality of equi-spaced ducts connecting said passage and chamber, said ducts being shaped to lead radially outwardly of the passage and radially inwardly of the chamber but lying completely inwardly of the periphery of the discharge chamber.

3. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged cylindrical discharge chamber of uniform diameter throughout its length having its rear side closed by a flat wall and its front side entirely open, a plurality of ducts connecting said passage and chamber and being grouped in diametrically arranged pairs, and a projection in the inlet passage for splitting all of the fluid flowing in said passage and directing it to said ducts.

4. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged discharge chamber having one open side through which all of the carbon dioxide passing through the nozzle is discharged, a plurality of ducts forming the sole connection between said passage and chamber and being grouped in diametrically arranged pairs with the discharge ends of the ducts of each pair being pointed radially

inwardly toward each other, and means in said discharge chamber constructed and arranged to have all of the carbon dioxide entering said chamber through the inwardly pointed discharge ends of the ducts to impinge directly thereagainst to reduce the velocity of flow and to create turbulence.

5. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged cylindrically shaped discharge chamber having one open side through which all of the carbon dioxide passing through the nozzle is discharged, a plurality of equi-spaced ducts forming the sole connection between said passage and chamber, said ducts being shaped to lead radially outwardly of the passage and radially inwardly of the chamber, a conical projection closing the end of the inlet passage for splitting all of the fluid flowing in said passage and directing it into the ducts, and means in said discharge chamber constructed and arranged to have all of the carbon dioxide entering said chamber impinge thereagainst to reduce the velocity of flow and create turbulence.

6. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged discharge chamber separated from the inlet passage by a common imperforate wall, and a plurality of tapering ducts communicating at their larger end with said passage and at their smaller ends with the discharge chamber and being grouped in diametrically arranged pairs.

7. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged discharge chamber of greater diameter than depth, and a plurality of equi-spaced ducts connecting said passage and chamber, said ducts being hook shaped in longitudinal section and being arranged to extend radially of both the passage and the chamber and to project into the discharge chamber to carry the discharge radially inwardly of the side wall of said chamber.

8. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a one-piece body having a cylindrically shaped discharge chamber formed with one flat side wall and open at its opposite side, an inlet passage axially arranged with respect to said flat side wall, a plurality of radially arranged ducts extending outwardly of the inlet passage and into the discharge chamber, and a conical projection arranged in the inlet passage to split the fluid flowing therein and direct it to the ducts; and a bell shaped diffuser detachably connected to the central portion of the flat end wall of the discharge chamber and operating to increase the yield of snow as a result of impingement of the carbon dioxide thereagainst and the creation of turbulence within the discharge chamber.

9. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having a discharge chamber formed with one flat side wall and open at its opposite side, an inlet passage axially arranged with respect to said flat side wall, a plurality of radially arranged ducts extending outwardly of the inlet passage and into the discharge chamber, and a conical projection arranged in the inlet passage to split the fluid flowing therein and direct it to said ducts.

10. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body hav-

ing a discharge chamber formed with one imperforate side wall and open at its opposite side, an inlet passage arranged on the opposite side of said imperforate side wall, a plurality of radially arranged ducts extending outwardly of the inlet passage and into the discharge chamber, and a projection arranged in the inlet passage to split the fluid flowing therein and direct it to said ducts; and a diffuser detachably connected to the central portion of the imperforate end wall of the discharge chamber and operating to increase the yield of snow as a result of impingement of the carbon dioxide thereagainst and for creating turbulence within the discharge chamber.

11. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged discharge chamber having an open side through which all of the carbon dioxide passing through the nozzle is discharged, a plurality of equispaced ducts forming the sole connection between said passage and chamber, said ducts being shaped to lead radially outwardly of the passage and radially inwardly of the chamber, and a conical projection closing the end of the inlet passage for splitting all of the fluid flowing in said passage and directing it into the ducts.

12. A one-piece fire extinguisher discharge nozzle for use with carbon dioxide, comprising a discharge chamber of considerably greater diameter than depth having imperforate rear and side walls and being entirely open at its front, a stem, having an inlet passage, integral with and exterior of said rear wall and concentrically arranged with respect to the discharge cham-

ber, a plurality of radial ribs exterior of and integral with the rear wall of the discharge chamber and the stem, and a plurality of radial projections in the discharge chamber integral with the side and rear walls of the chamber, the respective ribs being arranged in alignment with the projections axially of the nozzle and the thus aligned ribs and projections being cored to provide ducts which communicate at their opposite end with the inlet passage and the discharge chamber.

13. Fire extinguisher discharge apparatus for use with carbon dioxide comprising a discharge nozzle having an inlet passage, a coaxially arranged discharge chamber, said passage and chamber being separated by an imperforate wall which is normal to their common axis and which acts as the outer end wall for the inlet passage and the rear wall for the discharge chamber, and a plurality of radially extending ducts connecting the passage to the chamber, said ducts all discharging into the chamber toward its axis and forming the only discharge paths for the carbon dioxide from the inlet passage.

14. A fire extinguisher discharge nozzle for use with carbon dioxide comprising a body having an inlet passage, a concentrically arranged discharge chamber of cylindrical shape and having an imperforate, flat, radially extending rear wall which overlies and closes the adjacent end of the inlet passage, said chamber being entirely open at its front, and a plurality of ducts forming the sole discharge paths for the passage and the sole connection between the passage and chamber with the ducts discharging into the chamber toward its axis.

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