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PULSATION ELIMINATOR AND GAS CLEANER

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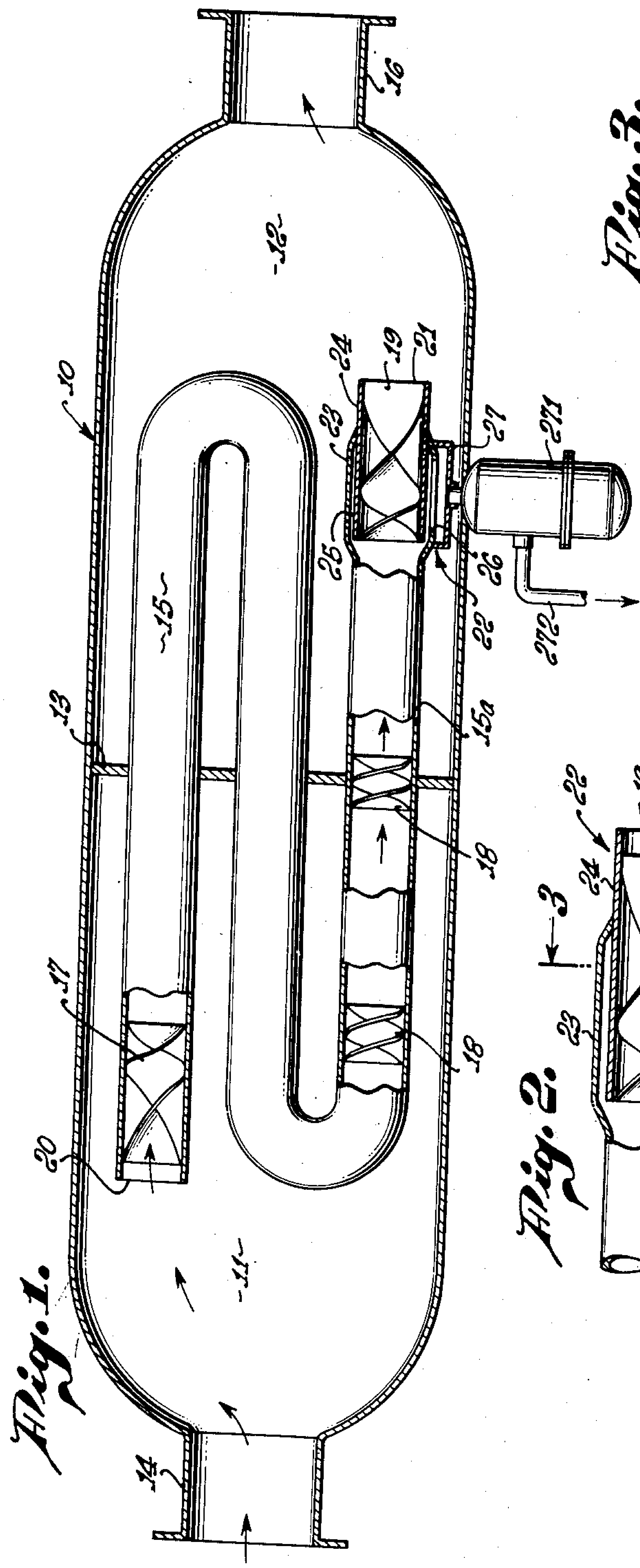

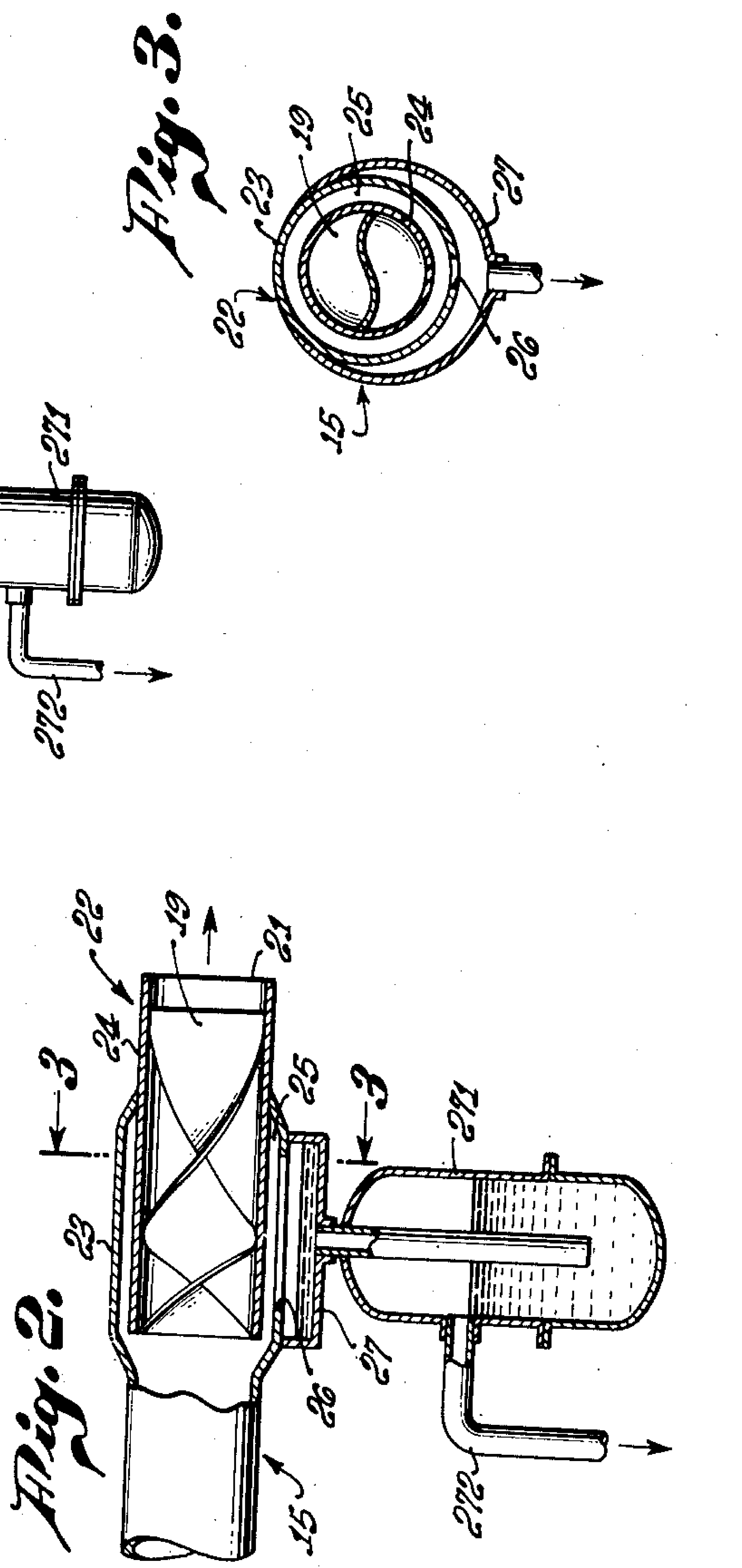

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PULSATION ELIMINATOR AND GAS CLEANER

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4 Claims. (Cl. 183—80)

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This invention has for its general object the provision of a unitary apparatus capable of performing the dual functions of eliminating pulsations from gas streams and of separating moisture from the gas. More specifically contemplated is a single shell-contained unit designed to function as an acoustical filter with respect to a moisture-laden gas stream entering the shell, and as a separator by which moisture is extracted through the employment of an element functioning both as a pulsation dampening and moisture separating element.

As to the general kind of pulsation dampener employed, the invention contemplates using essentially the type disclosed in the Stephens Patent 2,437,446, issued March 9, 1948, on Gas Pulsation Dampening Apparatus, and comprising a shell containing a pair of chambers connected by an elongated pipe for series flow of the gas from an inlet through the chambers to an outlet. As discussed in the patent, the shell chambers serve as acoustical capacitances and the elongated pipe as an acoustical impedance or inductance, all so related as to produce a canceling out of the pulsation phases. For present purposes, attention is directed to the effect of the chamber interconnecting pipe to restrict the gas stream over an extended path of flow.

One of my major objects is to utilize the interconnecting pipe, together with internal baffles or vanes, as a means of throwing out from the gas, liquid which may be removed separately from the outlet gas. Specifically, I place within the pipe a spiral or helical vane series acting to convert the gas entering the pipe to a swirling course of flow and acting on the gas at or approaching the outlet end of the pipe, to centrifugally segregate the liquid against the wall of the tube and from which the liquid is separably removable and recoverable and through an appropriate liquid trap.

The invention has various additional features and details, particularly with relation to the particular form and placement of the baffling vanes within the pipe, and also the liquid draw-off means, all of which however will be understood to best advantage from the following detailed description of an illustrative embodiment of the invention shown by the accompanying drawing in which:

Fig. 1 is a view taken in longitudinal section through the dampener shell, with portions of the chamber-interconnecting pipe broken away to expose the gas swirling vanes;

Fig. 2 is an enlargement of the liquid trap assembly at the outlet end of the pipe; and

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Fig. 3 is a cross section on line 3—3 of Fig. 2.

The dampener-separator structure includes an elongated shell 10 containing a pair of chambers 11 and 12 which may be of substantially the same size separated by a transverse partition 13. A wet pulsating gas stream entering chamber 11 through the inlet 14 flows through an elongated pipe 15 into chamber 12 and thence to the outlet 16. The functional relations of the chambers 11 and 12, serving as acoustical capacitances, and the interconnecting pipe 15 serving as an acoustical impedance, are fully developed in the Stephens patent referred to above. For present purposes it will suffice to explain that the chambers and their interconnecting pipe may be dimensioned generally in accordance with the formulation given in the Stephens patent, with the result that where designed for the removal of relatively low frequency pulsations, as developed, for example by the usual natural gas piston-type compressors, the inductance pipe 15 will be extended to a length greater than the length of the shell 10. Accordingly, the pipe may be accommodated within the shell by extending the pipe through the partition 13 and doubling the pipe upon itself within the chambers 11 and 12, substantially as illustrated in Fig. 1.

In flowing through the pipe 15, the gas is maintained in a course of swirling flow by suitable arrangement of baffles or vanes preferably of helical form and so distributed along the extent of the pipe as to maintain the gas in a condition of substantially swirling flow at the inlet and outlet extents of the pipe. Accordingly, the latter is shown to contain spaced spiral baffles or vanes 17, 18 and 19 at intervals maintaining the desired angular or swirling flow of the gas entering the pipe and approaching its outlet end. Preferably, the gas entering the pipe is baffled by vane 17 to have a progressively increasing angular velocity, thus reducing the resistance and inertia effects that would otherwise be imposed if it were attempted suddenly to bring the gas to its maximum swirling velocity. Accordingly, and as illustrated, the helical baffle 17 is shown to have a progressively decreasing lead inwardly away from the inlet end 20 of the pipe, so that the angular velocity of the gas progressively develops to the maximum reached as the gas leaves the baffle. In reverse relation, baffle 19 within the outlet end portion 21 of the pipe has a progressively increasing lead toward the open end of the pipe, with the result that the angular velocity of the gas is progressively reduced before being discharged into chamber 12. One important advantage resulting from the effect of baffles 17 and 19 on the gas stream is that the overall pressure drop through the pipe 15 is considerably reduced below that which would otherwise exist with the inlet and outlet vanes at constant minimum pitch corresponding to the desired intermediate swirl velocity.

At the high velocity imparted to the gas and flowing through the pipe, liquid entrainment in the gas is centrifugally and progressively thrown out against the wall of the pipe while being carried forward toward its outlet end 21 by placing one or more spiral vanes 18 within the lower pipe run 15*a*. Provision is there made for separating the liquid and removing it from the shell independently of the outlet gas stream. For this purpose I provide a trap, generally indicated at 22, comprising an enlarged diameter extension 23 of pipe 15 surrounding in spaced relation a pipe section 24 containing the vane 19. Centrifugally segregated liquid enters the space 25 and drains through slot or opening 26 into a trap chamber 27 from which the liquid drains into vessel 271 and thence into the draw-off line 272.

In the course of its flow from the inlet 14 to the outlet 16 through the chambers and their interconnecting pipe, the gas is subjected to the dual effects of pulsation elimination and liquid separation, with the final result that gas reaching the outlet is dry and has a regular or substantially non-pulsating flow.

I claim:

1. A gas pulsation dampener and separator comprising a shell containing a pair of chambers the first of which has a gas inlet and the second of which has a gas outlet, a pipe within the shell connecting the chambers for series flow of the gas therethrough, said pipe being of greater length than the shell and being doubled upon itself within the chambers, helical baffles within the inlet and outlet ends of the pipe, and a trap in the second chamber receiving liquid from an opening in the side of the pipe opposite the baffle in its outlet end and conducting the liquid out of the shell.

2. A gas pulsation dampener and separator comprising a shell containing a pair of chambers the first of which has a gas inlet and the second of which has a gas outlet, a pipe within the shell connecting the chambers for series flow of the gas therethrough, said pipe being of greater length than the shell and being doubled upon itself within the chambers, helical baffles within

the inlet and outlet ends of the pipe, additional helical baffles in said pipe at spaced intervals between the first mentioned baffles, and a trap in the second chamber receiving liquid from an opening in the side of the pipe opposite the baffle in its outlet end and conducting the liquid out of the shell.

3. A gas pulsation dampener and separator comprising a shell containing a pair of chambers the first of which has a gas inlet and the second of which has a gas outlet, a pipe within the shell connecting the chambers for series flow of the gas therethrough, said pipe being of greater length than the shell and being doubled upon itself within the chambers, helical baffles within the inlet and outlet ends of the pipe, the leads of said baffles increasing toward their respective ends of the pipe, and a trap in the second chamber receiving liquid from an opening in the side of the pipe opposite the baffle in its outlet end and conducting the liquid out of the shell.

4. A gas pulsation dampener and separator comprising a shell containing a pair of chambers the first of which has a gas inlet and the second of which has a gas outlet, a pipe within the shell connecting the chambers for series flow of the gas therethrough, said pipe being of greater length than the shell and being doubled upon itself within the chambers, helical baffles within the inlet and outlet ends of the pipe, an additional helical baffle in said pipe near its outlet end, and a trap in the second chamber receiving liquid from an opening in the side of the pipe opposite the baffle in its outlet end and conducting the liquid out of the shell.

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