Sept. 4, 1928. 1,682,929

C. OCHS ET AL

METHOD OF AND APPARATUS FOR INDUCING AND INCREASING THE FLOW OF WELLS

Filed March 21, 1925

Fig. 1

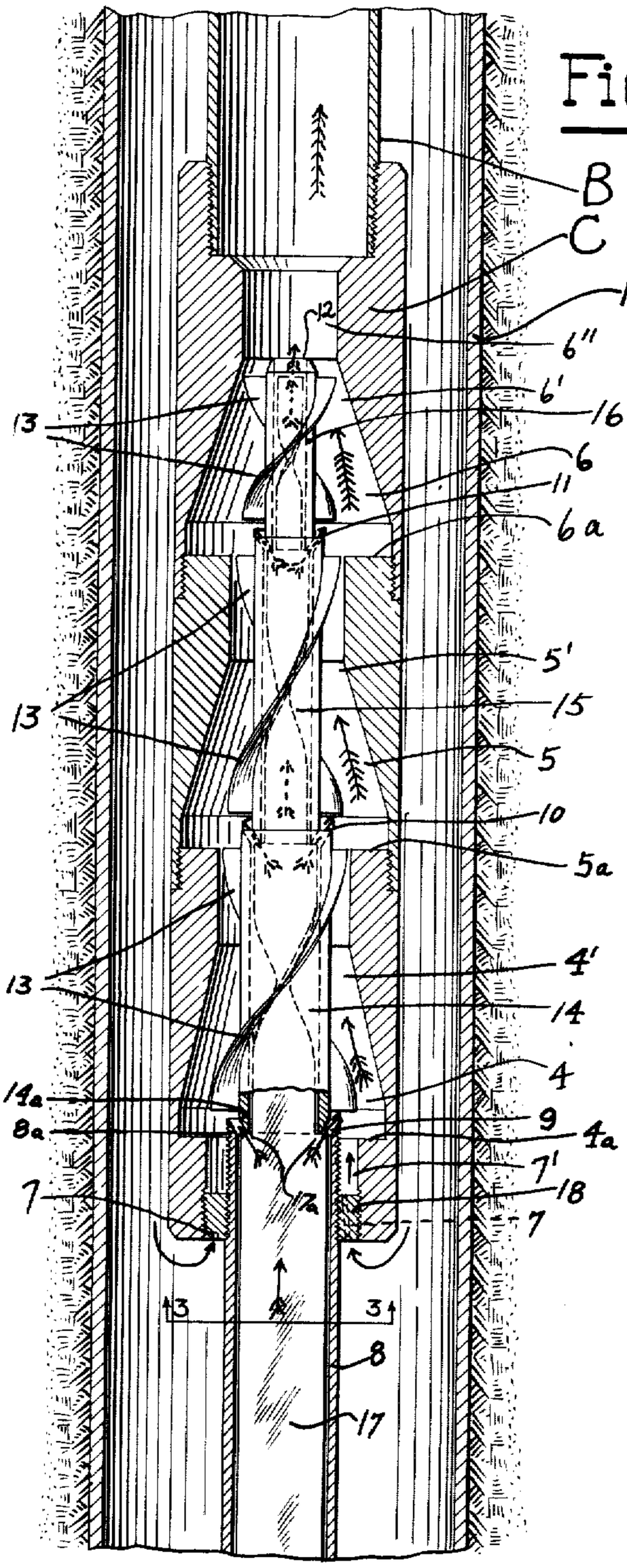


Fig. 2

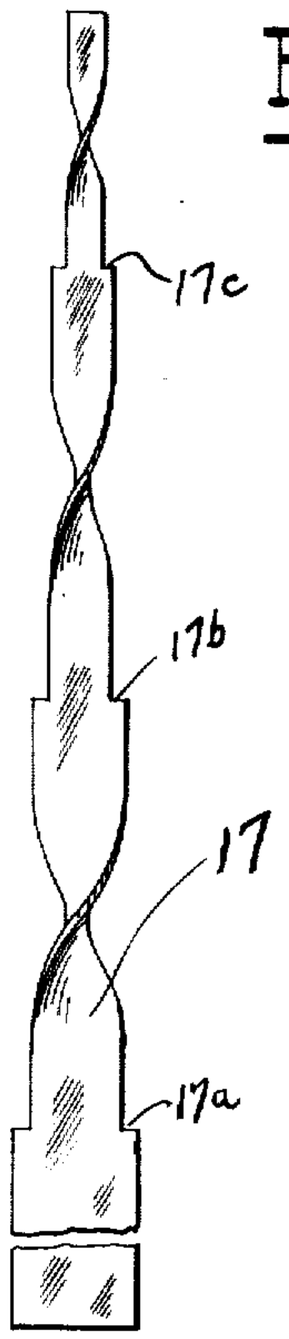
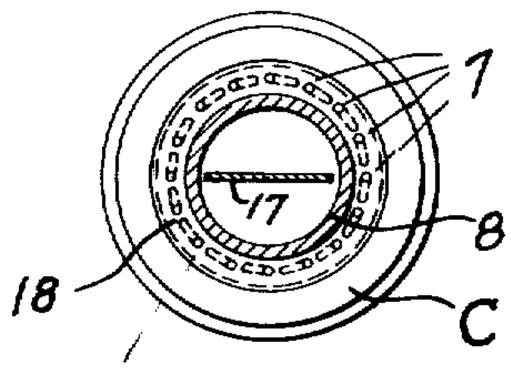


Fig. 3



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR INDUCING AND INCREASING THE FLOW OF WELLS.

Application filed March 21, 1925. Serial No. 17,171.

This invention relates to increasing the flow or discharge of wells by the efficient utilization of gas forced into the well under pressure, and includes both a method and apparatus for practicing the method.

Among the objects of the invention are to provide an improved method and means for increasing and accelerating the flow of fluid products from wells by gas forced into the wells under pressure, to affect the flow of wells by the combined forces of pressure and suction, to subject the well fluid to the effects of centrifugal force in increasing its flow, and in general to make the compressed gas in the highest degree efficient in bearing away the well fluid. Other kindred and incidental objects will become apparent from the more detailed description of the invention which follows:

Stated in its simplest terms the invention contemplates a method of thoroughly mingling or mixing the well fluid with compressed gas so that the well fluid in at least a partial if not an entirely vaporized state is rapidly carried away by the gas. To this end the gas and fluid may be forced in concentric ascending bodies, preferably with a body of gas enclosing a body of well fluid. In forming the ascending body of well fluid the invention contemplates so utilizing the compressed gas as to subject the well fluid to the combined effects of pressure and suction. The invention further contemplates imparting a whirling or cyclonic motion to one or both of said bodies to assist in the thorough mixing of the two and incidentally to contribute to augmenting the flow of the well. Other developments and refinements of the method may include the progressive acceleration of the mixing process and of the velocity of movement of the mixing fluid and gas. The invention further includes means and apparatus applicable on a commercial scale for practicing the method and effecting the above objects.

In order to illustrate the invention apparatus operating in accordance with the described method and capable of attaining the above objects is shown in the accompanying drawings, in which:

Fig. 1 is a vertical sectional view through the lower end of a well and disclosing the apparatus partly in section and partly in side elevation;

Fig. 2 is a side elevational view of a detail of the apparatus shown in Fig. 1:

Fig. 3 is a transverse sectional view substantially on the line 3—3 of Fig. 1.

The embodiment of the invention chosen for the purpose of illustrating both the apparatus and the method is shown in Fig. 1 as installed near the bottom of an oil well of which A is the casing and B is the discharge pipe for the products of the well, in this instance petroleum, gas, etc. To induce and increase the flow of the well products it is to be understood that the casing A is sealed near the top (not shown) and that gas or air under high pressure is forced into the well casing filling the space intermediate the casing A and the discharge pipe B. A preferred form of apparatus by which the compressed gas thus forced into the well is utilized in inducing and accelerating the flow of the well in accordance with the present invention will now be described in detail.

Attached to the end of the discharge pipe in any suitable manner so as to form a part of the same, as by a threaded connection, is a foot piece indicated generally by the reference character C within which the well products become intimately mixed with the compressed gas and are borne thereby up through the discharge pipe B. In order not to confuse the disclosure of the drawing, the fluid in the well is not shown but its path of movement is indicated by arrows, while the path of the compressed gas is indicated by arrow heads without feathering, the mixture of the two being indicated by an increased feathering of the arrows.

As is evident from Fig. 1 the foot piece C, which may be cast in one piece or made up of a plurality of sections as indicated, contains a series of chambers as 4, 5 and 6 in which the oil is progressively mixed with the compressed gas. To this end the gas and oil are caused to ascend in the foot piece C in the form of concentric bodies or columns, the gas being admitted through an annular series

of inlet ports 7 in the base of the foot piece and the oil and other well products through an inlet centrally thereof such as the conduit 8. The oil conduit 8 provides separate outlet ports 9, 10 and 11 registering with the mixing chambers 4, 5 and 6. In practice the foot piece C is lowered below the normal level of the oil so that the latter naturally rises in the conduit 8. When the compressed gas is admitted it forces the level of the oil below the gas inlet ports 7 so that the body of oil thus placed under pressure is forced into conduit 8 and out through openings 9, 10 and 11. The discharge from these openings is further increased by the tendency of the ascending body or encircling column of compressed gas in the foot piece to produce a partial vacuum or suction adjacent the said outlet openings which, incidentally are arranged to increase this suction effect as will later appear. To this end mixing chambers 4, 5 and 6 are constructed to serve as expansion chambers of limited size for the gas by being disposed immediately beyond constricted passages, as for example expansion chamber 4 immediately beyond constricted passage 7′. To confine and compress and thereby increase the velocity of the partly mixed gas and oil issuing from chamber 4 the connection of the latter with chamber 5 is by way of a progressively constricted or Venturi passage 4′. From chamber 5 extends a similar Venturi passage 5′ to make the connection with chamber 6 which in turn provides a Venturi passage 6′ leading into a constricted passage 6″ adjacent the open upper end 12 of oil inlet conduit which together open directly into discharge conduit B. The accelerative effect on the velocity of movement of the mingled gas and oil produced by following an expansion chamber with a Venturi passage is enhanced by making the expansion chambers 4, 5 and 6 progressively smaller and the Venturi passages 4′, 5′, and 6′ progressively more constricted.

In order to produce a more intimate mingling of the oil with the compressed gas to the extent of partial, if not entire, vaporizing of the former a whirling or cyclonic motion is imparted to the enveloping column of compressed gas passing through the foot piece C, initially by giving the gas entrance ports 7 a spiral inclination as suggested in Fig. 1 and clearly indicated in Fig. 3, and thereafter by suitable means within the respective expansion chambers and connecting Venturi passages, such as the spirally disposed flanges 13 on the oil inlet conduit. While any desired pitch may be given to these flanges a preferred arrangement, as shown in Fig. 1, is to effect a half revolution of the fluid body during its passage through each expansion chamber and connecting passage. Since the mixing chambers 4, 5 and 6 including their connecting passages progressively decrease in size as described above for the purpose of accelerating the velocity of movement of the mixed fluids, by preference the pitch of the flanges 13 in the successive chambers is progressively increased thereby similarly accelerating the whirling or cyclonic motion of the mixing fluids. The combined action resulting from the alternate expansion and contraction of the gaseous body, from the acceleration of its axial velocity, and from the acceleration of its cyclonic motion tend in practice to produce and actually does produce a complete vaporizing of the fluid products of the well. Any solid particles not initially vaporized on entrance to any one of the successive expansion and mixing chambers 4, 5 and 6 fall back upon the annular shelves or shoulders 4^a, 5^a and 6^a respectively where they remain until eventually vaporized by the sweep of the whirling, rushing, gaseous body. To assist in the vaporizing of the oil or other fluid product, to increase its discharge from openings 9, 10, 11, and 12 and to prevent even a momentary checking of the cyclonic motion of the gaseous body the ascending body or column of oil in the inlet conduit 8 is given a similar whirling motion similarly progressive in intensity by means which will presently be described.

While the oil inlet conduit may be constructed and arranged in any suitable or desired manner conforming to the above description a preferred construction comprises building the same of pipe sections progressively smaller in diameter and progressively less in length in substantial conformity with the dimensions of the mixing chambers 4, 5 and 6 and their associated connecting passages. Accordingly in the present instance the oil inlet conduit may be considered as comprising a pipe section 8 extending within foot piece C as far as chamber *a*, and a series of progressively smaller pipe sections supported therefrom, as sections 14, 15 and 16 terminating in chambers 5, 6 and in passage 6″ respectively. These pipe sections are not directly in contact with one another but are slightly spaced apart to provide the annular outlet ports 9, 10 and 11 which are preferably formed by beveling the opposed ends after the manner indicated at 8^a and 14^a in Fig. 1 to give the openings a rearward inclination and increase the suction effect of the gas passing the same. The adjacent pipe sections are thus disposed in slightly interfitting or telescoping arrangement but not in actual contact. A preferred means for disposing and maintaining the parts of the sectional oil inlet conduit in the proper relation comprises a flat metal strip 17 (Figs. 1 and 2) axially disposed within the conduit the strip being reduced in width at intervals in conformity with the sectional character of the conduit to provide stop shoulders 17^a, 17^b, 17^c upon which sections 14. 15 and 16 respectively rest

Strip 17 is by preference utilized to unite the several sections of the oil inlet conduit by being welded or otherwise directly secured to each section. By twisting strip 17 spirally as clearly shown in Fig. 2 it serves as the means for imparting the whirling or cyclonic motion to the well fluid referred to above, which motion is in the same direction as that given to the surrounding column of gas. This cyclonic motion in the oil inlet conduit brings centrifugal force into play in the discharge of the oil from openings 9, 10 and 11.

In practice the foot piece C and the oil inlet conduit therefore are made separately. The foot piece is either cast integrally or made up of machined sections as shown, and the inlet conduit is preferably in built up sectional form after the manner described in the preceding paragraph. To provide for assembling the oil inlet conduit within the casing of the foot piece the lower end of the lowermost section of the latter has an opening or is bored out to the size of passage 7'. Through this opening the assembled inlet conduit is passed and the lowermost section of the same, namely the pipe 8, carries an annular member or bushing 18 in which the gas inlet ports 7 are drilled, which bushing is suitably secured in the opening 7' in any suitable manner as by a threaded connection.

For the efficient operation of the method and apparatus herein disclosed it is essential that the compressed gas forced into the well casing should not enter the oil inlet conduit 8. While this may be avoided by using a short pipe section 8 with a packing engaging the casing A somewhat below gas inlet port 7, it is preferable to extend pipe 8 well down into the oil body as indicated in Fig. 1.

From the above description it is believed that the nature of the method for inducing and accelerating the flow of wells, together with specific means operable in accordance therewith, is clearly evident. It is to be understood however, that the above disclosure is illustrative only and that the invention is susceptible of changes and modifications adapting it to the varied conditions of practical use. Such changes and modifications as come within the spirit and scope of the present invention are intended to be covered by the appended claims.

We claim as our invention:—

1. The method of inducing the flow of wells which comprises forming ascending concentric columns or bodies of well fluid and compressed gas, effecting a gradual mixing of said fluid and gas, imparting a whirling motion thereto during the mixing process, subjecting one of said bodies and the portion of the other mixed therewith alternately to compression and expansion during the mixing process, and progressively increasing such forced compression and progressively reducing such permitted expansion.

2. The method of inducing the flow of wells which comprises forming ascending concentric columns or bodies of well fluid and compressed gas, causing alternate compression and expansion of the outer body, and permitting mingling of the two bodies at each period of expansion.

3. The method of inducing the flow of wells which comprises forming ascending concentric columns or bodies of well fluid and compressed gas, imparting a whirling motion to at least one of said bodies, causing alternate compression and expansion of the outer body, permitting mingling of the two bodies at each period of expansion, and progressively reducing the volume of the mingled bodies.

4. The method of inducing the flow of wells which comprises forming ascending concentric columns or bodies of well fluid and compressed gas, producing a whirling movement of both bodies in the same direction, progressively reducing the cross-sectional area of both said bodies, permitting mingling of the inner body with the outer body at spaced intervals during their ascent, and providing for expansion at each point of mingling of the bodies followed by reduction of the cross-sectional area of the stream of mingled fluids, whereby the well fluid becomes vaporized or atomized and is carried away by said gas.

5. In combination, in a well having gas under pressure forced therein, a discharge conduit for the fluid products of the well, and means associated with said conduit for producing therewithin an ascending body or column of well fluid including a surrounding and ascending body or column of gas, and means effecting contact between said bodies at spaced intervals only.

6. In combination, in a well having gas under pressure forced therein, a discharge conduit for the fluid products of the well, and means associated with said conduit for producing therewithin an ascending body of well fluid including a surrounding and ascending whirling body of compressed gas, and means effecting contact and mingling of said bodies at spaced intervals only during their ascent.

7. In combination in a well having gas under pressure forced therein, a discharge conduit for the fluid products of the well, and means associated with said conduit for producing therewithin an ascending body of well fluid including a surrounding and ascending body of compressed gas, means causing a whirling movement of said body of well fluid, and means permitting a part of the whirling body of well fluid to escape into the body of gas and mingle with the same.

8. In combination, in a well having gas under pressure forced therein, a discharge conduit for the fluid products of the well, and means associated with said conduit for producing therewithin an ascending body or

column of well fluid including a surrounding and ascending body or column of gas, means imparting a whirling movement in the same direction to both bodies, and means effecting contact and mixing of the two bodies at spaced intervals only during their ascent.

9. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising means producing within said conduit concentric ascending bodies of well fluid and of a mixture of the latter with said gas, means effecting alternate compression and expansion of the mixture, and means admitting a portion of the well fluid body to said mixture body at each expansion of the latter.

10. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising means producing within said conduit concentric ascending bodies of well fluid and of a mixture of the latter with said gas, means imparting a whirling movement to one of said bodies, means effecting alternate compression and expansion of the mixture, and means admitting a portion of the well fluid body to said mixture at each expansion of the latter.

11. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well, said means providing a series of mixing chambers for the well fluid and said gas, said chambers being progressively reduced in size, said means making said gas effective to bear away the well fluid through said conduit, a portion of the well fluid becoming vaporized or atomized.

12. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well, said means providing a series of mixing chambers for the well fluid and said gas, said chambers being progressively reduced in size, and means adjacent each mixing chamber for reducing the cross-sectional area of the fluid stream entering the same.

13. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well, said means providing mixing chambers connected in series through which the compressed gas makes its way into said conduit and a well fluid conduit within said chambers having separate entrance ports for each chamber.

14. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well, said means providing mixing chambers connected in series through which the compressed gas makes its way into said conduit, a well fluid conduit within said chambers having separate entrance ports for each chamber, the connections between said chambers being Venturi passages, whereby the mixed gas and well fluid passing therethrough are compressed and then permitted to expand in said chambers, thus further inducing the entrance of fluid through said ports.

15. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the well, and means associated with said conduit utilizing said gas to induce and increase the flow of the well, said means providing mixing chambers connected in series through which the compressed gas makes its way into said conduit, a well fluid conduit within said chambers having separate entrance ports for each chamber, the connections between said chambers being Venturi passages, whereby the fluid passing therethrough is compressed in said passages and then permitted to expand in said chambers, thus inducing the entrance of fluid through said ports, and means imparting a whirling motion to said fluids to effect an intimate mixing of the same.

16. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the wells, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising a foot piece having a series of chambers, means directing concentric bodies of gas and well fluid through said chambers, means providing for progressive mingling of said gas and fluid in said chambers, and means progressively accelerating the movement of the mixed gas and fluid.

17. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the wells, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising a foot piece having a series of chambers, means directing concentric bodies of gas and well fluid through said chambers, means providing for progressive mingling of said gas and fluid in said chambers, and Venturi passages progressively decreasing indiameter between said chambers for accelerating the movement of the mixed gas and fluid.

18. In combination, in a well having gas

forced therein under pressure a discharge conduit for the fluid products of the wells, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising a foot piece having a series of chambers, means admitting separate concentric bodies of gas and well fluid to said foot piece, means establishing contact of said streams for a limited period in each chamber to effect progressive mingling of said gas and fluid in said chambers, and means imparting a whirling motion to said bodies of gas and well fluid and progressively increasing said motion.

19. In combination, in a well having gas forced therein under pressure, a discharge conduit for the fluid products of the wells, and means associated with said conduit utilizing said gas to induce and increase the flow of the well comprising a foot piece having a series of chambers, means admitting separate concentric bodies of gas and well fluid to said foot piece, means establishing contact of said streams for a limited period in each chamber to effect progressive mingling of said gas and fluid in said chambers, means imparting a whirling motion to said bodies of gas and well fluid and progressively increasing said motion, and means progressively accelerating the axial movement of the mixed gas and fluid.

20. A foot piece for the discharge pipe of a well having an inlet for gas under pressure and providing a series of chambers to which the gas has access in succession, and means admitting well fluid in limited amount to each of said chambers to become mixed with said gas and be forced or carried thereby into and through said pipe.

21. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, and a conduit for the well fluid extending into said foot piece, said conduit having ports spaced longitudinally thereof and registering with said chambers to permit mingling of said fluid with said gas.

22. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, and a conduit for the well fluid extending through said foot piece, said conduit having annular ports spaced longitudinally thereof and registering with said chambers to permit mingling of said fluid with said gas.

23. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending axially into said foot piece comprising a series of progressively smaller pipe sections separated at their joints to form annular ports registering with said chambers to permit mixing of said fluid with said gas.

24. A foot piece for the discharge pipe of a well parts providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending axially into said foot piece comprising a series of progressively smaller pipe sections separated at their joints to form annular ports registering with said chambers to permit mixing of said fluid with said gas, and a flat metal strip disposed axially within said sections and maintaining the same in fixed relation.

25. A foot piece for the discharge pipe of a well parts providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending into said foot piece comprising a series of progressively smaller pipe sections, a flat metal strip extending through said sections and provided with shoulders supporting the same, the adjacent ends of said sections being beveled and spaced apart to provide annular ports registering with said chambers.

26. A foot piece for the discharge pipe of a well parts providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending into said foot piece and having spaced ports registering with said chambers to permit mingling of said fluid with said gas, and means imparting a whirling motion to the fluid in said conduit whereby centrifugal force is operative to force the fluid through said ports.

27. A foot piece for the discharge pipe of a well parts providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending axially into said foot piece comprising a series of progressively smaller pipe sections separated at their joints to form annular ports registering with said chambers to permit mixing of said fluid with said gas, and means causing said fluid to issue by centrifugal force from said ports.

28. A foot piece for the discharge pipe of a well parts providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending axially into said foot piece comprising a series of progressively smaller pipe sections separated at their joints to form annular ports registering with said chambers to permit mixing of said fluid with said gas, and a flat metal strip disposed axially within said sections and maintaining the same in fixed ratio, said strip being spirally twisted to impart a whirling motion to the fluid passing through said conduit.

29. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending into said foot piece and through said chambers, said conduit having means

for imparting a whirling movement to the compressed gas passing through said chambers and longitudinally spaced ports for admitting said fluid to said chambers.

30. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending into said foot piece and having annular ports spaced longitudinally thereof and registering with said chambers to permit mingling of said fluid with said gas, said conduit having means on its exterior and on its interior for imparting whirling movement to the gas passing through said chambers and to the fluid within said conduit.

31. A foot piece for the discharge pipe of a well providing a series of chambers to which gas under pressure forced into the well has access, a conduit for the well fluid extending axially into said foot piece comprising a series of progressively smaller pipe sections separated at their joints to form annular ports registering with said chambers to permit mixing of said fluid with said gas, and spiral flanges on said pipe sections for imparting a whirling motion to the gas passing through said chambers.

32. A foot piece for the discharge pipe of a well comprising a series of sections each containing a chamber and a Venturi passage of progressively smaller size, said sections when secured together forming a continuous conduit with chambers and Venturi passages progressively reduced in size, the lowermost of said sections having ports to admit gas under pressure, and a conduit for well fluid axially disposed in said foot piece and having at least one port opening into each chamber.

33. A foot piece for the discharge pipe of a well comprising a series of sections each containing a chamber and a Venturi passage of progressively smaller size, said sections, when secured together forming a continuous conduit with chambers and Venturi passages progressively reduced in size, the lowermost of said sections having ports to admit gas under pressure, and a conduit for well fluid axially disposed in said foot piece comprising a series of pipe sections progressively reduced in size and spaced apart to provide ports opening into said chambers.

34. A foot piece for the discharge pipe of a well comprising a series of sections each containing a chamber and a Venturi passage of progressively smaller size, said sections when secured together forming a continuous conduit with chambers and Venturi passages progressively reduced in size, the lowermost of said sections having ports to admit gas under pressure, a conduit for well fluid axially disposed in said foot piece and supported by said outermost section comprising a series of pipe sections progressively diminishing in size, and a metal strip axially disposed therein and supporting said pipe sections in spaced relation to provide ports adjacent each chamber.

35. A foot piece for the discharge pipe of a well comprising a series of sections each containing a chamber and a Venturi passage of progressively smaller size, said sections when secured together forming a continuous conduit with chambers and Venturi passages progressively reduced in size, the lowermost of said sections having an annular series of spirally inclined entrance ports for gas under pressure, an inlet conduit centrally disposed relative to said ports for well fluid and extending within said foot piece, said conduit comprising a series of pipe sections progressively reduced in size, a spirally twisted metal strip disposed therein and maintaining said pipe sections in spaced relation to provide a port adjacent each chamber and spiral flanges on the exterior of said pipe sections to maintain and increase the whirling motion imparted to the gas by its entrance ports.

36. A foot piece for the discharge pipe of a well comprising a series of sections each containing a chamber and a Venturi passage of progressively smaller size, said sections when secured together forming a continuous conduit with chambers and Venturi passages progressively reduced in size, the lowermost of said sections having a bushing in the end thereof provided with an annular series of spirally inclined entrance ports for gas under pressure, an inlet conduit mounted in said bushing and extending within said foot piece, said conduit comprising a series of pipe sections progressively reduced in size, a spirally twisted metal strip disposed therein and maintaining said pipe sections in spaced relation to provide a port adjacent each chamber, and spiral flanges on the exterior of said pipe sections, the spirals of said strip and flanges being in the same direction and progressively increasing in pitch as the chambers and pipe sections decrease in size.

37. A well fluid inlet pipe for a well discharge conduit comprising a series of pipe sections of progressively smaller diameter supported in spaced relation to provide a spaced series of stepped ports.

38. A well fluid inlet pipe for a well discharge conduit comprising a series of pipe sections of progressively smaller diameter supported in axial alignment, said sections having their adjacent ends interfitting but not engaging and their opposed faces beveled to provide a series of spaced annular ports.

39. A well fluid inlet pipe for a well discharge conduit comprising a series of pipe sections of progressively smaller diameter and a metal strip axially disposed therewithin securing said sections together but in relative spaced relation thereby to provide a spaced series of stepped annular ports.

40. A well fluid inlet pipe for a well discharge conduit comprising a series of pipe sections progressively smaller in diameter and length and having beveled end faces, and a flat, spirally twisted strip extending through said sections and maintaining the same in axial alignment with their ends interfitting but not contacting, said strip being progressively reduced in width to conform to the diameter of said sections and having stop shoulders fixing the relative positions of said sections.

Signed by us at city of Long Beach, California, this 14th day of March, 1925.

CLARENCE OCHS.
BUD HILDEBRAND.

CERTIFICATE OF CORRECTION.

Patent No. 1,682,929. **Granted September 4, 1928, to**

CLARENCE OCHS ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, lines 67, 79, 90, 101 and 112, claims 24, 25, 26, 27 and 28 respectively, after the word "well" insert the word "comprising"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of November, A. D. 1928.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)

40. A well fluid inlet pipe for a well discharge conduit comprising a series of pipe sections progressively smaller in diameter and length and having beveled end faces, and a flat, spirally twisted strip extending through said sections and maintaining the same in axial alignment with their ends interfitting but not contacting, said strip being progressively reduced in width to conform to the diameter of said sections and having stop shoulders fixing the relative positions of said sections.

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