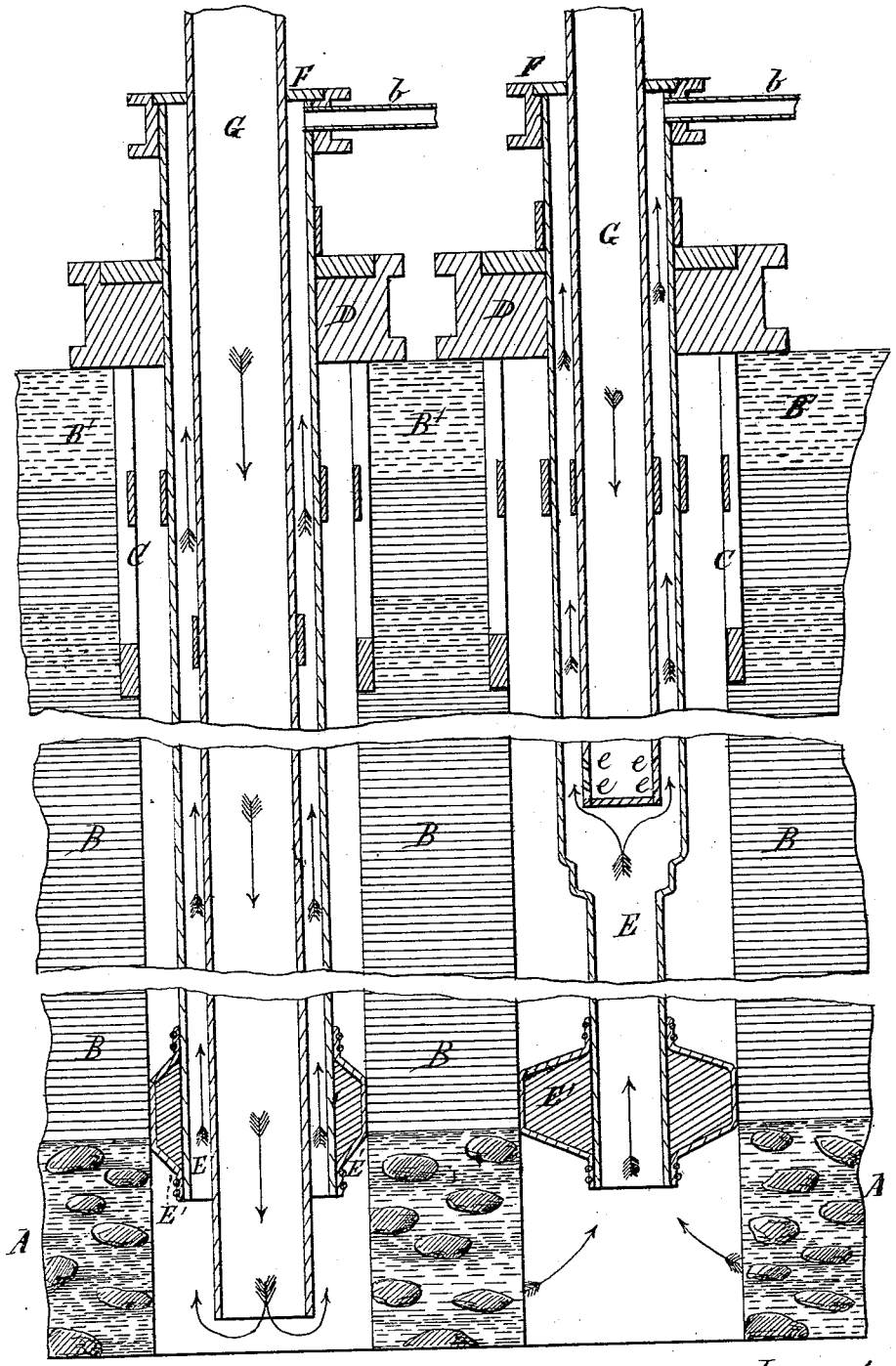
L. STEWART.

Petroleum Wells.

No. 166,426. Patented Aug. 3, 1875.

Fig. 1. *Fig. 2.*



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PETROLEUM-WELLS.

Specification forming part of Letters Patent No. **166,426**, dated August 3, 1875; application filed April 1, 1875.

To all whom it may concern:

Be it known that I, LYMAN STEWART, of Titusville, in the county of Crawford and State of Pennsylvania, have invented certain new and useful Improvements in Petroleum-Wells; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The first part of my invention relates to a novel method of reducing the capacity of a flowing tube or pipe through which it is desired to discharge oil from a petroleum-well by means of the expansive power of the gas which is incorporated with the oil, substantially as is set forth in a patent granted to E. McCurdy Stevenson, December 8, 1874; and this part of the invention consists in introducing within the bore of such flowing-tube one or more smaller pipes, tubes, rods, cylinders, or the equivalent thereof, as will be explained.

The second part of the invention relates to the employment of steam, hot air, or benzine for the removal of the "paraffine," so called, which may be deposited upon or within a tube or cylinder arranged within a petroleum-well.

Figure 1 is a vertical section of a well, showing my invention as applied to the flowing-tube usually employed in Stevenson's method, and Fig. 2 is a modification of the same.

In ordinary pumping-wells, in which the oil is taken from a point near the bottom as fast as it enters through the pores of the rock, the oil, in trickling down the sides of the well, deposits paraffine to such an extent as to materially diminish the yield. Under Stevenson's arrangement, as that portion of the well which passes through the oil-bearing rock is kept filled with oil, this deposit of paraffine does not take place at this point, but does take place at a point higher up upon the walls or sides of the passage through which the oil and gas are delivered, and under ordinary circumstances the greater part of this deposit takes place near the outlet of the well, or at least the upper part of the deposit is heavier than the lower part is. Under Stevenson's construction it is customary to draw out the tubing length by length, and melt out the paraffine, which is a slow and tedious operation; and as this involves the removal of the packer the flow of the well is temporarily suspended, which is objectionable, and further injury is done by the filling or partially filling of the well by salt-water, and by the sediment which accumulates above the packer. It is also customary under his arrangement to take out both the tubing and the packer whenever it is desired to reduce the size or capacity of the flowing-tube.

In the drawings, A represents the oil-bearing rock, and B B′ the slate and other rock formations and soil above. C is the casing usually employed at the upper part of the well, and extending to such depth as will shut out water, or at least the fresh water. D is the casing-head usually attached to the upper end of the casing. E is a flowing-tube passing through the head D, where it may be packed tightly, and extending down to about the upper surface of the oil-bearing rock, at which point it is provided with a packer, E′. F is a packing head or cap on the top of flowing-tube E, and provided with an outlet-pipe, *b*. G is a reducing tube, pipe, cylinder, or rod arranged within the flowing-tube E, and fitting tightly the cap F, through which it passes. In Fig. 1 the flowing-tube is represented as being of uniform size throughout, the reducing-tube G extending through tube E nearly to the bottom of the well; but under some circumstances, and for the sake of economy, as will be explained, I prefer to employ a small flowing-tube for a portion of the distance next above the packer, with an enlarged upper portion, as shown in Fig. 2. Although in the construction shown in Fig. 2 I employ a reducing-tube which is closed at the bottom, yet it is not essential that the corresponding tube G in Fig. 1 should be closed, from the fact that it extends to where the oil is comparatively dead or free from gas, and of course enters the tube G at the bottom, and rises only to such height as will counterbalance the pressure of the column of mingled oil and gas which surrounds this reducing-tube. Closing the bottom

of the reducing-tube would be objectionable, as it would interfere somewhat with carrying out the second part of my invention. For a well, of, say, one thousand feet in depth, and yielding from five to ten barrels per day, I would, if the flowing-tube E were one inch inside diameter from end to end, introduce a reducing-tube of three-eighths inch inside diameter, and of the thickness of iron usually employed in pipes of that size, or a rod or cylinder of, say, five-eighths inch outside diameter. Where a rod or a tube closed at the lower end is employed it need not ordinarily project below the packer in Fig. 1, and with the construction of flowing-tubes in Fig 2, the upper portion being of one-inch inside diameter, and the lower one, say, one-half inch inside, the rod or closed pipe need not ordinarily extend below the larger portion of the flowing-tube, substantially as shown.

I do not claim, broadly, the employment of a tube or rod to reduce the capacity or flowing space within, as I believe one Stevenson to be the inventor of that idea under two methods or arrangements, the first being shown in his patent of December 8, 1874, in which he employs a tube and a packer, the oil and gas being discharged through the center of the tube; his second form or method of application being the introduction of a reducing-tube within the well, and compelling the discharge of the oil and gas through the annular space between the tube and the walls of the well.

Two difficulties are met with in carrying out either of Stevenson's plans: First, in wells where salt-water enters below the casing, this water and other foreign matter are liable to fill up the well, even where the packer is used, whenever the tubing is taken out for the purpose of replacing by one of different size; and, secondly, there is no way provided for removing the paraffine which is deposited near the upper end of the tubing, except by taking the tubing out. By my combination of three elements or devices—to wit, a flowing-tube, a packer around this flowing-tube, and a supplemental reducing-tube—I am enabled to overcome both of these objections. When it is found that paraffine is being deposited in the tubing, or other space through which the oil is discharged, benzine may be poured into the reducing-tube, and as this benzine is taken upward by the ascending current of oil and gas it acts as a solvent to remove the adhering paraffine, and thus does away with the necessity for taking the tubing out of the well; or steam may be introduced into the reducing-pipe to melt the paraffine, in which case I prefer to raise the pipe G in Fig. 1 to such height that the water formed by the steam condensing within this pipe, and which escapes at the bottom, shall be discharged with the oil and gas. Ordinarily, lifting this pipe until the lower end is about a length or two above the packer will accomplish this desired result. As the paraffine is principally deposited near the upper end of the well I sometimes economize by using a single pipe for a portion of the distance above the packer, as in Fig. 2, in which case I prefer to close the lower end of the pipe, through which I introduce the benzine, and provide said pipe with a number of small perforations, slanting outwardly and upwardly, as indicated at *e*, Fig. 2, for the purpose of giving an upward direction to the escaping benzine or other agent, and also to prevent the oil and gas from so readily entering this pipe at this point. The holes *e* may be made very small, as the pressure of the column of benzine within the tube G will force the fluid through apertures which are so small that the oil and gas will not, in the effervescing condition in which it reaches this point, ordinarily pass through them in any considerable quantity. Should the oil or gas enter the holes *e*, so as to interfere with a proper working of the well, the top of the reducing-pipe should be closed by means of a screw-cap, a screw-plug, or other equivalent device.

In case hot air or steam be used in pipe G to melt out the paraffine, it may not be found necessary to leave the lower end of this pipe open, and in case other obstructions get in between the pipes they may be sometimes removed by moving the pipe G up and down, the couplings on this pipe serving to break up the obstructing material. Nor do I claim, broadly, the idea of introducing benzine or other solvent, or hot air or steam, within the bore of the well to remove the deposit of paraffine, being aware that this has been done in the lower or oil-bearing portion of the pumping-wells; but I believe that I am the first to apply a solvent by introducing it below the deposit in or upon the flowing tube or outlet of a flowing well, and compelling the ascending column of oil and gas to carry it (the solvent) upward into contact with said deposit near the upper part of the well or tubing, and I believe that I am the first to introduce steam within a well through an open-bottomed tube, or a tube with fine perforations, under such conditions that the water resulting from the condensation of the steam will be carried from the well by the flowing column of mingled oil and gas, instead of falling to the bottom of the well, from which it must be pumped, as is the case in ordinary wells.

Having given what I believe to be the best sizes of pipes for the depth of well and the yield of oil herein stated, I wish to be understood that I do not limit myself to the sizes given, as their relative proportions may be changed without departing from the spirit of my invention.

What I claim is—

1. The combination, with the well, of the flowing-tube E, the packer E′, and the reducing-tube G, substantially as set forth.

2. In a petroleum-well, a reducing-tube,

diminishing the discharging capacity of the well, and arranged as shown and described with relation to the discharging-outlet of the well, that benzine introduced to remove the paraffine, or the water arising from the condensation of steam used for the same purpose, shall be carried up by the ascending column of oil and gas without the use of a pump, substantially as set forth.

In testimony that I claim the foregoing as my own, I have affixed my signature in presence of two witnesses.

LYMAN STEWART.

Witnesses:
JNO. D. MCFARLAND,
MILTON STEWART.