Putnam (J.P.)

REPLY

TO THE

REPORT OF MR. GLENN BROWN

ON

Experiments in Trap Siphonage,

AT THE

MUSEUM OF HYGIENE,

U.S. NAVY DEPARTMENT,

WASHINGTON, D.C.

BY

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4 Pemberton Square, Boston, Dec. 13, 1886.

Dr. T. J. Turner, *Medical Director U.S.N., in charge Museum of Hygiene, Bureau of Medicine and Surgery, Washington, D.C.:* —

My dear Sir,[1] — I send you, herewith, my deductions from the experiments made by Mr. Glenn Brown, at the Museum of Hygiene. You will see that the same tests are susceptible of two different interpretations, and I feel that it would be fair and desirable to have the other side of the case presented to the readers of the first Report . . . . . .

I think you will see that my reasoning is clear and logical, and that the deductions cannot easily be disputed. I should be glad to have this Reply appear as soon as convenient, in order that the views presented may appear as nearly as possible simultaneously, since this will add to the value of both, and to the facility of comparing them together.

Very respectfully yours,

J. PICKERING PUTNAM.

Museum of Hygiene, Bureau of Medicine and Surgery,
Cor. 18th and G Streets, N.W.,

Washington, Dec. 15, 1886.

Mr. J. P. Putnam, *2 Pemberton square, Boston, Mass.:* —

Dear Sir, — I am directed by the Surgeon-General to state that the Museum of Hygiene will receive and send copies of your Report to all those who have had the report of Mr. Glenn Brown.

Very respectfully,

T. J. TURNER,
Medical Director U.S.N., in charge.

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[1] Extract from letter to Dr. Turner.

REPORT.

TRAP SIPHONAGE.

The necessity of enacting suitable plumbing regulations has lately begun to be keenly felt by our legislators and Boards of Health throughout the country. Following the example of a few large cities the smaller cities and towns are everywhere, in rapid succession, hastening to frame codes of plumbing laws, and the present is a time of unprecedented activity in this direction. Accordingly any measures tending to throw light on the very important subject under consideration, where light is greatly needed, are of the utmost practical value.

The most important question upon which a difference of opinion still exists, to the great confusion of the legislator, is in relation to the desirability of special trap-venting. The final solution of this question will practically turn the scales either in the direction of complication or of simplicity in plumbing. All admit that special trap-venting adds enormously to the complication, cost, and danger of defective work in our plumbing. It is, therefore, evident that

it cannot be permissible, unless it can be clearly shown, not only that plumbing *can* be made safe *with* it, but also that plumbing *cannot* be made safe *without* it.

The tests which are now being made by Mr. Glenn Brown, at the Museum of Hygiene, and which have in part been published, form valuable accessions to the data necessary to enable us to decide the question, but have not been sufficient to justify their author in his conclusions. What was needed on his part was a careful comparison of these data with those heretofore obtained by other experimenters, and an intelligent and impartial interpretation of them all. A difference of opinion among investigators, particularly in this field, too frequently arises from a failure on the part of one to study the results obtained by others as carefully as he should. The consequence is a disagreement on the part of those whose facilities for arriving at the truth are the greatest, and this disagreement not only confuses the public, but throws discredit on the experimenters themselves. I have endeavored, by a careful study of the apparatus and experiments of Mr. Brown, and by a personal interview with their author, to account fully for the difference of opinion existing between us.

I find, FIRST, that Mr. Brown's experiments were made with apparatus and conditions which do not, and, in most cases, could not, exist in practice in plumbing; SECOND, that in his comparisons of different traps with each other different conditions were employed, rendering the comparisons unreliable; and, THIRD, that he has drawn his conclusions from in-

sufficient data, ignoring facts which have an important bearing upon them.

Considering the matter more in detail we are forced to accept the following : —

(1.) The object of our tests is to determine what adverse influences are liable to affect the seals of traps in good plumbing, and how to guard against such influences in the best manner.

(2.) The trap-vent pipes used in Mr. Brown's tests are larger and straighter than those used in practice in house-plumbing under the trap-vent law. The pipes used by Mr. Brown were 3-inch, with short 2-inch branches to the traps. His drawings, of which Fig. 1 is a partial reproduction, are incorrectly made. They show the vent-pipes not more than half the size he actually used, and produce an erroneous impression on the very point under discussion, namely, the efficiency of the trap-vent pipes.

(3.) The trap-vent pipes which are used in ordinary plumbing practice, in accordance with the present vent laws, would not be large enough to protect ordinary S traps, such as were used by Mr. Brown, from the severe tests which he applied to them. We know that the reason why trap-vent pipes often fail in their duty, as they are now made, is because the air is retarded by friction against their walls in passing through them, and that the amount of this friction is increased as the size of the pipe is diminished, and as its course varies from a straight line. Siphonage acts with the rapidity of a flash, inasmuch as it is caused by a falling body of water as it passes suddenly by the mouth of the branch waste-pipe. The

air must, therefore, as instantly be supplied, if it is to protect the seal of the trap. This it will certainly fail to do if it encounter any obstructions, such as are frequent in plumbing practice, either in a sharp bend in the vent-pipe, or in too great friction along its walls.

The 3-inch pipes in Fig. 2 show more correctly the true appearance of the vent-pipes used by Mr. Brown. At the right-hand side of the drawing is shown a trap-vent pipe run in a manner very common in ordinary practice under the trap-vent law. Such venting, even when new, has been shown to be far less effective than the use of a good antisiphon trap, which, like the Sanitas trap, commended by Mr. Brown, may be made substantially self-scouring, and which has been repeatedly shown by numerous disinterested authorities to be proof against any siphonage that can be encountered in good plumbing practice.

(4.) It would be useful to extend the tests at the Museum of Hygiene by using vent-pipes 1 inch, 1¼ inches, and 1½ inches in diameter, as used in practice, and varying in length between 5 and 25 feet. Such tests would then correspond with those made by Messrs. Putnam and Rice for the Boston City Board of Health, and with those made at Worcester by the Worcester master-plumbers, in both of which series of tests ordinary traps fully vented lost their seals under siphonage no stronger than that applied by Mr. Brown, while unvented antisiphon traps held their seals under the same tests.

(5.) Certain forms of unvented antisiphon traps, including the larger pot or cesspool traps, would be capable of resisting a much more powerful siphoning

action than S traps vented in the manner shown in Mr. Brown's drawing, or as is usual in practice.

(6.) Back pressure may be easily guarded against by simpler methods than by trap-venting, one of which methods is to connect the waste-pipe of the trap with the soil-pipe at a point *beyond* the bend which causes the back pressure. This can always be very easily done in practice. Another method is to set the trap far enough below the fixture to permit of the formation in the waste-pipe, above the trap, of a column of water long and heavy enough to resist the greatest back pressure of air likely ever to be encountered in good plumbing. The trap must then be constructed with sufficient water capacity to fill such a pipe. In the experiments for the Boston Board of Health the length of pipe required in the worst cases which could be encountered in good plumbing was found to be from 14 to 18 inches. This method could always be easily applied in practice in places where back pressure was expected, and the other method was not as convenient.

(7.) It would be useful to make the tests last referred to on the apparatus at the Museum of Hygiene.

(8.) The tests made by Mr. Brown, which broke the seals of the traps, were powerful enough to collapse and crush out flat the stout lead pipe through which the discharges were sent, so that it had to be replaced by another pipe. Such a fearful suction is evidently much greater than would ever be encountered in plumbing work, and rules for practice should not be based on such severe tests. Such tests are only serviceable as means of comparison between dif-

ferent traps or systems, and care should then be taken to apply precisely the same tests to each trap or system so tested.

(9.) The only tests made at the Museum of Hygiene which were powerful enough to destroy the seal of the strongest antisiphon trap were those in which the main soil-pipe openings were closed as by snow or ice. Such closure, however, *would be equally, if not more, likely to close also the mouth of the trap-vent pipe.* Hence, in those cases, trap-venting would be useless. It would fail, too, in the very cases where it would be most needed. Trap-venting is, therefore, not always to be relied upon as a safeguard.

(10.) Waste-pipes and traps, especially under kitchen and pantry sinks, often become clogged, or coated with congealed vapor and grease. Hence the mouth of the vent-pipe, wherever placed in them, must, and does often, become closed by such clogging. Here, again, the vent-pipe is rendered inoperative and unreliable.

(11.) The water discharged from the tank in Mr. Brown's experiments was discharged by opening and closing a *solid plug without air-vent*, in the bottom of the tank, only a portion of the water in the tank being discharged at a time. This caused a very powerful suction, so powerful, in fact, that it was found exceedingly difficult at first for the assistant to manage the plug without injury to his hands. This kind of discharge would never occur in plumbing practice, since every plumbing fixture has, and must have, its overflow passage, and this supplies air during the discharge, and breaks the force of the

vacuum. A plunger closet produces an effect nearest in power to this; but the overflow-pipe, though small, is still sufficient to break the vacuum. Now the seals of the traps and overflows of plunger closets are often destroyed by their own discharges in supplying air to break this vacuum, and the use of this kind of closet should never be permitted in plumbing practice. If the use of valve and plunger closets were prohibited by law the greatest cause of siphonage would be removed.

(12.) As is the case with plunger closets, so is it with other fixtures, such as wash-basins, when constructed, as they always should be, with outlets large enough to fill their traps and waste-pipes "full-bore," their own discharge will often destroy the seal of their traps, provided ordinary S traps are used. This has frequently been demonstrated by myself and others. Hence, if the vent-pipe be used at all, it should be applied at the crown of the trap to protect it from "self-siphonage."

(13.) If the vent-pipe be applied at the crown of a trap, as it should be in the case of S traps, the ventilating current will rapidly destroy the seal of the trap through evaporation, and the vent becomes again unreliable as a protection against sewer-gas.

(14.) Siphonage and back pressure are supplementary to each other. The greater the power of the one at any place, the less that of the other. They cannot coexist in full force at the same time and place, but stand in inverse relation to each other. Thus, where at the bottom of a straight soil-pipe just

above an abrupt bend back pressure is strong, siphonage is scarcely perceptible. Hence, in making comparative tests on different traps the same conditions of head and foot vent should be observed. This was not always done in the tests at the Museum of Hygiene, and a much more powerful test was applied to the unvented antisiphon trap (see experiments 77 to 89) than to the vented S trap (see experiments 35 to 48). Mr. Brown's recapitulation should be entirely remodelled, in view of this and the other facts above enumerated. His Deduction No. (1.) seems to be contradicted by his Deduction No. (3.). For in the latter he admits that the vent should not be less than 3 inches in diameter to be efficacious. In practice they are rarely, if ever, found so large throughout their length. Hence in practice the vent is *not* efficacious.

From the above fourteen considerations we draw the following conclusions: —

(1.) The seals of ventilated traps are not always secure against the adverse influences liable to affect them in good plumbing.

(2.) The seal of a properly formed antisiphon trap is secure against such adverse influences when properly placed in good plumbing.

(3.) Where trap-vent pipes are large, straight, new, and not too long, they will afford protection against siphonage and back pressure as long as they remain unobstructed. To make them large enough would involve a greater expense than would be justifiable in view of the result attained.

(4.) Back pressure may be easily and safely provided for by simple means without the aid of the trap-vent pipe.

(5.) From the above considerations we conclude that special trap-venting is not desirable, the simpler system being safer and more economical.

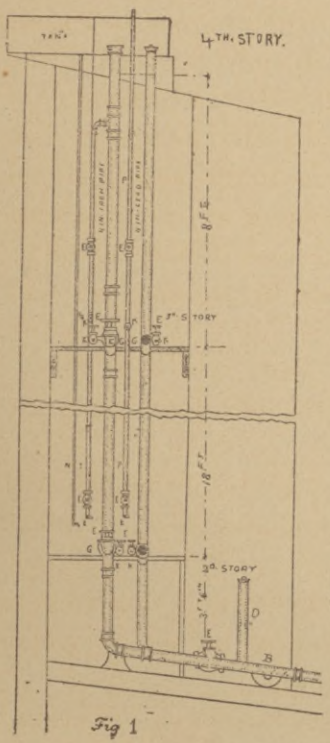

Fig 1

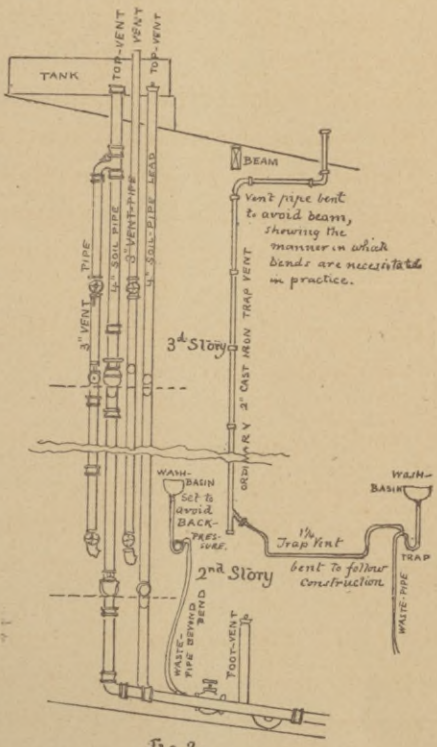

Fig. 2.

I take pleasure in saying that Mr. Brown has consented to make the experiments above suggested on the apparatus, at the Museum, as soon as the weather

permits, which will result, as have the tests of many other experimenters, in a further confirmation of the statements made herewith.

Very respectfully,

J. PICKERING PUTNAM.

To Dr. T. J. Turner,
Medical Director U.S.N.,
In charge of Museum of Hygiene,
Bureau of Medicine and Surgery,
Washington, D.C.