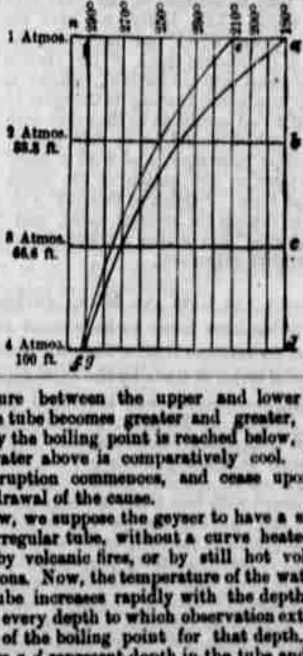
are speedily petrified. The water of geysers is simple spring water, and they are true springs and not volcanoes. Mackenzie supposes that the eruptions are caused by the condensed steam of heated water seeking a vent and forcing the water up through the geyser pipe, as in Fig. 2; *a* shows the opening into the geyser; *b*, the chamber in which the steam condenses. As the steam accumulates it forces the column, *c*, up through the opening or vent at *d*, with greater or less force, according as the supply of steam is greater or less, and then when the steam has escaped, the geyser returns to its quiescent state until another accumulation occurs. This theory, however, seems to be untenable on the ground that it is inconceivable that all of the many thousands of geysers should have a separate cone and conduits so peculiarly constructed. According to Bunsen, the geyser does not possess a cave or even a perpendicular tube, ready made, but, like volcanoes, makes its own tube.

Fig. 3 is an imaginary section of a geyser mound, showing the manner in which, according to Bunsen's view, it is found.

The irregular line, *b*, *a*, *c*, is the original surface, and *a* the position of a hotspring. If the spring be not alkaline, it will remain an ordinary hot spring; but if it be alkaline, it will hold silica in solution, and it will be deposited about the spring. Thus the mound and tube are gradually built up. For a long time the spring will be *boiling*, but not eruptive. But as the tube becomes longer, and the circulation more and more impeded, the difference in temperature between the upper and lower parts of the tube becomes greater and greater, until finally the boiling point is reached below, while the water above is comparatively cool. Then the eruption commences, and cease upon the withdrawal of the cause.



Now, we suppose the geyser to have a simple but irregular tube, without a curve heated below by volcanic fires, or by still hot volcanic ejections. Now, the temperature of the water in the tube increases rapidly with the depth, but is, at every depth to which observation extends, short of the boiling point for that depth. Let abscissa *a d* represent depth in the tube and also pressures, and the corresponding temperature be measured on the ordinate *a n*. If, then, *a b*, *b c*, *c d*, represent 33 feet depth, or one atmospheric pressure, the curve *e f*, passing through 210°, 250°, 275°, and 293°, would correctly represent the increasing boiling points as we pass downward. This curve may be called the curve of boiling point. The line, *a g*, commencing at the surface at 180° and gradually approaching the boiling point line, would represent quiescence. Now, at the moment of eruption, at some point below the reach of observation, the line *a g* actually touches the line *e f*—that is, the boiling point for that depth is actually reached. As soon as this occurs, water in the lower portion of the tube would be changed to steam, and its expansion would lift the whole column of water in the tube, and cause it to bulge and overflow the basin. As soon as the water overflowed, the pressure would be diminished in every part of the tube; and a large quantity of water before very near the boiling point would flash into steam and instantly eject the whole of the water remaining in the pipe. The steam itself would rush out immediately afterward.

The premonitory cannonading beneath is produced by the collapse of large steam bubbles rising through the cooler water of the upper port of the tube; in other words, it is *simmering on a large scale*. An eruption is more quickly brought on by throwing stones into the throat of the geyser, because the circulation is thus more effectually impeded.

Fig. 4 will illustrate this theory. The apparatus is an artificial geyser, and consists of a tube of tinned sheet-iron, about ten feet long, expanded into a dish above for catching the erupted water. It is heated also, a little below the middle, by an encircling charcoal chauffer, to represent the point of nearest approach to the boiling point in the geyser tube. When this apparatus is heated at the two points, as shown in the figure, the phenomena of geyser eruption are completely reproduced; first, the violent explosive simmering, then the overflow, then the eruption, and then the state of quiescence.

Fig. 2.

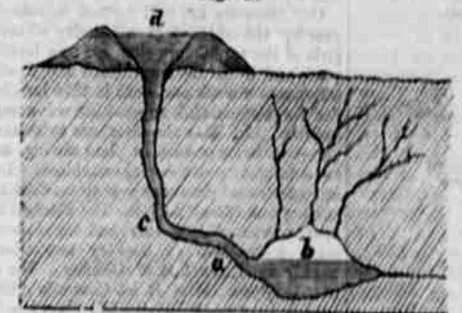


Fig. 3

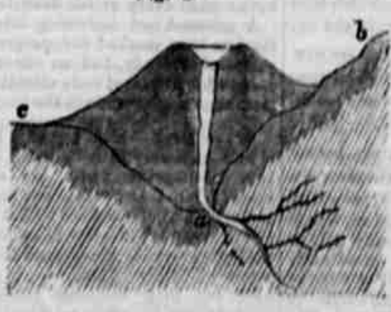


Fig. 4

GEYSER THEORIES ILLUSTRATED.

WRITING TELEGRAPH.—The writing telegraph which reproduces the messages sent, in almost perfect *fac simile* of the sender, has been fitted up between Waterloo and Woking, a distance of some 26 miles, and according to the *Echo* has been working very well. The instrument itself is too recent an invention to have yet reached even an approach to perfection, but the defects made evident in practical working have so far been remedied, and it is clear that a useful improvement will shortly be available. One great advantage is that the instrument is quite automatic at the receiving end, and does not require the constant attendance of a clerk. It writes in messages on a roll of paper, and they can be cut off and sent to their destinations as opportunity offers. That is an important point, because it is well known that the time wasted in calling and in obtaining the attention of the receiver far exceeds that required for the actual sending of the messages.

THERE was a man in Paris who, when he went out, was always robbed. Somebody said: "Why don't you carry pistols?" He replied, "Suppose I did—why, the robbers would take them too."

THE NEW YORK AND BROOKLYN BRIDGE.

At a meeting of the Trustees of the New York and Brooklyn bridge, July 7th, the contract for supplying the steel and iron for the suspended superstructure, was awarded to the Edgemoor Iron Co. The contract calls for 10,728,000 pounds of steel and 34,000 pounds of iron. The bid of the Edgemoor Iron Co. was 4 35 100 cents a pound, amounting to $468,147. Chief Engineer Roebling said that when the change from iron to steel was first contemplated he supposed that the difference in price would be at least $100,000, but in fact the lowest bid for steel exceeded by only $4,000 the accepted bid for iron last year. The difference between the lowest bid and the lowest bid for crucible steel was $364,000.

Both towers of the bridge have been completed, the last work on the Brooklyn tower having been finished July 5th. Mr. Kingsley expressed the belief that through this contract it would be possible to complete the bridge by January 1st, 1881. The financial condition of the bridge on June 30th was as follows: Total receipts, $10,623,492.94; total expenditures, $10,523,574.85; outstanding liabilities, $112,807.62.

EDISON'S ELECTRIC-CHEMICAL TELEPHONE.—This new invention of Mr. Edison dispenses with the necessity of holding the telephonic receiver to the ear, and besides furnishing a greater volume of sound, renders distinct the slightest peculiarities of the voice. It has been found to work perfectly at a distance of 50 miles. The improvement consists in causing the current to pass through a spool of chalk containing crystallized caustic soda, and having a thin tongue of steel resting upon. The chalk is mounted on a shaft turned by a crank, thus creating friction, and when so operated, the current passing through the spool, polarizes the chemical agent, and is thence transmitted through the steel tongue to a thin metallic diaphragm. The current only flows so long as the crank is turned. It is Mr. Edison's intention to furnish clock-work for the mechanical movement, so that it may be stopped and started by electricity at the will of the operator.