greater or less number of perfectly distinct, regular, and transparent crystals, which are imbedded in the amorphous material; to make them visible, it is only necessary to submit a slip of glass to the action of hydrofluoric acid gas, mixed with vapors of water. The operation is stopped the moment the crystals are uncovered by the dissolving of the surrounding amorphous part, which is generally more soluble than they, and the figures thus obtained, may be reproduced by the galvano-plastic processes.

The operation presents no difficulty; it is only necessary to place the slip of glass, on a certain inclination, in the mixture of sulphuric acid and fluor spar, which is used to produce the fluorhydric acid, so that one part of the slip may be plunged in the liquid, and the other be without it; the crystals then become visible above the line of separation, upon that face of the slip which is turned towards the liquid. These crystals also appear on the inner surface of bottles in which very weak fluorhydric acid has been kept, but they are then accompanied by broken lines and concentric circles analogous to those of agate.

These crystals may be followed in the different phases of their formation by means of the slags of smelting furnaces, and I have in this way been able to persuade myself that their number and their development depend essentially on the manner of annealing, and the greater or less rapidity of cooling of the mass.

There are also natural crystals perfectly formed, pure and transparent, which present the same defects of homogeneousness as glass, when they are submitted to the action of different solvents. This is a new subject of study with which I am at the present time employed.—*Comptes Rendus de l'Academie des Sciences, (Paris,) 12th April, 1852.*

Translated for the Journal of the Franklin Institute.

Note on the Incrustations in Steam Boilers. By M. DELANDRE.

With well or spring waters, the evaporation produces the precipitation of the earthy salts, and gives rise to the incrustations which become so adherent to the wall of the boilers and the tubes that they cannot be detached. When nevertheless it is desirable to continue to use the boilers, a less quantity of steam is generated with a greater expense of fuel, and often the metal becomes softened in the parts where the incrustations are the thickest and nearest the fire, thus occasioning cracks and finally explosions.

To obviate the destruction and dangers in the use of steam, caused by the incrustations, the aggregation of the earthy and calcareous salts must be prevented, by making them soluble in place of insoluble as they were.

Now the protochloride of tin, under the influence of water, is converted into an insoluble basic subsalt, and a soluble acid salt, which dissolves the earthy salts.

After having undergone, for a long time, great annoyances in the use of tubular boilers, in spite of the use of known preservatives, I have for a year past obtained the perfect protection of these generators from incrustations, by placing 4 kilogrammes (8 lbs.) of protochloride of tin in a

boiler which works 12 hours every day, at a pressure of 3 atmospheres, and consumes in that space of time from 1500 to 1600 litres (400 galls.) of water, and is only emptied and refilled once a week.

For steam boilers which are emptied every day, and are of great power, the consumption of the protochloride of tin should be calculated at 1 kil. (2 lbs.) per cubic metre ($35\frac{1}{4}$ cub. feet).

My tubes, stop cocks, and machines, which were also finally covered with incrustations, have been kept in the most perfect state of cleanliness.—*Comptes Rendus de l'Academie des Sciences, (de Paris,) 29th March, 1852.*

On a Continuous Expansion Steam Engine. By MR. JAMES SAMUEL, of London.*

The economy of working steam expansively is well known, but the application of the expansion principle is practicable only to a limited extent in most forms of engine, from practical difficulties in their mode of working, which prevent the attainment of the full economy of which the expansive principle is capable.

The greatest useful effect is obtained from the steam, when it is allowed to expand in the cylinder until its pressure upon the piston just balances all the useless resistances of the friction of the engine itself, and the resisting pressure on the back of the piston, (whether the pressure of the atmosphere, in a high pressure engine, or of the uncondensed vapor, in a condensing engine,) the surplus power beyond these useless resistances being alone available for the purposes to which the engine is applied.

But in driving machinery, so great a uniformity of motion is essential, that any great variation in the moving power throughout the stroke of the engine is inadmissible, as the fly-wheel would not be able to absorb enough of the excess of power to equalize the velocity sufficiently, by giving it out again at the deficient part of the stroke; consequently, though two engines are often employed working at right angles to each other, for the purpose of diminishing the variation in total moving power, the expansion principle can only be carried to a portion of the extent to which it is theoretically applicable.

Only in such engines as the large Cornish pumping engines can the expansion be carried practically to its full theoretical limit, as the variation in the velocity of the load moved is of much less importance in those engines, and the very unequal amounts of moving power that are developed in equal times, by the full carrying out of the expansive principle, which would produce the most prejudicial and inadmissible variations of velocity in the engine, are controlled within prescribed limits by the great weight of material to be moved by the engine in the pump rods and balancing machinery, forming, as it were, a distributing reservoir for the moving force developed.

In the locomotive engine there are practical difficulties in carrying out the expansion principle efficiently, beyond a moderate extent, in a single cylinder, from the shortness of stroke, and rapidity of reciprocation,¹ and

* From the London Artizan, for March, 1852.