AN IMPROVED HOLDER FOR TOOL SHARPENING.

A patent has been granted to Mr. Geo. Salot, of Dubuque, Iowa, for the invention shown in the accompanying illustration, the object of which is to provide a tool holder, designed for holding chisels, plane bits, and other tools in the proper position while sharpening the same on a grindstone or other tool sharpener, so as to form the desired bevel or angle for the cutting edge.

The holder consists of a flat base, upon which the tool is placed, which has two upwardly projecting sides, carrying a crossbar, the center of which is threaded to receive a thumbscrew, adapted to bear upon the top surface of the tool and hold the same firmly down upon the plate. The under side of the tool holder is provided with a couple of lugs which carry a wheel, said wheel being intended to travel upon the surface of the grindstone. The distance from the under side of the wheel to the upper surface of the holder being constant, it is evident that the angle of the cutting edge of the tool may be made more or less sharp by shifting the tool forward or backward upon the base plate of the holder. In case a very short bevel is required, a set screw is provided close to the rear edge of the plate, by means of which the tool may be raised until the desired angle is obtained. In order to adjust the tool accurately to the proper angle before it is placed upon the grindstone, the holder is provided with a graduated gage, adapted to be hooked on to the shaft of the above mentioned wheel. By adjusting the tool on the base plate of the holder until the cutting edge coincides with the proper graduation on the gage, the desired angle can be formed upon the tool with great accuracy.

SALOT'S IMPROVED HOLDER FOR TOOL SHARPENING.

THE PERMEABILITY OF THE EARTH.

When we make an excavation in a cultivated field in order to observe the development of roots, and then examine a vertical wall well smoothed with the spade, we are struck with astonishment to see how compact the earth is. It appears to form a continuous mass, and we are surprised that it is possible for the air to enter and circulate freely therein.

Now, in order that plants may live, grow, and develop normally, it does not suffice that their stems and leaves shall expand in an oxygenated atmosphere, but their roots also must breathe, and to this effect they need oxygen. The very existence of plants therefore suffices to show that air habitually enters the earth, and is even easily renewed therein, since air that remains for a short time in a closed vessel in contact with the earth very quickly loses its oxygen, which is converted into carbonic acid. If the air did not renew itself in the soil, it would become deprived of oxygen. Now, all analyses of air extracted from the earth reveal therein, on the contrary, a large proportion of oxygen.

Earth is therefore usually permeable to the air, but is it always so? Is all earth permeable to the same degree? And if, at times, it is but incompletely so, and if, even, it becomes impermeable, to what cause is such impermeability due?

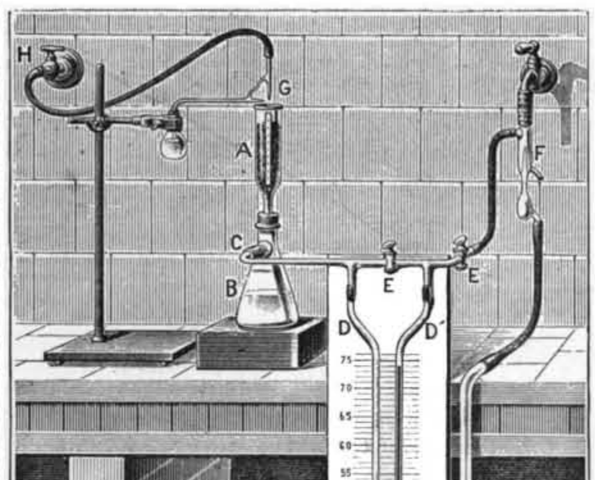
It was in order to answer such questions that Mr. Demoussy (preparator at the museum) and I arranged the apparatus represented in the accompanying figure. In a percolator, A, is placed the earth under experiment in fine powder. The percolator is fixed in a rubber stopper capable of maintaining a vacuum in a tubulated bottle. To the tubulure of the latter there is adapted, through a tight rubber coupling, a tube that is bent at right angles and is fixed to a vertical board. To this tube, C, are soldered two others, D and D′, which, after curving toward each other, descend to a small mercury reservoir. Glass cocks, E and E′, permit of putting them in communication with or isolating them from a tromp, F, actuated by a current of water furnished by a cock fixed to the wall of the laboratory. A sheet of paper upon which are traced divisions of one centimeter is glued to the board between the two tubes.

When it is desired to moisten the earth, it is sprayed by means of an atomizer, G, analogous in principle to the apparatus used for diffusing perfumes. The current of air is furnished by a blowing apparatus whose nozzle is fixed to the wall of the laboratory.

After the fine earth under experiment has well settled, the air is sucked from the bottle by means of the tromp, F. If the earth is very permeable and is traversed at every instant by a quantity of air equal to that removed from it by the tromp, the pressure in the bottle, B, will be equal to that of the atmosphere, and the mercury will not rise in the tubes, D and D′; but if, on the contrary, the air experiences a certain resistance in traversing the earth, less will enter the bottle than is removed therefrom by the tromp, the pressure will diminish and the mercury will rise in the tubes so much the higher in proportion as the difference between the pressure in the bottle, B, and the pressure of the atmosphere is greater. It will be understood that the height that the mercury reaches in the tubes, D and D′, that measure such difference indicates the greater or less permeability of the earth submitted to experiment when it is dry or, on the contrary, after it has received an increasing number of sprayings.

Arable soils are composed of four different elements: sand, clay, lime, and humus. If we investigate the permeability of these various elements to the air, we shall find that it differs greatly. While sand, even when very fine, and dry or moist, is absolutely permeable and allows the air to pass freely, and the mercury does not rise in the tubes when the tromp is actuated, the case is entirely different with lime, and especially with clay. When these are sprayed, the water traverses the mass with difficulty and quickly forms a stratum upon the surface, the air no longer passes, and the mercury rises and reaches 75 centimeters, the limit of the vacuum that can be obtained with the tromp employed. The humus of peat, on the contrary, is very permeable. The water that surmounts the clay or earthy lime finally drains off, even when we cease to attract it by stopping the operation of the tromp, but the mercury remains suspended in the tubes for a long time, and it is not until after one or two days that the pressure is established again in the bottle, B.

If we put some earth into the percolator, A, we very soon see that the permeability decreases with its degree of fineness and its compactness, and we find besides that it decreases again with the quantity of water furnished it. It comes about that an earth that is very permeable after it has received 50 or 100 cubic centimeters of water in a spray becomes more and more impermeable in measure as the spraying is more prolonged. If, however, after each influx of water, we weigh the percolator in order to ascertain, through its increase in weight, the quantity of water that it retains, we shall find that such quantity does not increase. So it is not the water interposed between the molecules of earth that prevents the passage of the air.



APPARATUS FOR THE STUDY OF THE PERMEABILITY OF THE EARTH.

If we recall, besides, that the permeability is so much the slighter in proportion as the earth is finer and more compact, we shall come to the conclusion that the latter becomes impermeable when the water mixes with the finest portions of it, carries them along into the interstices between the molecules of earth, and then abandons them when its motion slackens. These interstices gradually become obstructed and clogged up and an impermeability is produced.

In fact, we see the earth become entirely impermeable to the air, and the mercury rise in the tubes that indicate a complete vacuum, only so far as the earth is covered with a stratum of water. As soon as this stratum disappears, and the external air can reach the layer of earth, it precipitates itself upon the latter and the mercury descends.

According to these observations, it is patent that if we could render the molecules of earth sufficiently stable, solid and resistant to prevent them from becoming disintegrated or mixed with water, we should have a chance of keeping the earth permeable. Now, we know that a molecule of earth is a small aggregate of sand cemented by coagulated clay. This coagulation of the clay is determined by the carbonate of lime dissolved by the carbonic acid furnished by the slow combustion of the humus.

This decisive influence of the salts of lime upon the coagulation of clay, and consequently upon the stability of the aggregates of earth, and finally upon permeability, is easily shown by a pretty experiment due to Mr. Schloesing.

The clay is stirred up in distilled water, wherein it remains in suspension. This muddy water is preserved thus for several hours without its being observed to become clear. But if we pour into it a small quantity of a saline solution (one of marine salt or of a lime salt, for example), the aspect of the liquid will quickly become modified and we shall observe the appearance in this mass, but just now homogeneous, of small flakes of clay, which will slowly descend in the liquid and soon unite at the bottom of the vessel, leaving above them water that is nearly limpid. Clay is therefore capable of assuming two very different states: Now it is miscible with water, passes through filters, and allows itself to be carried along, and now, on the contrary, it is stable, does not mix with water, remains upon the filter, and allows limpid water to flow beneath it.

Pure water mixes with clay, and water charged with salts coagulates and precipitates it; hence the limpidity of sea water and the production of deltas at the mouths of all the great rivers, which deposit the clay that they have carried along as soon as their water becomes brackish.

So long as the earth contains dissolved salts of lime, its coagulated clay resists the action of rain and it is permeable, but if a persistent rain removes such salts, the clay allows itself to be carried along, the interstices through which the water and air circulated become clogged, and the earth becomes impermeable.

We are made aware of such impermeability by the persistence of the water in all the sloping portions. In winter, if the water remains in the furrows, the earth is impermeable. The remedy is easily pointed out. It is necessary to lime or marl the soil, and, of marling, one of the advantages, among many others brought to light by the experiments that we have just described, is precisely that of preserving the earth permeable to water and air.—P. P. Deherain, of the Institute, in La Nature.

The Mineral Production of Canada.

The annual preliminary statistical table of the mineral production of Canada, prepared by the Division of Mineral Statistics and Mines of the Canadian Geological Survey, has just been published, says the Iron Age. It shows the value of the total production in 1895 of minerals, both metallic and non-metallic, at $22,500,000, of which $6,370,146 was metallic and $15,875,197 was non-metallic, with $254,657 as the estimated value of mineral products not returned. The total production in 1894 was $20,900,000; that in 1893, $19,250,000; that in 1892, $19,500,000; that in 1891, $20,500,000; that in 1890, $18,000,000; that in 1889, $14,500,000; that in 1888, $13,500,000; that in 1887, $12,500,000; and that in 1886, $12,000,000. From this last it will be seen that the production of last year was the largest in any one year during the past decade, and that there was an increase of $10,500,000 from 1886 to 1896. The metallic productions last year consisted of copper of the value $949,229; gold, $1,910,921, iron ore, $238,070; lead, fine in ore, etc., $749,966; mercury, $2,343; nickel, fine in ore, etc., $1,360,984; and silver, fine in ore, etc., $1,158,633. The non-metallic productions were: Asbestos, $368,175; baryta, $168; chromite, $41,301; coal, $7,774,178; coke, $143,047; fire clay, $3,492; graphite, $6,150; grindstones, $31,532; gypsum, $202,608; limestone for flux, $32,916; manganese ore, $8,464; mica, $65,000; ochers, $14,600; mineral water, $111,048; moulding sand, $13,530; natural gas, $423,032; petroleum, $1,201,184; phosphate, apatite, $9,565; precious stones, $1,650; pyrites, $102,594; salt, $180,417; soapstone, $2,138. The production of last year exceeded that of the highest amount in any previous year by $2,000,000, the highest amount in any previous year being $20,500,000, which was reached in 1891. It is expected that the returns for the current year will show a still further increase, as the development of the mineral resources of British Columbia is exhibiting great progress.