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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 405,

For the Week ending October 6, 1883.

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FORGING BY PRESSURE.

The Collins Company, Collinsville, Connecticut, make the adz shaped heads of pickaxes by pressure instead of by percussion. A square bar of Norway iron, one and three-eighths inches diameter, is heated to a softening red heat, placed between clamping jaws forming a matrix of the shape and dimensions of the ax head, and a punch propelled by an eccentric and lever moves forward and forces the iron into the mould, or matrix, the punch being the size and shape of the handle hole. The action of the punch, or movable die, is not rapid—no more so than the movement of ordinary punching presses or cutting shears for boiler plate—it is a pushing or pressing movement, and in no sense a blow. The effect, however, is to form from the inch and three-eighths bar a head two and a half inches deep with a lozenge-shaped eye three by one and an eighth inches. The longitudinal fibers of the iron are not broken, but are bent so as to follow the contour of the projecting portion of the head. The advantages of this method, in this instance, are that no appreciable portion of the iron is wasted by forging down from a wide bar and punching the eye from the solid, a saving of labor, and a gain of strength by preserving the continuity of the fibers of the iron. There may be many other instances in which the forging by pressure would be preferable to forging by percussion.

THE GREEN MOUNTAIN RAILWAY.

This road leads from the shore of Eagle Lake to the summit of Green Mountain, on the island of Mount Desert, Me. The survey was made last winter by Alden F. Hilton, C.E., and the construction was carried forward under the supervision of Warren Nickerson, C.E. For the most part the roadway is constructed upon the solid ledge, to which the string pieces are secured by 1¼ inch iron bolts every six feet. Where the stringers are above the surface, bed ties are used every six feet; and back of every tie on all the ledges two and three 1¼ inch bolts are set into the ledge.

All longitudinal timbers are bolted to the bed ties, and every timber resting on the ledge was carefully fitted to its inequalities. The track ties are six inches square by six feet long, and are laid upon the stringers two feet apart, center to center. The ties are grooved to prevent lateral motion and are bolted to the stringers by two ⅞ inch bolts.

The ordinary T-rail is used, the gauge being 4 feet 7½ inches. The rails are coupled by the common style of fish plate, and fastened to the ties by spikes, two in each end of every tie. The cogs are of 1¼ inch iron, made in the same set of rolls, so as to insure uniformity. They are held between two angle iron plates, which are secured to the ties by lag screws 5½ inches long, 14 screws being in every section of 12 feet. If a locomotive set in the "forward gear" be pulled backward, the cylinder acts as an air pump, forcing air into the boiler. This fact is made use of on this road. The ascent is made by steam in the usual way, but the descent is made by allowing a reduction of pressure to take place, the engine being always set to go forward. The engine (built by the Manchester Locomotive Works) has four cylinders, two cog wheels, and two driving shafts, so that the breaking of one part would still leave a reserve. There is an intermediate gear between the shafts and axles of the cog wheels. On the cog wheel axles are two ratchet wheels on which two pawls are constantly dropping, either of which is strong enough to hold the train on any of the grades. As additional safety appliances there are two band brakes that can be instantly applied by the engineer.

The cars were built by the Hinckley & Egery Iron Company, and have floors adjusted to the average grade, the side being open to permit observation. The car is pushed ahead by the engine It is provided with double hand brakes, two cog wheels, and a pawl and ratchet capable of holding the car on the steepest grade if the engine should get away.

SELF-IMPOSED RISKS.

Railroads are built for a well defined, specific purpose, which does not include their use for pedestrianism. This principle is so well recognized in Europe that it is made by law a penal offense—in England and in some Continental countries—for persons to walk on the tracks. In this country there are portions of railroad tracks, particularly in the vicinity of manufactories, that are so constantly trodden that the earth has become almost as solid as a pavement. The railroad managers put up warning signs, but they are disregarded, and once in a while "an awful accident" horrifies the community; a man or a woman walking on the track is torn to pieces by the remorseless locomotive, one track having a train coming in one direction and another track one going in the other direction, a step on to either track being probably fatal. There is a curve under a high bank, in close vicinity to a railroad depot, which is occupied by two important railroads with their network of tracks, and at no hour of the day are all these tracks clear. This curve leads to large manufactories, and the roadbed is the common route of at least two thousand workmen twice if not three times a day. On account of the killing of two persons who were walking the track, the railroad companies were blamed and the managers put up warning signs—as far as they could go in prohibition, in the lack of law, with its penalties and enforcements. Yet the use of the track is in nowise abated for a pedestrian route, and it never will be abandoned until a law, that shall be enforced, compels these riskers of life and limb to use the general and public highway, that is a trifle longer but is absolutely safe.

In many of our railroad stations—"union depots"—several trains on different roads meet, or else they pass with only a moment's interval. Crossing from side to side of such a station is very common; sometimes by persons carrying loads of baggage. Miscalculating the speed of a locomotive, even at its slowing-up pace, perhaps gauging its velocity by that of a horse, they are overtaken unexpectedly, and if not killed are seriously hurt.

The getting on to cars when in motion is another method of risking limb and life without proper cause. The feat of swinging on to a railroad car in motion, which looks so easy and so graceful when practiced by an agile conductor or an ambitious brakeman, is one difficult to the occasional traveler; and yet there are plenty of men who think it shows a sort of independence to wait until the train starts before saying good-by to friends.

Probably the foolish practice of jumping from an arriving train before it comes to a stop is the occasion of a large number of vexatious if not of serious accidents. It is still practiced, however, by those who learn nothing either by experience or by observation. On this subject the *National Car Builder* says:

"We are not in favor of excessive precautionary measures, such as locking people in cars when traveling, or fettering the free movement of a thousand sensible persons in order that one person with no sense may be kept from hurting himself. The desired end could be reached by subjecting the one foolhardy and stupid individual to a light penalty rather than give inconvenience and trouble to a vastly greater number who need no protection."

CARBONIC ACID IN THE AIR.

The composition of the atmosphere was one of the first problems which scientific chemistry, in its origin more than a hundred years ago, set itself to solve; so far from being definitely settled, this problem offers to-day a field in which the accumulated knowledge and invention of a century finds ample room for its exercise in investigation.

The study of this apparently simple question has involved the settlement of so many related points, that the science of chemistry may almost be said to have been built up about it.

More than one hundred years ago the foundations of chemistry as a science were laid by Black, Priestley, and Lavoisier, in applying exact methods to the study of the composition of the air; and their successors have handed down a record of determinations of oxygen, increasing in accuracy until those of Regnault seem to leave little to be desired.

Apart from oxygen and nitrogen, the chief components of the air, there is but one other substance in dry air which we are at present warranted in regarding as a necessary and constant component, namely, carbonic acid or carbon dioxide (CO_2). Small as its proportion is, however, in the air, its relation to animal and vegetable life on the earth has long been recognized.

All gases occurring in the air, except those already mentioned, are either accidental in their occurrence or are subject to such variation and occur in such minute proportions, that their relation to the air or the laws which govern their variations have never been clearly made out. Ozone and peroxide of hydrogen, oxides of nitrogen, ammonia, and its salts, all resulting by natural process from the normal components of the air, may appear and disappear, but the detection and measurement of them has yielded, thus far, data too meager to permit of generalization. Sulphureted hydrogen, sulphurous acid, hydrochloric acid, and hydrocarbon gases may pass into the air by natural processes, or escape from the chimneys of factories, but they are either destroyed by chemical action or washed down to the earth again by rain.

With regard to carbonic acid, however, the case is different. Being much more soluble in water than either oxygen or nitrogen, and being required in enormous quantities to supply the vegetation of the world, it might be expected to vary in its proportion in different parts of the world, at different altitudes, or with other changes of condition. But the fact of its constancy in proportion, so far as earlier methods could demonstrate it, was known almost as soon as its part in the economy of nature was understood; and the possibility of its variation even within very narrow limits is a question which has been left for the present generation of chemists to decide. It is interesting to note, however, the gradual improvement which has been made in dealing with the small proportions which this gas represents in the air. For many years chemistry was content with the statement that it represented from 4 to 6 parts by volume in 10,000 of air; many works on chemistry still give 4 parts in 10,000, but there is the best reason for believing, at present, that the average proportion is slightly below 3 parts in 10,000 all the world over.

From a number of European observers has come during ten years past a mass of information upon the question of carbonic acid in the air, which at present may be said to well nigh exhaust the subject. Angus Smith found in the air over the moors of Scotland 3·36 parts in 10,000 by volume; Farsky found 3·43 as the mean of 295 observations; Henneberg, 3·20; Hasselbarth and Fittbogen, 3·24 in Germany for inland districts, and 2·92 near the sea coast. Reissler found 3·035 as the mean of a year's observation in Switzerland, 420 meters above the level of the sea; and Muntz and Aubin, on the top of the Pic du Midi, in France, 2,877 meters above the sea, 2·86 as an average of 14 determinations.

To the observers Muntz and Aubin, and to Reiset, we