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## No. 405,

**For the Week ending October 6, 1883.**

Price 10 cents For sale by all newsdealers



### 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 foolbardy 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 owe the most recent and satisfactory results upon this subject. Working by different methods, each apparently faultless in its details, and carefully tested as to its sources of error before using, the substantial agreement of their results is the best guarantee of the accuracy of their work. Reiset finds 2·962 as the average number of volumes in 10,000 of air, Muntz and Aubin, 2·84. Both agree as to the fact that the air of cities is appreciably richer in carbonic acid than that of the country. Muntz and Aubin find 3·19 for Paris as an average of many determinations; Reiset finds 3·516 as the highest and 2·913 the lowest. The lowest proportion ever found by Reiset was 2·779 in the midst of a field of barley and lucerne far from the city, and therefore under conditions where, presumably, the absorption of carbonic acid from the air would be most rapid. As to the air of cities and towns, Schulze had previously shown that the air of narrow courts and alleys contained much higher proportions of carbonic acid than that of open places.

Carbonic acid is most abundant during fogs and generally during still and cloudy weather, while clear days indicate a decrease in its proportion. Rain, however, seems also to lessen it. During the day there is less than at night. Altitude of places seems to have little effect upon the quantity of carbonic acid when other conditions are constant. The influence of vegetation in decreasing the proportion is less than might be expected, and the predominance of carbonic acid in the air of cities is to be ascribed mainly to the use of fires, decreasing and increasing with the seasons as the consumption of fuel varies.

To show the influence of animal respiration, Reiset mentions that on one occasion the proportion of carbonic acid was sensibly increased by the proximity of a flock of 350 sheep, while his apparatus was in use.

In all of the above cases of variation in the proportion of carbonic acid with changing conditions, it is to be remembered that the variations are exceedingly small, never reaching 1 part in 10,000 between the extremes. The entire range for all outdoor places tested in these experiments was between about 2·8 and 3·5 volumes in 10,000 of air.

In order to find whether carbonic acid is uniformly diffused in the air throughout the world, Muntz and Aubin prepared a number of tubes for absorption of carbonic acid from the air, and put them into the hands of members of the different expeditions sent out to observe the recent transit of Venus. The tubes were sealed until opened at the appropriate stations, and after passing the proper volume of air the observers sealed them again and returned them to the above chemists at Paris. From an examination of these tubes the carbonic acid in the air of the distant station was determined, and in this way new data were obtained from widely separated points in many parts of the world. The results, as recently published, are as follows:

The general average of all the stations shows 2·78 volumes of carbonic acid in 10,000. The average for France, as given above, was 2·84. The highest results in the series were never higher than the highest observed in Europe, while the lowest results are less than the lowest of the latter. The average for the northern hemisphere is 2·82, almost that of France, while the average for the southern hemisphere is notably lower, viz., 2·71. The latter result has led to a re-examination of the air of the southern hemisphere through the aid of a resident observer at Cape Horn, and the examination, should it confirm the above figures, will indicate some agency peculiar to this hemisphere in lessening the proportion of carbonic acid. Muntz and Aubin account for such a result by reason of the lower average temperature of the southern hemisphere, owing to which, in accordance with the hypothesis of Schloesing, the absorption of carbonic acid by the water of the ocean and its fixation as calcium bicarbonate (bicarbonate of lime) would be more active.

As to the sources of the carbonic acid in the air, Dumas holds that physiological processes can have little to do with its increase, and that volcanic agencies are the principal sources. The gas is known to escape in abundance from volcanic craters and from fissures in volcanic regions. The reports of recent volcanic disturbances in Java and adjacent islands are accompanied by accounts of suffocation of men and animals by carbonic acid from such sources. It is liberated in abundance by the action of heat upon limestone and other carbonates, and also by the spontaneous decomposition of solutions of bicarbonate of lime, such as are often found in nature. The abundant deposits of limestone in the crust of the earth form, therefore, an inexhaustible source of the gas under certain conditions, and their abundance, together with that of mineral coal, points probably to a period in the earth's history when a much higher proportion of carbonic acid was present in the air.

While all evidence goes to show, therefore, that carbonic acid is at present an almost invariable constituent of the air, it is one which requires least change in the physical conditions under which the earth exists to effect a change in its proportion. Minute as the proportion is, the delicacy of its relation to animal and vegetable life on the earth makes the maintenance of the apparently unstable equilibrium a matter of serious concern to mankind.

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VIRGINIA is making flour of peanuts, of which she raises 2,0 0,000 bushels this year. Peanuts, so called in the Old Dominion, were introduced from Africa, and are known in North Carolina as ground peas, in Tennessee as goobers, and in Georgia, Alabama, and Mississippi as pinders.

## THE OSCILLATIONS OF THE SEA.

In a note of mine published in No. 10 of the *Revista Scientifico Industriale*, I spoke of the work of Mr. G. H. Darwin entitled "The Stress Caused, etc." In this note I said that the author, with others, had reached the conclusion that the tension produced by the weight of the continents and mountains was not adequate to cause terrestrial elevations and depressions. This conclusion at first seems contradicted by the fact of the continual oscillation of the earth's crust, the actual emergence and immersion of the continents, but in fact it is not. Adhemar and Croll have given an explanation of continental movements upon the hypothesis that, by the procession of the equinoxes, the motion of the terrestrial perihelion, and the eccentricity of the earth's orbit there was accumulated alternately at the poles enormous masses of ice. This ice once deposited displaced the center of gravity of the earth and produced a movement in the oceans, the water always flowing toward the center of gravity, hence the submergences. To-day this view has become modified, but the conclusion remains unaffected.

According to the law of gravitation, all substances attract in proportion to their mass. A continent hence exerting an attractive influence upon a surrounding sea produces an elevation of its level along the coast line and sustains the water at a height proportional to the mass of the attracting region. This result was deduced by Fischer reasoning upon the observations made with a pendulum, and Listing and Bruns reached an analogous conclusion. This of course destroys the assumption that the sea has a level surface. Moreover, the ocean is more or less high along the same line of sea board, according to the variable mass of the same from point to point. Thus Dr. Penk explained in this way many local phenomena of elevation and debasement especially conspicuous during the glacial period. He said if a region can attract the sea in proportion to its mass, whatever increases that mass increases the effect; and an accumulation of ice will bring about a raising of the sea level. I say that these views will not invalidate the conclusions of Adhemar and Croll, but in fact substitute for the displacement of the center of gravity another force, *i. e.*, surface attraction, the disturbance of the ocean remaining as before. The objection is made to the theory of the movement of the sea produced by the alternating accumulation at the poles of ice that in fact there is no difference in temperature between the north and south hemisphere. I doubt it. To decide whether the two hemispheres vary in heat, observations should be made over a century and over the whole superficies of the land. It is certain that for many thousand years this difference, assuming it, will decrease with the decreasing eccentricity of the earth's orbit. Should to-day or in the future no difference in temperature be established, it certainly obtained when the eccentricity was much greater, hence the conclusions of Adhemar and Croll as to the displacement of the sea can always stand. In the future, whether by increase of cold, or by decrease in eccentricity, the marine oscillations, from the accumulations of ice at the poles, should become less, and at length insensible.

Passing from the general question to a particular phase of it, we can extend the conclusions of Dr. Penk, saying, not only does the addition of ice over a region raise the sea level about it, but also the addition of any other body. In Italy we have two local facts of elevation and debasement, the oscillations of the sea level around the columns of the temple of Serapis, and the lowering of the plain of Venice. The first can be explained by Vesuvius, the second by the Venetian streams. Vesuvius, emptying the caverns that certainly exist in that region, attracts less, and the sea falls, and the columns of the temple of the Serapis emerge. If on the other hand by successive eruptions the mountain mass is enlarged, the surrounding sea rises, and the columns again become the home of a new generation of boring mollusks. The Po, Adige, Brenta, Piane, Tagliamento, all discharge their muddy streams around Venice. The sea by the invasion of the torrents retires, but upon the augmentation of the mass of the shore it raises the level and the plain of Venice seems lowered. The elevation of the sea causes the alterations noticed in the region, and the streams to be able to push their water into the sea at its higher level must raise their beds, which is helped by the protrusion of their mouths forward, and by the greater influence of the rising of the sea.—*Professor Zona, in Revista Scientifico Industriale.*

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### The Approaching Comet.

On September 3, Prof. W. R. Brooks discovered a faint nebulosity which rapidly increased in brilliancy, and which subsequent observations proved to be an approaching comet. It is now quite certain that the stranger is the comet originally discovered by Pons, at Marseilles, July 20, 1812, when its period was determined to be about seventy and one-half years. At that time it was a moderately bright object, clearly to be seen by the naked eye, and having a tail one or two degrees long.

During the present visit it will not be visible, in all probability, without a glass until the latter part of next January. But calculations concerning its greatest brightness cannot as yet be made; as during the past month it has behaved very erratically, increasing to many times its first luminosity. According to calculations made by Prof. S. C. Chandler, Jr., the position of the comet on the 10th inst. will be, right ascension 16 hours 33 minutes and 44 seconds; and declination 56° 51' north. On the 26th inst. right ascension 16 hours 55 minutes 6 seconds, and declination 53° 40' north.

### United States Life Saving Service.

The report of the operations of this service for the year ending June 30, 1882, contains much information of general interest, and above that the scope of the work, whether viewed from a humane or a financial point of view, is much greater than commonly supposed. The present system dates from November 1, 1871, although the life saving service was organized in conformity to an act of Congress approved June 18, 1878. At present it faithfully watches the greater part of our coast, and is ever on the alert to render assistance to vessels in danger. It is founded on the grand principle of neighborly kindness, and its efforts are put forth to aid those of any nationality.

At the date of the report there were 189 stations distributed as follows: Coast of Maine and New Hampshire, 7; Massachusetts, 15; Rhode Island and Long Island, 37; New Jersey, 40; Cape Henlopen to Cape Charles, 11; Cape Henry to Cape Hatteras, 24; Florida, 5; Gulf Coast, 5; Lake Erie and Ontario, 10; Lakes Huron and Superior, 12; Lakes Michigan, 16; Pacific Coast, 7. Of the above 144 were on the Atlantic, 37 were on the Lakes, 7 on the Pacific, and 1 was at the falls of the Ohio, Louisville, Ky. On the coast of Florida surfmen were not employed at the stations, as the character of the coast for the most part makes escape from stranded vessels comparatively easy, the main danger to shipwrecked persons being of dying from hunger and thirst, as the region is but thinly settled. The keepers are in charge of houses of refuge, and are required to search the coast in both directions after every storm.

During the year there were 287 disasters to vessels, and of the 2,258 persons on board all were saved but 12. The estimated value of the vessels and cargoes was $4,758,357, of which $3,099,987 was saved. There were 67 vessels totally lost. In addition to this there were disasters to 58 smaller craft, as sail boats, row boats, etc., on which were 128 persons, all of whom were saved. The results of all the disasters coming within reach of the service were as follows:

| | |
|---|---|
| Total number of disasters | 345 |
| Total value of property involved | $4,766,227 |
| Total value of property saved | $3,106,457 |
| Total value of property lost | $1,659,770 |
| Total number of persons involved | 2,398 |
| Total number of persons saved | 2,386 |
| Total number of persons lost | 12 |
| Total number of shipwrecked persons succored at stations | 468 |
| Total number of days' succor afforded | 1,379 |
| Number of vessels totally lost | 67 |

To the above list should be added the rescue of 29 persons who had fallen from wharves and piers and who would certainly have drowned but for the assistance of the life saving crews.

Of the disasters, 198 occurred on the Atlantic and Gulf coasts, involving the lives of 1,225 persons, all but 10 of whom were saved, and property (vessels and cargoes) to the amount of $2,676,132. 140 of the disasters were on the Lake coasts, and the people imperiled numbered 1,082, of whom 2 were lost, and the property involved was $1,722,720; on the Pacific coast there were 7 disasters, risking 91 lives, and $367,375 worth of property. During the year the surf boat was used 284 times, making 381 trips, and landing 327 persons; the self-righting and self-bailing life boat was used 11 times, making 15 trips and landing 27 persons; smaller boats were used 98 times, making 121 trips, and landing 43 persons; the river life skiffs were used 30 times, making 111 trips and landing 124 persons; the breeches buoy was used 17 times, making 170 passages, and landing 158 persons. Five persons were rescued by surfmen swimming out to them; 10 more were saved by casting lines over vessels. In one case a disabled man lying at the foot of a cliff 780 feet high was rescued by one of the life saving party who was lowered down the cliff at the end of a line, by means of which both men were drawn to the summit.

Since November 1, 1871, there have been 1,692 disasters involving 14,702 persons, of whom 407 were lost, and $29,278,714 worth of property, of which $11,213,362 worth was lost. The total expenditures for the Life Saving Service for the year were $506,239.55.

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### A Fast Steamer.

The steamship Alaska, of the Guion Line, arrived in New York, September 23, from Queenstown, 6 days 21 hours and 40 minutes, surpassing her former record by more than 2 hours. Her 24-hour runs varied from 310 to 436 miles, her speed at some times, as shown by the log, being 18¼ knots per hour. The Alaska has also made the fastest easterly trip from Sandy Hook to Queenstown, covering the distance in 6 days 18 hours and 37 minutes; the faster time easterly being due to the favorable current of the Gulf Stream. Other fast trips westerly were made by the City of Rome, of the Anchor Line, in 7 days and 2 hours; the Servia, of the Cunard Line, in 7 days 3 hours; the Britannic, of the White Star Line, in 7 days 7 hours and 11 minutes; the Arizona, of the Guion Line, in 7 days 8 hours and 34 minutes; the Fulda, of the North German Lloyd Line, from Southampton to New York, in 7 days 21 hours and 5 minutes; the Werra, of the same line, in 7 days 23 hours.

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A CONSIGNMENT of very lively leeches was among the first day's receipts at the General Post Office in London on the inauguration of the new parcels post. The box containing them was a very slight one, and becoming fractured in transit, the contents escaped, and traversed the establishment in search of a promising "subject."