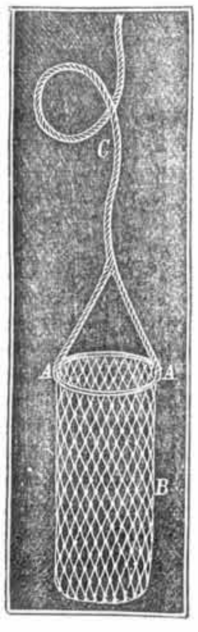
Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Life Preserver for Hotels and other Lofty Buildings.

MESSRS. EDITORS:—While reading an account in the papers of the great loss of life at the burning of the Spotswood Hotel, in Richmond, a very simple and inexpensive means of escape in case of fire suggested itself to my mind, and I give it to you for publication, if you think it worthy of pratical application. Let A in the sketch given be an iron hook of suitable strength to retain its form, and bear the weight of an ordinary man. Let B be a bag of net work, made of rope about the size of a clothes line, and secured to the hoop; and C, a rope attached to the bag, and long enough to reach from a window to the pavement beneath, with slack to secure it to any object in the room, even at a distant point. With an arrangement of this kind in the room: on the upper floors of a hotel, every man, woman, and child might escape in perfect safety, the last man, of course, would have to slide down by means of the rope itself. The bag ought to be made about 4½ feet high, or perhaps a little above the waist would answer; and in case of infants and children being put in, they would have plenty of air through the open spaces. It will be necessary to use a bag, because being perfectly pliable the party in it could more readily assist in launching himself or herself off the sill of the window; for in case of having to lift out an affair of the kind with its human freight, more strength would have to be brought to bear than person at the top could easily put forth. I have thrown out these hints in hopes that the may lead to the saving of human life, and if of no practicul value in themselves, possibly some one may be thereby induced to bring out an invention that will answer the end in view. HUMANITY.

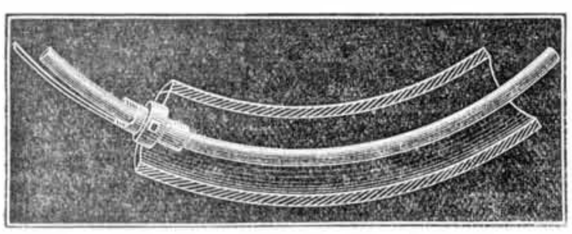


Baltimore, Md.

Boring Segment of Hollow Cylindrical Ring.

MESSRS. EDITORS:—In your issue of the 20th of November L. V. asks this question: "Will some practical mechanic tell me how I can bore out true a segment of a hollow cylindrical ring, the segment being the sixth part of such a ring, the diameter of which is two feet, and the diameter of the bore being required to be six inches?"

I sent you what I supposed to be a true plan for the purpose, but in your issue of December 17th you ask me, "Have you not mistaken the drift of L. V.'s query?" In reply I answer, yes. And now, fully understanding your correspondent's wishes or statement, I propose to try it again:



Make a wooden frame, into which fasten the segment to be bored, with the bore down. Place this frame in front of an engine lathe opposite the face plate. Turn a piece of round iron about one third the diameter of the bore of segment, and bend it over a turned circle the same as desired (viz., two feet); pass it through the segment and fasten it to the frame rigidly. In the exact center of the segment on this bent bar or mandrel make a sliding head some four inches long (in halves and rabbeted) so as to move freely through the segment. Feather the same, if liable to turn in the least. In the center of this slide turn a collar, and thereon place a ring with a cutter in the center. Set the cutter out to take a cut, and hold the loose ring with a set screw. Now it is very evident that if you push this slide through the segment you will cut a groove to correspond with the circle of the mandrel. Draw it back and loosen the set screw and turn the ring for a new cut. Tighten with the set screw, and renew the operation until the circle is complete. I propose to use the face plate of the lathe for a crank, and employ connecting rods from the crank pin to the slide for the purpose of driving it. This is an expensive method, but I am sure it is a good one. H. WHEELER.

Silver Creek, N. Y.

[We fear all our readers will not share the confidence our correspondent feels as to the practicability of his method. We see many practical difficulties in the way of getting a true job in the manner specified. However, as it is an attempt to solve a difficult problem, and suggests thought, we give it for what it is worth.—EDS.

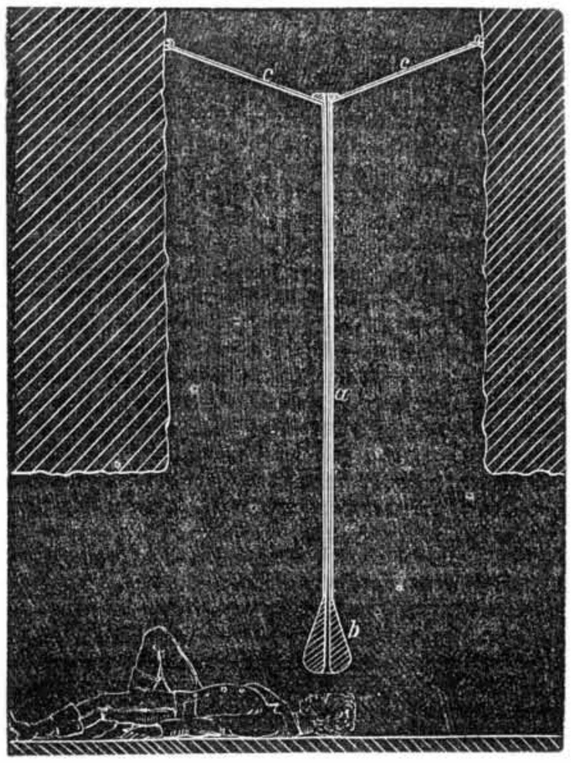
The Great American Desert a Myth.

MESSRS. EDITORS:—A short time ago I read a short article on the barrenness of the land west of the Missouri River, which conveys a very wrong impression. After over 5,000 miles travel over the plains, mostly on foot, I am thoroughly convinced that there is but very little which cannot be utilized. I was taught in my schoolboy days the magnitude of the great American desert, but, with the exception of the sand bluffs along some parts of the Platte River, and a sand tract about twelve miles wide a little south-east, and about sixty miles from what used to be named the junction on the South Platte, I have failed to find it. All over the plains there are indications of water near the surface, and springs are frequent in the bluffs. As for the soil it is very rich. I am more willing to trust my own eyes than the speculations of others. T. L. VON DORN.

Omaha, Nebraska.

The Hoosac Tunnel.

MESSRS. EDITORS:—In your issue of Dec. 24th, No. 26, Vol. XXIII., is an article from the pen of G. C. Breed, on the difficulties of getting a correct plumb line, etc., in the Hoosac tunnel. Now, Messrs. Editors, I am not an engineer, but occasionally do some thinking, and this article suggested the



idea to me that if the thing cannot be done from the top of the shaft by a long plummet, why can't it be done from the bottom from a short-sighted one.

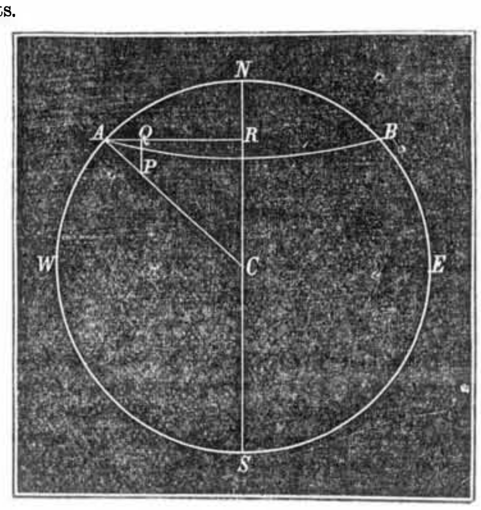
I give you a rough sketch of my idea. We will suppose a rod or tube, *a*, suspended by strings, *c*, or in any other convenient way, in the center of the bottom of the shaft, the rod or tube being hollow or sighted like a gun barrel. Why couldn't a person, looking through it or its fine sights, get the point as it ought to be, either at the top of the shaft or by a star or some other point in the sky.

I do not believe in perpetual motion, or any thing of that kind, but in my experience I find that if a thing cannot be done in one way it is no sign that it cannot be done in another. This suggestion may expose my ignorance, but still take it for what it is worth. CYRUS COLE.

Havana, N. Y., Dec. 24, 1870.

Can a Perpendicular be Obtained by Means of the Plumb Line?

MESSRS. EDITORS:—As Dr. Heirry's article, in your issue of December 10th, has impressed an erroneous idea upon some of your readers hereabouts, I submit the following for the purpose of enlightening the doctor upon the subject, as well as such of your readers as have been misled by his statements.



The doctor's statement that it has been proved to be impossible to obtain a perfect perpendicular line by means of a plummet is a mistake, which has probably resulted from his not having comprehended the experiment to which he alludes. It is well known that a plummet suspended and caused to vibrate as a pendulum, will, by the motion of its plane of vibration, demonstrate the rotary motion of the earth; and it is also well known that a plummet dropped will strike a point below, eastward (not westward, as stated by Dr. H.) of a vertical through the point whence it was dropped; but these facts by no means prove that a plummet may not be suspended so as to indicate a true vertical line, all of which will readily be understood from the subjoined diagram and explanation.

Let E W N S represent a horizontal section of the earth through its center, and let A B represent a parallel of latitude through A, which may represent the mouth of the central shaft in the Hoosac tunnel in lat. 42°, say L; and let P represent a point at the bottom of the shaft vertically below A; let A R be perpendicular to the earth's axis, S W, and let P Q be parallel to S N. Then, because the earth revolves on its axis, all parts not in the polar axis have an eastward motion in space which is proportional to their distance from the polar axis; therefore the eastward motion of a point at P (which is at the same distance from the axis as the point at Q) will be less than the eastward motion of the point at A. But the point, A, will make a revolution about R in one sidereal day—about 86,160 seconds. Hence, we readily find the difference per second of the velocities of the points, A and P, to be $\frac{2a\ \pi\ \cos.\ L}{86,160}$ $8=0.671$ of an inch nearly, *a* being the depth of the shaft.

Now, for a plummet to face through 1,030 feet will require about 8 seconds of time. Hence a plummet would fall to the bottom of the shaft of the Hoosac tunnel in 8 seconds, and consequently it would fall east of the point vertically below the point from which it was dropped, a distance$=\frac{2a\ \pi\ \cos.\ L}{86,160}$ $\times 8=5.37$ inches, nearly.

But if the plummet is suspended in a vessel of oil, for instance, as you suggest, which vessel rests upon the earth at the point, P, it is clear that when the plummet is at relative rest within the oil, it will have lost a portion of the motion it had when at the point, A, and will have precisely the same eastward motion as the point, P, and will therefore be at rest, relative to the oil, when vertically below A.

Des Moines, Iowa. J. E. HENDRICKS.

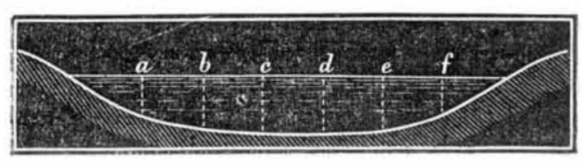
To Estimate the Power of a Stream.

MESSRS. EDITORS:—Almost every man has about him in his daily walk sufficient apparatus for a tolerably accurate estimate of the quantity of water flowing in any stream. A walking-stick, a jack-knife, and a watch, provided the walking-stick is just three feet long, are all the tools necessary for the purpose.

Take a section of the stream as uniform in breadth and depth as possible, and measure off upon its bank some definite length, say from one to four hundred feet, according to the rapidity of the water; set a stake close to the water at each end of this section, then throw into the water, opposite the upper stake, a green twig or limb of a tree, or other object of such specific gravity as to nearly, but not quite, sink, and of such size that one portion shall remain at the surface while another portion nearly touches bottom; the object being to get the average speed of the water; the resistance caused by the bed and banks of the stream necessitate some care in this part of the experiment.

Note accurately the time the object is passing from stake to stake, and repeat the operation several times and at as many points towards the opposite shore; the sum of the several times divided by the number of points at which the speed was taken gives the average speed of the water.

Now measure the depth at several equidistant points across the stream, as at *a, b, c, d, e, f* (the diagram representing a cross section of the stream), the sum of these depths divided by the number of points at which the depth was measured



gives the average depth; this average depth multiplied by the breadth of the stream gives the area of the cross section, this area, multiplied by the length of the section, gives the cubic contents of body of the water embraced in the section Thus we have the quantity and its velocity, which are the elements necessary to show the value of a stream for manufacturing purposes, provided it has sufficient fall anywhere to render it available.

Allowing sixty-two pounds for each cubic foot of water, and a supply of one thousand cubic feet per minute, and a fall of ten feet, we have 1,000 × 62 = 62,000 pounds, 62,000 × 10 = 620,000 pounds momentum, 620,000 ÷ 33,000 = 18·7-horse power. One fifth at least must be deducted for friction and loss, making in this case about 15-horse power. F. G. W.

Popular Errors Regarding the Watch.

MESSRS. EDITORS:—A hunter's (or close) case is almost universely supposed to be the best protection for the watch; it is also supposed that it prevents the breaking of glasses, that it better protects the movements from dust, and that in all things is the most desirable to have—to all of which I wholly dissent.

Every watchmaker of experience and observation knows that a close case permits more dust and lint to get into the movement than an open one, for the reason that the case over the glass, which springs open on being unlocked by the push in the stem, necessarily fits loosely down on its place, to allow it to open by the force of the lifting spring. If it snapped, like the opposite side, the spring could not lift it open. The dust finds its way inside the cover, through this loose fit, and thence it works its way into the movement through the opening left for the lifting spring to act on the case, and through the opening around the locking spring, which holds the case shut; the hole through the stem, through which the push-pin acts, also permits dirt to pass inside. There is also another trouble in close-case watches, which is, that the lifting spring is constantly bearing upwards on the cover, and every time the case is opened the hinge (joint) is worn a little. After opening many times, the joint becomes much worn, and more or less open, affording an additional place for the dust to enter. Particularly does this occur when the case is allowed to fly back against the joint with a force proportioned to the strength of the lifting spring and the weight of case, thus adding to the natural wear a stretching open of the joint, that very soon allows the dust to pass in quite freely. All these causes conspire to foul the movement in a very short time.

In the open-faced watch not one of these openings exist for the admission of dust; the rim (bezel) which holds the glass closes with a snap-joint; the back case closes with the same snap, there is no opening through the stems, and the whole case, if properly made, is water-tight, and will remain so for years, thus affording almost perfect protection to the movement from dust.

The serious inconvenience caused by the rapid accumulation of dirt in the close cases, has stimulated inventive genius to devise ways and means to remedy the defect. "Dust rings" thus far have been the only product of this inventive labor; some are placed around the edge of the movement; some go inside the case; neither kind are entirely successful in excluding the dust. The only possible advantage in the use of the close case is, that it may be continued in use after the glass is broken. An open-face watch must be laid up if the glass breaks till another can be had; but only the very heavy cases protect the glass from breakage, and probably three fourths of the close cases in use are supported by the glass, instead of affording protection to it; and particularly is this the case with ladies' watches in which the glass must be flat, and very thin.

There is no doubt but that more glasses are broken by the use of close cases than would be broken if open cases were in general use, the latter admitting of much thicker and stronger glasses. Neither are the very heavy close cases the protection to the movement that many suppose; one sufficiently heavy to prevent being crushed, is well, but all the weight of metal beyond that is dangerous, and for this reason, that in the event of the watch falling, or enduring any sudden jar, the momentum of the massive case produces a concussion which must damage some part of the movement, thus its very strength proves destructive.

For the benefit of the "craft," I advise the use of "hunter's cases;" for the good of the wearer, most certainly "open" ones. R. COWLES.

Cleveland, O.

Nitro-Glycerin Explosions.

MESSRS. EDITORS:—In your issue of November 19th, 1870 you refer at some length to the recent explosion of nitro-glycerin at Fairport, Ohio.

In the article referred to you denounce in a very emphatic manner its manufacture and use as a blasting agent. As I have been engaged in its manufacture for two years, and have possibly as much practical knowledge of it as most men, I beg you to allow me space in your valuable journal to vindicate, in some degree, this much abused substance.

In the first place, without attempting to disparage the general accuracy of the report of the Painesville (Ohio) *Telegraph*, further than to call attention to their sensational style of reporting such matters, I will state a few facts in relation to the explosion not generally known, but which, if published, will go far to allay the popular fear of nitro-glycerin.

On the day of the explosion there were 15,000 pounds of the substance in the magazines (equal in explosive force to 195,000 pounds of gunpowder) all of which exploded almost simultaneously. Nevertheless we find by actual facts that its deadly area did not extend to a radius of eighty yards, and that the concussion was incapable of exploding a quantity of nitro-glycerin in an exposed position eighty feet from the nearest magazine. Again, the effect upon the houses in Fairport has been ridiculously exaggerated. Ruinous previous to the explosion, all the dwelling houses, thirty or forty in number (the nearest being about 600 feet from the magazines), have since been put in good repair by an expenditure by the nitro-glycerin company of a sum not exceeding eight hundred dollars.

As to the assertion that the shock was communicated through the earth 160 miles, I think it is simply puerile and unworthy of consideration. For why was not Cleveland, only thirty miles distant, also moved by the shock? The inhabitants in that city did not even hear the report. May not, however, the theory of a simultaneous earthquake be entertained on good grounds of belief? It is on record in the public prints that on the same day and about the same time of the explosion, the shock of an earthquake was distinctly felt in Canada, the States of New York, New Jersey, and Pennsylvania. The working of telegraph wires was in some places interrupted, and many individuals are reported as having experienced the peculiar feeling of nausea which is said to be the concomitant of earthquakes. Taking these circumstances into account you can, of course, draw your own inferences.

In Gainesville (notwithstanding sensational reports) no consternation was caused, and no damage was done. Many people did not even know of the explosion. Others hearing the noise thought it was the firing of a cannon or, perchance, the explosion of a steam boiler.

You refer to the case of a man sick with typhoid fever having been instantly killed by the shock. Dr. Jackson, the physician in attendance upon the man, declared upon oath last week that his patient, previous to the explosion, was moribund, and died some time after the explosion.

Apart from the assumption that this explosion may have resulted from an earthquake, I can easily believe that it may be accounted for thus: The unfortunate men were engaged in removing from the magazines some earthenware jars containing nitro-glycerin in a partially frozen or solidified state, and I assume that one jar must have been let fall upon another accidentally, which, striking against each other with sufficient force, would fully account for the unfortunate occurrence.

I will now, if your space will permit, state my conviction, induced by large experience, that the manufacture and handling of, and the blasting with, nitro-glycerin can be carried on with perfect immunity from danger. During its manufacture I cannot conceive any circumstances under which it may explode. In my experience I have seen at the same time two vessels, each containing six pounds of nitro-glycerin in a state of incandescence, caused by a small quantity of unconverted glycerin lying on the surface of the crude nitro-glycerin. This apparently alarming phenomenon proved to be perfectly innocuous, as on precipitating the unconsumed contents of the jars in water, I found that ten pounds of nitro-glycerin had been consumed gradually and without explosion or instantaneous decomposition. Can a correlative case be quoted as to gunpowder?

Undoubtedly in the safe manufacture and using of nitro-glycerin certain conditions must be implicitly complied with, the chief of which conditions are, persistent forethought and caution. All the employés of the Lake Shore N. G. Company were duly advised on their engagement of the nature of the product, and were well instructed in the mode of handling the same, but "familiarity may have bred contempt;" carelessness may have been the result, and hence the catastrophe.

During the last two years the Lake Shore Nitro-Glycerin Company have manufactured about 150,000 pounds of nitro-glycerin, equal in explosive force to 1,950,000 pounds of gunpowder, all of which has been used for blasting purposes without the loss of one single life. Has gunpowder a similar record? Indeed the very fact that miners were certainly unconversant with the rudimental principles of chemistry, have (taking their safety into consideration) decided wherever it has been introduced, in favor of nitro-glycerin, shows beyond doubt that the dangerous properties of nitro-glycerin are merely hypothetical.

I have been a regular subscriber to your invaluable journal for the last twelve months, yet, notwithstanding that many casualties, through the use of gunpowder, attended with the loss of many lives, have occurred during the same period, I have not seen that you have censured those manufacturing or using it.

Since the explosion in Fairport I have observed in the public prints that in various parts of this country and in Europe seventy people have lost their lives and many more been injured by the accidental explosion of gunpowder and gun cotton, all of which you pass by without comment.

In conclusion, may I venture to suggest to you that it is impolitic, not to say unfair, to decry and condemn any branch of national industry simply because some serious accidents have occurred in its development.

Look back through the histories of gunpowder and the steam engine—two of man's most indispensable servants—and note the black record of death upon their pages, and then say if nitro-glycerin deserves the anathema you have hurled against it. SAMUEL THOMPSON,

Chemist to the Lake Shore Nitro-Glycerin Co.

Painesville, Ohio.

[We are always willing that both sides of a question shall be heard. In this case we allow an advocate of nitro-glycerin to speak with peculiar satisfaction, since we think every candid mind will, upon reading his communication, rise with strengthened belief that nitro-glycerin is too dangerous a substance for general and indiscriminate use. Since the explosion at Fairport another man has been blown to atoms at the Hoosac Tunnel, and the black record will keep increasing so long as nitro-glycerin is used as a blasting agent. Only such exigencies as rarely occur in engineering work should, in our opinion, justify the use of this deadly explosive. Our correspondent's theory of an earthquake occurring simultaneously with the Fairport explosion strikes us as particularly humorous, if such a thing as humor may be tolerated in so serious a matter. So far as we have been able to learn from the accounts of the many disasters caused by such explosions the earth has in every case literally quaked at the power of an agent that can instantaneously annihilate human beings so that not race is left of them.—EDS.

Chemistry in Relation to Practical Agriculture.

MESSRS. EDITORS:—A writer of great intelligence in a recent number of a prominent agricultural journal in Richmond, Va., declares his conviction that science, and especially chemistry, does not aid practical agriculture? *Per contra*, the statement of one fact may illustrate the fallacy of his conclusion more briefly than his argument to "prove a negative":

This farm has been in the possession of my forefathers for more than one hundred years, and during all of that period a bed of peat has occupied a central and comparatively elevated position. Moreover, since my boyhood here (during more than forty years) some of the best practical farmers in Delaware have rented it, and never paid, on an average, a sufficient amount to equal the rent of my dwelling in Baltimore. Since 1865 one half has increased in productiveness, yielding last year an income of $7,000, and an aggregate of $14,000 during the preceding three years, and I depend on this peat to make the other half equally productive and indirectly sustain the crop as above. Its value, however, was not ascertained until last summer, and then as one of the first essays in analysis of my son, which I subsequently verified. We both agreed that the nitrogen or quasi ammonia, when valued at the same rate as we pay for it in Peruvian guano, would pay for excavation, although associated with more than seventy-five per cent of water—in proportion to the carbonaceous residue or magma or solid part of the peat. Still our estimate of the phosphoric acid potash and lime indicated a money value of these elements alone in each tun of 2,000 pounds, worth $3·70, including the ammonia. After more than twenty years' experience in the analysis of soils and marls for others in Maryland, I now testify to the practical importance of such results on my own farm, having devoted my attention to it as a much more certain and profitable investment of my time and acquirements than the laboratory, although that was a success and decidedly so.

DAVID STEWART, M.D.,

Formerly Chemist of Maryland State Agricultural Society, etc.

Port Penn, Del.

To Put a Grain Mill in Order.

MESSRS. EDITORS:—ADJUSTING THE SPINDLE.—First see if the cock-head and spindle-neck be true; if not, take the spindle out and adjust it. Put the cock-head in a female center, in the dead head of the lathe. Turn the neck true, then run the neck in a suitable bearing. Gland the spindle to the face plate, run the dead head back, and true the cock-head with the center out.

FITTING THE DRIVERS.—Turn the runner or upper burr back down. Draw a chalk line through the center of the burr and through the center of the recesses in which the drivers work. Then draw another line (which we will call A) at right angles or square with the first line, passing over the center of the burr and cutting its circumference into four equal parts. Turn your spindle head downwards with the driver on into its place. Wedge the drivers hard up with hard-wood wedges on which it will press when running. Put on your jack or radial arm and file the pressing faces of the driver till the point in the jack stands equidistant from the face of the burr at both ends of the line, A.

LEVEL THE BED STONE true in all directions with a good spirit level. Put in your spindle and tram it true to the leveled bed stone.

BALANCING THE RUNNER.—If the back is much out of true it will look a great deal better to turn it. However, it can be balanced without turning. You can either face off your burr with sand and water and turn it while this is going on; or you can run the burr up about three fourths of an inch and put in two pieces of hard wood dressed true, 6 inches wide by $\frac{3}{4}$in. thick. Bring your runner down nicely till it takes the oscillation of the burr without grinding the wood. After you have turned the back, take out the wood. See how much weight it will take, placed on the very verge of the back, to bring it to standing balance. Place the same weight on the same light side on the edge of the burr, down as near the face as possible. Run up to grinding speed; either mark the back with a pencil or the face with a lath dipped in red paint. If the originally heavy or opposite side now trails, move your band and balance a little nearer to the cock-head till you find the exact point where it will be both in running and standing balance. If, on the other hand, the light side still trails, or if the trail has moved to right or left, or "quartered," put more weight over the trail on the lower edge of the burr near its face, and exactly the same weight on the top or back of the burr on the opposite side of the circle, as much as will bring it to balance. It will then be in balance, standing, and at all speeds.

CONCLUDING REMARKS.—In order that the intelligent mechanic may know the theory as well as practice of balancing, let him fancy a pair of governor balls, one of wood and one of iron. The iron one will fly up to the horizontal line quicker than the wooden one; and suppose these balls are inverted (turned upside down), the iron one will come down quicker and press harder than the wooden one. From this it will be seen that the cock-head is the center of suspension for the balancing forces, and that you cannot put a burr in standing and running balance by operating on the back alone. You can put it in running balance at one speed, and then you can put it into standing balance on the neutral ground of the plane of the cock-head. JOHN W. HOPKINS.

Wilmington, Del.

Dualin, the New Explosive.

MESSRS. EDITORS:—I notice an article in the SCIENTIFIC AMERICAN, page 401, Vol. XXIII, in relation to the experiments made with dualin at the east end of the Hoosac tunnel, in which your correspondent wrongly informed you about the strength of it. Lieut. Dittmar, the inventor, brought 1,500 lbs. here Nov. 28th, which I used on our 8 ft. slope with good success. I have used over 1,000 lbs. of dualin here since Dec. 1st, and am confident that it possesses the full strength of nitro-glycerin, besides being perfectly safe for any ordinary blaster to handle. It will not explode by concussion, and can be tamped as hard as powder with perfect safety. I see no reason why it will not eventually entirely supersede common powder for all blasting purposes. H. G. HOLDEN,

Supt. east end of Hoosac Tunnel.

Dec. 30, 1870.

Why Mainsprings Break.

MESSRS. EDITORS:—On page 372, last volume, of the SCIENTIFIC AMERICAN, Mr. Henry Hollinshed, Jr., of Camden, N. J., attempts to solve the mystery of the breaking of mainsprings by stating that they are wound up too tight around the arbors, and that in this state contraction breaks them.

If Mr. Hollinshed is conversant with watches, he must know there is a stop attached so as to prevent the spring from even being wound tight around the arbor, or strained to its full capacity, and also to prevent its running down beyond a certain point. But it is a practice among watch repairers or watch spoilers to forget to put these stops back after taking a watch apart, so as to get plenty of jobs in putting in new mainsprings. This is one of the radical causes of mainsprings breaking, as the spring is in that case sure to be overtaxed. Springs are also sometimes unequally tempered. In this case the weak point gets continually weaker until it finally breaks. Most generally this occurs soon after winding, because at that time the spring is strained most. C. H. PALMER.

New York city.

Something about Lavas.

Lava is seldom seen in a state of complete igneous fusion, but consists of crystals, or granules, in a fused paste, and its fluidity is, in a great measure, due to the steam with which it is permeated. The flows of lava vary very much in extent. We may quote two cases, in the first of which an area of fourteen miles by six miles was covered, and in the second an area of fifty miles by fifteen miles was covered to a depth of 500 ft. When we consider that the mass of liquid stone in the last instance far surpasses the magnitude of Mont Blanc, we may form some idea of the extent to which the face of the country would be altered, even by an ordinary eruption; and, in such a case as this, the lava would probably continue to flow for more than a year. Owing to the expansion of the elastic vapor in it, lava is often vesicular, or porous, and, when these vesicles, or hollows, are filled up by minerals deposited from the water percolating the mass the lava is called amygdaloid; and when single detached crystals are scattered through a compact base, or large crystals through a fine-grained base, the lava is known as porphyry, and the rock is said to be porphyritic. Lava, also, sometimes assumes a columnar structure, of which the well-known "Giant's Causeway," in Ireland, is a good example. Besides these formations lava is often forcibly injected into cracks in other rocks, forming what are called "dykes," or walls; the adjacent rocks are very much altered, both in form and construction, by the exceeding heat of the melted lava injected into them.

Igneous rocks, are without exception, composed of silicates of magnesia or alumina, and may be classified under three heads—Volcanic, Trappean, and Granitic. Volcanic rocks differ among themselves in being made up of different minerals; they also differ very much in texture. Some are crystalline (or granular), some compact, and some glassy. The mineral constituents of the granular rocks are easily determined by simple inspection, while those of the compact rocks may be discovered by chemical analysis.

Volcanic rocks, or lavas proper, may be classified under three heads—Trachyte, Dolerite, and Trachy-Dolerite. Trachytes are so called from the Greek word "trachys" (rough), because they have a rough, prickly feeling when handled. In appearance they are generally pale-gray or white, though they sometimes assume a dark-gray and nearly black aspect. They are composed principally of a feldspar, which is rich in silica, but the different varieties vary both in composition and appearance. The trachyte, properly so called, has either a fine-grained or quite compact texture, a harsh feel, and a cellular appearance. In color it varies from pale to dark gray, and is sometimes reddish, from the presence of iron. Of the many varieties of trachytes we will only mention two—Volcanic glass, which is the vitreous condition of a trachytic rock, resembling coarse bottle glass in appearance; and pumice, which is the cellular and filamentous form of the foregoing. Cellular pumice is dark-green in appearance, with less silica than alumina, while the filamentous is richer in silica, and white in appearance. Pumice is, in fact, the froth of lava, and although when powdered its specific gravity varies from 2 to 2½, yet it will float in water, owing to its porous character.

Dolerites or hornblendic lavas are so called from the Greek word "*doleros*," deceptive. They are usually of a dark green or black color, becoming brown on the surface, when exposed to the weather. They are generally heavier than the trachytes, containing less silica, and more of the heavier hornblendic minerals. The dolerite itself is of a dark gray color, and of a granular crystalline structure; and besides the main ingredients, silica, magnesia, and alumina, a considerable proportion of iron and lime enter into its composition. The two chief varieties of dolerite are anamesite and basalt. Anamesite is only a fine-grained dolerite, so fine grained that its granular texture is only just perceptible. It forms the connecting link between dolerite and basalt, which is a compact and, to all appearance, homogenous black rock. It often contains crystals of hornblende and magnetic iron, and is sometimes vesicular or amygdaloidal. It is for this reason that the "Giant's Causeway," in Ireland, has sometimes been called an anamesite, though generally considered to be a basalt. The trachy-dolerites or, as they may be called, intermediate lavas, do not, from their very nature, admit of any accurate definition. They consist of an almost intimate mixture of the two foregoing species of rocks, the minerals of each blending together so that they can scarcely be distinguished. Besides these regular lavas or volcanic rocks, there is the volcanic ash, which consists of the ash mixed with fragments of lava ejected from the crater of a volcano during eruption. This so-called ash often greatly exceeds in bulk the streams of lava. A tract of country, with a radius of 25 miles, has sometimes been covered to a depth of ten feet, and the lighter ashes may be carried 600 or 700 miles by the wind. The degree of consolidation of these materials varies very much, and depends upon the circumstances under which they were ejected. Sometimes they remain loose, and sometimes form a solid rock. If they are ejected upon land, they may be consolidated either by their own weight, or in consequence of the percolation of water derived from rain falling with the ashes, or subsequently gaining access to them. As an example of this we may say that the ash which fell on Herculaneum was mixed with water, and is, consequently, much harder than that which covered Pompeii. If the ash falls into the sea, it becomes consolidated in a manner precisely similar to the mechanically-formed aqueous rocks already treated of, and often contains fossil shells.

Air Holes in Ice.

Mr. John Langton, of Ottawa, Ontario, in a very interesting communication to *Nature*, upon the "Prismatic Structure of Ice," thus speaks of the formation of air holes:

"There are also some curious facts connected with the air holes which form themselves during winter. There are often particular spots where partial openings in the ice will be formed every winter. These I conceive to arise from warm springs, and to have no connection with air holes, properly so called, which are not confined to any particular locality, but may appear anywhere. There is always a good deal of air under ice, and you may often see it scattered about in small bubbles when the ice is thin. It is probably air excluded in the process of crystallization, and when there is added to it sundry gases formed from decaying matter in the water, it amounts, during the winter, to a considerable quantity. Such collections of air, like the bubble in a spirit level, are in a very uneasy condition, and are rapidly transferred from one place to another on any casual disturbance of the level, giving rise to one of the numerous noises which are always, more or less, heard on a lake covered with ice—at least, we used always to attribute to this cause a peculiar groaning sound, which was very common. Now, if there should be any casual inequality in the lower surface of the ice, the air will naturally collect there, and if it is above 32° F., which, in so far as it consists of evolved gas, it probably will be, the receptacle will be increased by thawing. A dome-shaped cavity will thus be gradually formed, which will finally reach the surface; air will escape from below, and the surface water, of which there is almost always more or less after the snow has fallen, will run from above, wearing the little jagged channels, which are characteristic of air holes. The whole thing will then, after a while, freeze up again, leaving an indication of where the air hole has been in the different color of the freshly-formed ice. I have tried several such air holes with an axe, when first formed, and have always found them to lead to such a dome-shaped cavity. I remember, on one occasion, an otter frequenting a large air hole which remained open for some time, and which must have been from a mile and a half to two miles distant from the nearest open water. How did he reach it? for no otter can travel that distance under water without access to air. The Indians say they will go to greater distances still under the ice, and that they will always find air there. It is likely enough that there may be many such dome-shaped cavities, which have not yet reached, and may never reach, the surface as air holes, but one would imagine the air they contain to be not of the most wholesome character. However, this otter did frequent that air hole for about a week, which it certainly did not reach by traveling on the ice; and though it had few chances of breathing there, in the daytime at any rate, it contrived during that period to elude the snares of a white man and an Indian, who wasted a good deal of time in looking after it.

"So far, the process of the formation of air holes, if I am right in my explanation, is intelligible enough; but sometimes they are formed in a manner which is difficult to account for. Upon one occasion I had crossed the lake to a friend's house, about four miles off, and we had determined to start together next morning to our nearest town, but I had to go home first. I first went over by daylight, when there certainly was nothing unusual in the appearance of the ice, which might be four or five inches thick at the time, with a slight sprinkling of wettish snow on it. I returned home about eleven at night, and, as it was bright starlight, with only a few floating clouds, I should have noticed any change; but I came straight across, and saw nothing to attract attention. But when I crossed again at daylight in the morning, in one part of the lake the whole surface was covered with air holes; there must have been hundreds of them. At first I gave them rather a wide berth; but, on approaching one to examine it, I found it frozen up again, the clear ice in the hole, with very slight indications of the characteristic jagged edges, being the only sign that there had been an open air hole there during the night. I had no axe with me to try whether they were connected with any cavity, but the appearance was as if holes of from two to six inches in diameter had been punched through the ice. Of course, we attributed it to electricity, as people will do anything which they do not otherwise understand, and I have never been able to give any more intelligible explanation of the phenomenon. There certainly had been some faint sheet lightning that night, a very unusual thing in winter; but what connection, if any, there may have been between the two things, I cannot say."

Method of Searching for Diamonds.

There is little doubt that diamonds exist in many places as yet unknown, or where their presence is unsuspected. Gold is discovered readily in auriferous regions, even by those who are inexperienced at the work, but the diamond is far less easily detected. It is very difficult for the unpracticed eye to distinguish it in its natural condition from crystals of quartz or topaz. One, therefore, who has no experience in diamond seeking may see, and even handle, such gems without recognizing them or even suspecting their value. It was in consequence of the geological knowledge of Humboldt that the diamond regions of the Ural Mountains, in Russia, were first discovered. At his suggestion the gold washers were directed to search for diamonds before they had been found or any suspicion raised of their existence. From that time to the present the finding of diamonds there has become frequent.

The color of the gems constitutes the main difficulty in detecting their presence. They, in fact, are of various shade and hues, as yellowish brown, green, blue, and rose-red, and very closely resemble the common gravel by which they are surrounded. The finest, however, are of no color at all, and are to the inexperienced diamond seeker identical in appearance with transparent quartz crystals.

In Brazil, where great numbers of diamonds, chiefly of small size, have been discovered, the method of searching for them is to wash the sands of certain rivers in a manner precisely similar to that employed in the gold fields of Australia; namely, by the aid of prospecting pans. A shovelful of earth is thrown into the pan, which is then immersed in water, and gently moved about. The result is that the contents are converted into a kind of thick, muddy slush, from which the stones are picked out by the hand. As the washing goes on the dirt and sand are gradually disposed of, and the pan contains apparently only about a pint of thin mud. Great caution is now observed, and ultimately there remains only a small quantity of sand. The diamonds and particles of gold, if haply they are present, sink, by virtue of their great specific gravity, to the bottom, and are selected and removed by the practiced eye and hand of the operator. But how shall the gems be detected by one who has had no experience, and who in a jeweler's shop could not separate them from quartz or French paste? The difficulty can only be overcome by testing such stones as may be suspected to be precious. Let these be preserved until the day's washing is over, and then tried by the very sure operation of attempting to cut with their sharp corners glass, crystal, or quartz. When they are too minute to be held between the finger and thumb the specimens may be pressed into the end of a stick of hard wood, and run along the surface of a piece of window glass. A diamond will, in such case, make its mark, and cause, too, a ready fracture of the glass in the line over which it has traveled. Tested in a similar way upon a crystal of quartz the diamond will make such an impression as no one crystal can have upon another. But a yet more certain and peculiar characteristic of the diamond lies in the form of its crystals. The sapphire and the zircon will readily cut glass and scratch quartz, but they have not the curved edges of the diamond. In small crystals this peculiarity can only be observed by using a magnifying glass, but it is invariably present in the true gem, whether it be large or small. It is, perhaps, rare to find a diamond with four curvilinear faces, but such a circumstance places its identity beyond the domain of doubt. Another form of diamond is that of the octahedron, or eight-sided solid, with the edges replaced by interrupted narrow convex surfaces. Such interrupted, convex, or rounded angles are sure indications of genuineness. The diamond breaks or is scratched with difficulty, and hence a test sometimes employed is to place the specimen between two hard bodies—as a couple of coins, for example—and force them together with the hands. Such a pressure will crush a particle of quartz, but the diamond will only indent the metal. Thus much of practical information for the service of the diamond hunter of the Cape; and now, supposing a successful issue to his exertions, let us say a word or two as to the mode of estimating the value of diamonds. They are invariably valued by the carat, which is four assayer's grains. The estimate is made by squaring the number of carats, and multiplying the result by the price of a single carat. The price, it will thus be seen, increases in a multiple proportion to the weight. The actual price of a small, rough diamond, fit to be polished, is about £2 per carat. One of two carats is worth, therefore, $2 \times 2 = 4 \times 2 = £8$; one of four carats, $4 \times 4 = 16 \times 8 = £128$. The value increases by both size and color—or water, as it is termed.

When diamonds are cut and polished they are known to jewelers as brilliant, rose, and table diamonds, depending on the form and number of the artificial faces. Diamond cutting is chiefly done in Holland, on wheels of iron or copper, and with the agency of the dust of inferior diamonds, known as diamond dust. A set diamond may be tested by placing wax on its back. The luster of a true gem will not be affected by this operation, while the spurious brilliancy of paste imitations will be totally destroyed by it.—*Mechanics' Magazine.*

Unhealthy Foundations for Buildings.

Two learned doctors, says the New York *Mercantile Journal*, have disagreed (a thing not unprecedented in history) in regard to the cause of the recent unhealthiness in Liverpool. Dr. Stallard, who has made a report on the subject, attributes it to the filling in of the brick-pits with refuse, consisting of ashes, fish bones, lobster shells, cabbage leaves, potato parings, old door mats, broken pottery, and other things, too numerous, as well as disagreeable, to be mentioned, which the drainage of the sewers will not remove. He affirms that no house can be healthy built on such a sub-soil, and that sewers must inevitably be filled with noxious gases, so long as such a state of things exists. To whom Dr. Trench opposes the opinion that, as a physician and chemist, he sees no reason why the materials named should not, if left undisturbed, be decomposed without the evolution of noxious gases, to any injurious extent, and the products of decomposition become a good and firm, though porous foundation; the latter quality rendering it a more healthy foundation than the clay upon which the greater part of the city stands. The Health Committee of the city, in view of these conflicting opinions, have resolved to refer the matter to Professor Huxley, requesting him to name two competent scientific men to investigate the matter thoroughly. The report which will be made will be looked for with interest, as this is a sanitary question of the first importance to all cities.

Improved Steam Gage.

On page 375, volume XXIII., of the SCIENTIFIC AMERICAN, in an article headed "Safety *versus* Economy in Steam Boilers," we expressed our opinion that "unsafe boilers should be legislated out of the market, if possible," etc. Since we thus wrote, the daily journals have given accounts of several sad disasters from "Boiler Explosions," on land and water, which are doubtless to be attributed either to imperfect construction, or to the unfaithfulness or incompetency of employés—provided the owners themselves were not in fault, from unworthy pecuniary considerations. Not seldom do the latter force their employés to use apparatus which they know to be extra hazardous, or of the safety of which, at least, they have no assurance. We feel justified in the inference that the party who sells and the one who buys a boiler second-hand, for one fourth its first cost, cannot be ignorant of the probable existence of defects from which serious consequences may result. If, however, they persist in the use of such boilers, they endanger lives and property criminally.

We also stated in the article alluded to, that it is somewhat difficult to frame a law the enforcement of which would secure proper care in the attendance of boilers, and their usual attachments, or to conceive any system of legal inspection which would be sufficiently stringent with one class, without having conditions that would be onerous in their bearing upon others.

Such being the case, we must look for some mechanism to be used in connection with the various adaptations of steam, both as a power and in its general application as a vehicle for transmission of heat, which will afford greater security to the public against foolhardiness, presumption, ignorance, and irresponsibility.

Pertinent to this subject, we present to our readers an illustration and description of Edson's Recording Steam Gage, an invention which received the first premium at the late Fair of the American Institute, and which seems to meet a long-felt want. This instrument will doubtless be as fully appreciated in its practical use as it already has been in anticipation. We have evidence that the charts, or steam-written "logs" it affords, are considered by the life, fire, and marine underwriters, as reliable vouchers of the care exercised by those in charge of steam, and that they consequently are valuable to them in determining risks which they assume. If, as is claimed by the inventors (who have been several years secretly perfecting these steam gages, before submitting them to public inspection), these instruments shall prove to be more reliable for accuracy in denoting the steam pressure than the gages heretofore used, in addition to their recording features, users of steam will not fail to discriminate in their favor. A watchman of this kind will supervise machinery and workmen with more fidelity than many a living watchman. An alarm gong is continuously sounded when any limited pressure is exceeded.

One of the charts will last for several months, and portions may be removed from time to time and filed away for future reference. The cut needs but a brief description. The steam enters by an ordinary pipe coupling into a series of circular, horizontal chambers, placed behind the pencil bearing, and by expanding, the former is made to operate the gear, causing the pencil to move upward in proportion to the degree of steam pressure, and ringing the alarm when the previously fixed limit is reached. The reverse movement of the gear, produced during the reduction of pressure, moves the pencil downwards, simultaneously with the rotary motion (given by means of a horizontal rack and lever operating a pawl within the upper rim) of the receiving drum, and, in consequence of the motion thus given to the chart, the pencil is made to trace an oblique line, invariably in proportion to the fluctuation or reduction of pressure. A vertical line always denotes degrees of increasing pressure.

The chambers consist of pairs of corrugated steel disks, each disk, as well as the other motive parts, being nickel-plated, to prevent them from corrosion, even in a saline atmosphere.

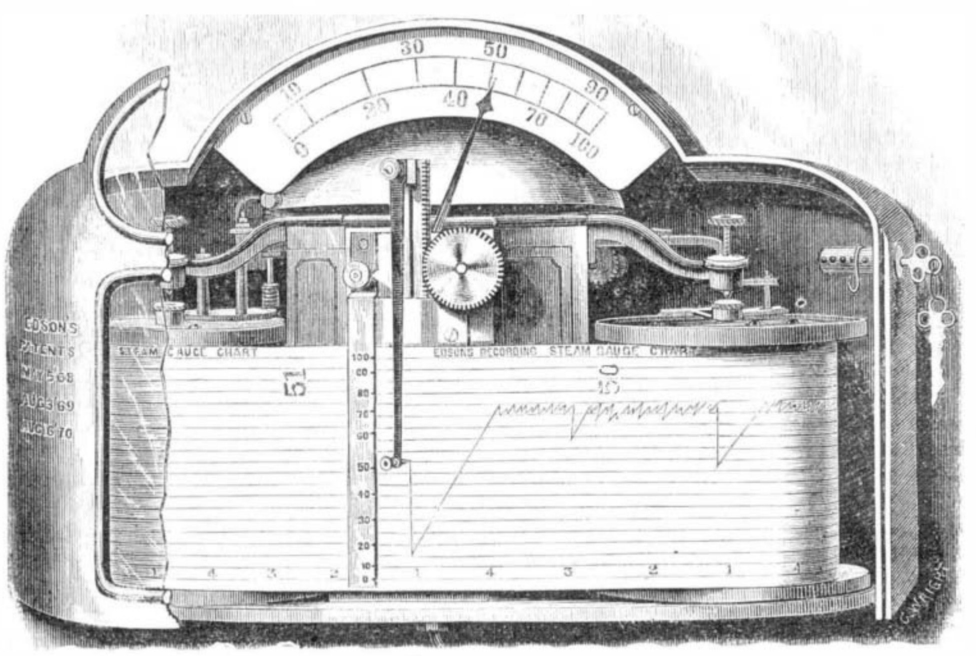
The vertical scale is placed at the left of the pencil, as a guide for the chart; also for greater convenience when marking the pressure upon the chart, previous to its removal. The charts are divided into sections, numbered consecutively "50," "51," etc., the sections being sub-divided into four parts, marked 1, 2, 3, 4.

The instrument is secured with a combination lock, and may be placed in the cabin of a steamer, or office of the commander, as well as in an engineer's or superintendent's room, when required. It is adapted to locomotive, stationary, and marine boilers, of high or low pressure, and to any vessels sustaining internal pressure, as gas receivers, stills, soda fountains, etc.

It was patented in the United States May 5, 1868, Aug. 3, 1869, and Aug. 16, 1870; also in several foreign countries. Manufactured and sold solely by "The Recording Steam Gauge Company of New York," 91 Liberty st., New York.

A Queer Capture of Telegraph Apparatus.

At Manheim there is on exhibition a telegraphic apparatus, taken from the French, which is to be sold for the benefit of the captor. It was obtained in the following manner: A certain dragoon of the Baden Guards, by name Muench, with two of his comrades, was sent to reconnoitre as far as the Vosges. They had to pass through the village of Raon l'Etampe, the simple inhabitants of which place had not, as yet, seen any Germans. On the entrance of the three armed dragoons they fled in every direction, with the cry of "The Prussians! the Prussians!" and shut themselves up in their houses. Thus left masters of the town, the dragoons, coolly smoking their cigars, rode to the Town Hall and summoned the *Maire*. He soon came, pale and trembling. They asked him where the Telegraphic Bureau was located. He pointed it out, and they at once went to it, and Muench singly, and in the presence of the assembled City Council, cut the wires, unscrewed the apparatus, and buckled it on to his horse. The three dare-devils then coolly mounted and rode away.



EDSON'S RECORDING STEAM GAGE.

The commandant of the place, on learning what had happened, declared that he could not survive the dishonor of having commanded in a town of 8,000 inhabitants, where three of the enemy's men were allowed to enter and work their own will, and shot himself dead on the spot. The apparatus is worth about 600 francs, and was presented to Muench, on his return to camp, by his commanding officer.

MERRIMAN'S IMPROVED WATER-PROOF DRESS AND LIFE PRESERVER.

The accompanying engravings represent C. S. Merriman's patent water-proof dress and life preserver ready for use, and a detail of the same.

. It consists of two parts; namely, pantaloons and coat joined at the waist, so as to be water-tight, by means of a metallic ring and elastic rubber bands, as shown in Fig. 2.

The coat is provided with a hood, which covers the head, leaving an aperture about the nose, eyes, and mouth, which is surrounded by a band of elastic india-rubber.

The neck of the garment is made of a size sufficient to allow the head to pass up through into the hood, which has a lining extending down the back of the neck in such manner as to form an air chamber. When unfolded the air chamber presses upon the back of the head of the wearer, causing a tendency to push the head forward out of the opening, and causing the flexible rubber to be drawn smoothly and tight about the faces so as to exclude water from pressing in.

The front and back of the coat are also lined, and are inflated by means of the tubes shown. Vertical partitions in the middle of the front and back of the coat, and also at the side seams, divide the space between the outside of the coat and the lining into four air chambers, besides the one at the back of the head. The sleeves terminate with rubber gloves, as shown.

The bottom of the coat is provided with an elastic rubber band, three inches wide, and one sixteenth of an inch thick. The inside and lower edge of this band for a width of one inch is left three sixteenths of an inch thick, with the projection on the inside, and square shoulders at the top, as shown in the detail.

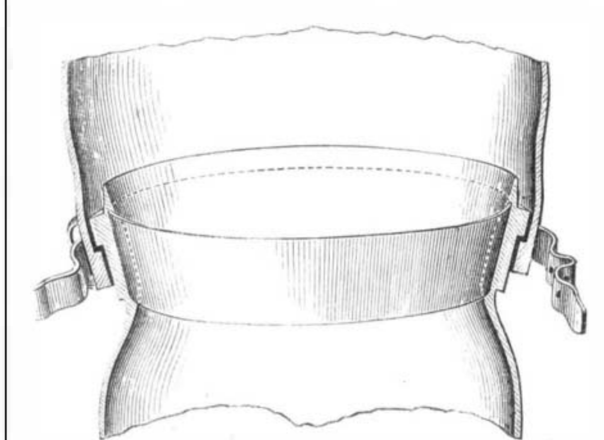
The pantaloons are provided with a ring or band of metal or other rigid material, sufficiently large to pass over the hips of the wearer. Said band is made flaring, with the large side up, and is put between the inner lining and outside material at the top of the pantaloons. A rubber band, two and one half inches wide and one eighth of an inch thick, is then drawn smoothly about the first even with its upper edge, and all firmly cemented together.

The pantaloons are lined down to the knees, and are inflated by means of rubber tubes which pass in at the pockets. The lower portions of the pantaloons terminate with tight boots.

When the coat and pantaloons are joined together, the bottom of the former is drawn over the top of the latter, so as to have the thicker portion of the rubber band on the coat below the thicker portion of the similar band on the pantaloons. The joint then forms a dovetail or lock-joint, as shown in the detail. The whole is now secured by means of a strap buckled tightly over the joint. The strap is secured in its place by small loops or thimbles placed at intervals about the rubber band of the coat.

On the 18th day of October, 1870, the inventor, as we learn from a Western exchange, swam and floated fully three miles in the Missouri River in presence of many spectators. The water was very cold, ice having formed a quarter of an inch thick the night before. On coming from the water he found himself perfectly dry, warm, and comfortable. On the 19th day of December, 1870, he gave an exhibition off the Battery, at New York, with equal success, which exhibition we had the pleasure of witnessing, and from which we formed a very favorable opinion of the usefulness of the device as a life-preserving apparatus.

The dress is convenient to carry, weighing only from ten to fifteen pounds, and when folded, being easily packed in a carpet bag. It can be put on and adjusted in from two to three minutes, and when properly put on excludes the water perfectly. When the dress is fully inflated the body is surrounded with a stratum of air, and lies with the utmost ease upon this elastic cushion. The non-conducting property of this layer of air, and the material of which the suit is made,



keeps the body warm even in a very cold atmosphere. The body floats about one third above the surface, and the head rests on the elastic pillow formed by the inflated hood. We judge from the experiment we witnessed, that, under favorable circumstances, a man in this dress could swim from two to three miles in an hour without exhaustion.

Patented in the United States, August 10, 1869, and subsequently patented in most of the foreign countries through this office. Communications may be addressed to the inventor, Mr. C. S. Merriman, 363 Broadway, New York.

THE lessons of the war to surgical science are beginning to be published. One of the most remarkable facts made known from the hospital reports is that the French soldiers have suffered more from the Prussian shells than from the needle gun and bayonet combined. This is contrary to usual experience, which has reckoned artillery more powerful to frighten than to harm; but it agrees with Napoleon's reported remark to King William at Sedan, as to the marvelous precision of the German cannoneer. It is also said that the needle-gun bullets, though larger than those of the chassepot, do not penetrate the flesh so far, and so make less serious wounds. The sword bayonet used by the French is a much more savage weapon than the old-fashioned triangular blade, which is still retained by the Prussians. Shell wounds are generally found to heal very easily if no bones are fractured

IT is said that in the Antarctic seas there are sea weeds which have stems about twenty feet high, and with a diameter so great that they have been collected by mariners in those regions for fuel, under the belief that they were drift-wood. They are as thick as a man's thigh.