power, as it is called. It does not reside in the air, as supposed, although it may easily be traced, as we shall see. It produces a great deal of mischief, other than exploding steam boilers. It is the *love of money*. Avarice is the mysterious agent that is blowing up boilers and destroying property.

The mischief is not in the air, it is in the pocket. All talk about any other "inexplicable power" is inexplicable bosh. Here was a confessed ignoramus and a *careless* ignoramus repeatedly complained of, but still allowed to retain his position until his carelessness resulted in a wholesale murder. We do not gather how much was paid him for his services, but if it was two or three dollars a week less than a competent man would have demanded, that would be a sufficient inducement for many employers to risk the lives of their employés.

If this sort of thing goes on much longer, it will correct itself. People working in steam factories will demand so much greater wages for the extra risk they take, that it will be much cheaper to employ competent engineers.

As to the tantrums of boilers described by engineers (sic) in the above quotation, they are simply sensational moonshine. There has been enough of this kind of endeavor to saddle ignorance and incapacity upon Providence. There is nothing mysterious about boiler explosions, in general. In some cases there is absence of knowledge as to the particulars in which neglect or carelessness has been permitted, but in ninety-nine cases out of every hundred, there has been some neglect. Boilers explode from the disruptive force of steam, aided sometimes by the force of unequal expansion in the iron; and if weakened by age or bad usage, they explode more easily than when sound and strong. This is the whole story in a nutshell. Put ignorance and steam in contact, and you have a very dangerous combination. Place integrity, fidelity, and intelligence in charge of steam generators, and keep them there from the time the first plate is cut, and the first rivet driven, till the boiler is pronounced unfit for service, and boiler-explosions will become as rare as they are now abundant.

LOCKAGE WASTE ON OUR CANALS.

The following extract from the *Pittsburgh Commercial*, has been referred to us for opinion:

There seems to be some doubt entertained as to whether a sufficient supply of water can be had on the higher "levels" of the Erie Canal to accommodate the large tunnage that will undoubtedly seek transportation over this line when it is enlarged to the capacity of a ship canal! In discussing this phase of the subject your correspondent, "Observer" (Mr. John F. Bennett), raises the question of the possibility of passing boats through the locks with a less expenditure of water than is commonly required. This is a pertinent inquiry that can be very satisfactorily answered. If boats have never yet been passed through canal locks without the usual waste of water and water power, it must be because *that* economy has not been needed, for a very little practical knowledge will establish the fact that the *power due to the water falling from the higher to the lower level* in passing boats up and down, DOES NO WORK in raising or lowering the tunnage, and may be employed in pumping back into the higher level a volume of water almost equal to the entire lockage. Moderately efficient machinery ought certainly to return more than one half, and thus add more than one half to the ordinary capacity of the canal. No fears of a scarcity of water need operate to deprive us of this great improvement.

In its construction, the locks may be at once made large enough to accommodate any probable future traffic, leaving the "levels" to be enlarged from time to time as the demands of business shall require.

To make the water power that now goes to waste available in preserving the maxmium of water in the levels, it is only necessary, instead of letting the water into the locks through the ordinary wicket gates, to let it pass into the lock *through a turbine wheel*, and employ the wheel in driving suitable pumping machinery that will lift water from the lower to the higher level, and in emptying the lock let the water *pass out through the same* or another wheel, and again employ the power in raising a further quantity of water to the higher level.

When the immense power thus to be utilized is not needed to assist navigation by returning the lockage water to the higher levels, it can be readily made available for other uses, and along the entire line may be the source of no small income to the company owning the canal.

The general theory of mechanical saving in water waste given above is correct, and has attracted the attention of hydraulic engineers for many years, as to convenient and useful *modus operandi*, one favorite idea being to make the summit locks double acting by balanced frames, so that an emptied chamber on one side would in part restore a supply to the upper level. If, however, the gentleman who has advanced this suggestion, with a slight *coleur de rose*, will patiently work out the process by exact calculations of the power available for the net return, and more carefully examine the various sources of loss which go to make up canal waste, as a whole, he will see that the economy is far less demonstrable than the primary impressions indicate.

The lockage waste itself, on a canal of any length, between points of supply, though undoubtedly a large item, does not measure the whole waste.

If we take, for instance, the estimated water supply for the "Improvement of the Champlain Canal," as given on page 98 of Mr. McElroy's Report in 1867, it will be observed that the items for one summit group of locks, on 11¼ miles of canal, 225 and 100 feet lock, were for

	Cubic feet.
Lockage per day	5,203,167
Evaporation, filtration, and weirs	2,368,800
Gate waste	720,000
Total	8,291,967

about 62 per cent being lockage waste on a short length like this.

Taking into account then the restriction of this mechanical device for return supply at the upper lock, the limited quantity of water which is delivered with a descending boat, the absolute limit to time of filling and discharging on any important canal, the necessity of an entire rearrangement of the methods of inlet and outlet, the fluctuating head under which the pumping machinery must work, and the probable or possible ratio of return supply, engineers who have carefully studied the general subject have rather been induced to advise the use of an independent pumping establishment. It would, however, be a professional service, if any detail and careful analysis is presented of the advantages of a local and special lock return, on the general plan above mentioned, by which the actual merits could be carefully estimated.

RESTRICTIONS ON THE WEIGHING OF COAL.

Granted that coal dealers are on the average as honest as any other class of men, and that they are no more disposed to rob the poor than their neighbors who have less opportunity for so doing; is it safe to tempt men as coal dealers must be tempted?

Not one man in fifty, when he orders a tun of coal delivered at his house knows whether he gets full weight; and the coal dealers are perfectly aware of this fact. They know that if a purchaser stands and looks on while the weighing is performed, that he must, perforce, take the weight of the cart on trust, and therefore that even such vigilance would avail little to prevent fraud in the weighing.

It is so inconvenient for people in general to re-weigh their coal, and so difficult to devise any means whereby in the absence of personal attention, and without extra expense to themselves, they can be secured against fraudulent weighing, that in our opinion the system of selling coal by weight is a bad one. It would be far better to sell it by measure.

There is no doubt that short weights are common in the retailing of coal, and cases have come to our knowledge where such fraudulent dealing has been practiced in the filling of contracts to large manufacturing establishments, which ought to be able to take care of themselves, and therefore are not much to be pitied.

But the poor who are only able to get coal by the very hardest, and who are wholly at the mercy of the dealer, ought to have some protection. This would be afforded were coal sold by measure. They would soon learn to detect frauds in bulk, and thus the power to cheat would no longer exist so far as quantity is concerned.

We do not suppose coal dealers more likely to take an advantage of opportunities to defraud than retail grocers, or even milkmen, but we respect them too much as a class, to wish them subjected to temptation, which might be removed by a prayer to the Legislature to deliver them from it.

THE WATER WHEEL TESTS AT LOWELL.

There are always two sides to every question. Our recent article on the test of turbine wheels at Lowell, has called forth a communication from Mr. Emerson, whose testing apparatus was employed at Lowell, and which will be found illustrated and described in another page of this issue.

We have so far resisted all importunities to publish communications upon this subject, and we shall adhere to this rule; but having given a *resume* of one side of the question, as gathered from our correspondence, we do not wish to commit the injustice of refusing the same for the other side. We therefore, now give the gist of Mr. Emerson's statements, leaving our readers to form their own opinion upon it.

It is denied that the charges made in the correspondence, upon which our former article was based, are true, and a copy of the circular sent to manufacturers inviting them to send wheels to be tested, and stated to contain the only terms ever made in any way whatever, now lies before us.

The statement that the wheels were required to be of a specified power, is not contained in the circular; but, on the contrary, it is distinctly announced that "each competitor will select the size and finish of wheel to suit himself."

The circular further specifies that "for use of flume and weir, competitors will be charged $250; for use of dynamometer and water, enough to cover expenses. Cost of flume, water, and dynamometer will not exceed $300. The arrangements have cost $1,500. If there is sufficient competition, the cost will be divided fairly with all. Each will make their own arrangement with Engineers." It adds that further information may be obtained by addressing James Emerson, and invites all who wish to witness the test.

That anything different from this was communicated by letter in answer to subsequent inquiries, is denied by Mr. Emerson, who positively states that "*these were the only terms ever made.*"

The arrangements alluded to as costing $1,500 was the flume only. The dynamometers cost $1,700 and nearly a year's time was given by Mr. Emerson to the tests, and to preparations for it.

In regard to the cost of the tests, we are informed that as the wheel specified in the circular as one of those to be tested, was distinctly announced as finished in the ordinary manner. it was expected that the others would follow in the same way and without delay; instead of which, four months elapsed before some of the wheels were prepared for the test, and it was well understood by the tardy competitors that the expense would be increased by this delay.

Mr. Emerson states that in return for over a year's expenditure of time, and an outlay of several thousand dollars, he has received in all only $650, a considerable part of which has been paid out for freight on wheels, telegrams, oil, etc. This certainly does not look much like extortion.

In regard to the settling of the flume, we are told that it still stands in the same place, and has been in use all winter for testing large and expensive wheels, and that it is considered as being in good condition.

It is stated that there was abundance of water for months after the test was announced. Early in the autumn there was a slight drought, but before the wheels were ready there was plenty of water again. At the time of the disastrous freshet which occurred in the fall, there was a break in the canal which caused a delay of four or five days, but Mr Emerson states that at the time of testing there was so much water that unless restrained at the head gates it would over flow the flume. So much for the statement that there was a scarcity of water.

In regard to the placing of the wheels, we are told each party placed his wheel as he liked, and if there were any fault the exhibitors were solely to blame, as each party had full control of the flume, while their wheels were tested, cutting out or filling in as they liked.

The steadiness of the brake is attested by Mr. Hiram F. Mills, C. E., under whose supervision the tests were conducted. Our own reporter also stated that when he was present in July (see issue of July 17, 1869), the arrangements seemed perfect and the brake worked satisfactorily.

It seems then that the question resolves itself into one of fact, so far as this controversy is concerned; and we have endeavored to give impartially every essential statement made on either side.

The apparatus for testing turbine wheels, shown in the descriptive article we this week publish, is the same as that used in the Lowell tests, and our readers will be able to judge intelligently of its probable efficiency.

We may, in closing, remark that the terms in which the tests were announced in the circular before us, seem not to be sufficiently specific. There cannot in such matters be too definite an understanding. It would seem that not only the size and finish of the wheels, but the time when they were to be on the ground ought to have been definitely fixed, and no departure from the prescribed conditions permitted. A competitive test will always give dissatisfaction if performed under variable conditions.

An Immense Salt Mine.

The great Humboldt salt mine, near Austin, Nevada, is described by a California paper as looking like a lake frozen over. The salt is as hard and as smooth as ice. Were it not for fine particles which are condensed from vapors arising from beneath, and which cover the crystalline salt to the depth of perhaps one eighth of an inch, it would make an excellent skating rink at all times of the year, except on the very infrequent occasions when it is covered with water. The expanse of crystallized salt is no less than twenty miles in length and twelve in width, without a break or flaw for the greater portion of that extent. The stratum of solid salt is about six or seven inches thick, under which comes a layer of sticky, singular looking mud, about two feet thick, and under this again another stratum of solid salt, as transparent as glass, of which the depth has been found in some parts to be six feet. In summer, this salt plain, glittering and scintillating in the light of an almost tropical sun, presents a brilliant appearance. The frosty covering and the solid salt is as white as the snow, while the crystalline portion, when exposed, reflects dazzling prismatic colors. This immense deposit is remarkably pure, being ninety-five per cent of salt and five per cent of soda—which is purer than what we commonly use for our tables.

Opera House Dirt.

The dust obtained from the places of amusement in New York have recently been analyzed by the scientific officers of the Metropolitan Board of Health. Over one hundred specimens of the particles floating in the air and falling as dust, were collected on plates of glass, and were examined under the microscope. The proportions of the different ingredients varied, but the same substances were found in all the specimens. The composition of the matter subjected to the microscope was as follows: "The dust of the streets in its finer or coarser particles, according to the hight at which it had been collected, with a large proportion of organic elements; particles of sand, of quartz and feldspar; of carbon, from coal dust and lampblack; fibers of wool and cotton of various tints; epidermic scales: granules of starch, of wheat, mainly the tissues of plants; the epidermic tissue, recognized by the stomata or breathing pores; vegetable ducts and fibers, with spiral markings; vegetable hairs or down, either single or in tufts of four or eight, and of great variety, and three distinct kinds of pollens. Fungi were abundant from mere micrococcus granules to filaments of mold. When water was added to a portion of dust from whatever source, and exposed in a test tube to sunlight or heat for a few hours, vibriones and bacteria made their appearance, and the fungous elements sprouted and multiplied showing that they maintained their vitality, and proving that the germs of fermentation and putrefaction are very widely diffused."

Zinc Light.

By digesting metallic zinc in iodide of ethyl, we obtain a volatile liquid which takes fire spontaneously in the air, and is known to chemists under the name of "zinc-ethyl." It can be distilled in an atmosphere of hydrogen, and if this gas be made to pass through the liquid it will carry off some of the zinc-ethyl, and when ignited will burn with a magnificent white flame. It is probable that ordinary illuminating gas would answer as well as hydrogen for this experiment. The light produced in this way can be employed to take photographs, but its actinic properties are not equal to the effects produced by burning magnesium.

Dust and Disease.

Mr. Horace Waller, F.R.G.S., writes to *Nature* as follows:

The extremely important discoveries brought to light by Professor Tyndall will call forth great exertions on the part of thinking persons to carry his plans into operation, and I have no doubt, when due precautions are taken to sift infected air as it passes into the lungs of those whose duties take them where contagion abounds, we shall have the happiest results.

So great will be the tide of interest in this direction, that I am anxious to cast into it a theory I have long held, in hopes that it may drift in some one's way to be turned to use; I commend it to the traveling portion of your readers especially.

While traveling in some very unhealthy parts of Africa, more particularly among the marshes bordering on the Shiré and Zambesi rivers, it was often necessary to camp at night just where the canoe happened to be moored when daylight failed us. Reeds, rushes, and mud were never many feet off, and the accumulation of scum, decaying vegetation, etc., lodged in the sedge, made the situation as delightful to mosquitoes as it was trying to the constitution of the European.

Still, with all this, as long as it was possible to rig up a mosquito curtain, I am convinced that really less danger existed in thus sleeping in the midst of miasma than in other places where less of it was supposed to be present, but where the traveler felt no necessity to stretch this thin covering over him.

I have in this way done canoe journeys of twenty to twenty-five days in length without a day's illness from fever, and I could instance similar experiences on the part of others.

Now the reason I assign is this: the mosquito curtain is to miasma, what the Professor's cotton-wood respirator is to the poison of scarlatina, we will say.

The curtain, after being used once or twice, saturated with dew, folded up while damp and crammed into the limited space generally provided for it in the safest place, becomes just so much affected by this treatment that each thread loses its smooth glaze, and is soon fluffy and fuzzy for want of a better expression.

The little honeycomb holes in the fine "net" are now a series of small six-sided sieves, each covered over with the fine filaments of cotton which have got disturbed and frayed up. Dew, falling upon a surface of this kind, quickly turns it into an exquisitely fine strainer—in fact almost a film of water—through which all the air has to pass which is breathed by the person reposing beneath it.

Now, it is an old notion that the miasma which produces the bilious remittent fever (the pest of this part of Africa in question) and various other diseases of the tropics, cannot pass across water.

I believe that acting upon this theory, the Admiralty provides that boats' crews shall sleep in their boats anchored off shore in malarious rivers. However, be this as it may, I have a strong belief that the "wet sieve" *does* stop the poison in some way or other, and that it is a great safeguard to the voyager in these places.

The whole subject of miasm is in the dark; it is lawless as a cause of disease; it baffles the most astute, but the day may be coming when such hints as those of Prof. Tyndall's shall fit into an organized attack upon it, and we shall be able to overcome it in a measure.

A curtain, properly made, and taken care of with that instinct which alone is begotten by the buzz of mosquitoes, is perhaps the most valuable possession a man can have against deadly attacks in the night while men are asleep; were its merits studied more, we should not find men stuffing their companions so perpetually with quinine, to the keeping up an unhealthy tone by this abuse alone, and to the confusion of this most invaluable medicine when it is really called in to do its duty upon the fever-stricken patient.

The Bulging of Walls---Cause and Prevention.

The ugly protruding curvature commonly called a bulge, to which external and front walls seem especially subject, may frequently be traced to original defects of construction. Bulges very often occur at about the level of a floor, and where there is a floor, the brick work of outer walls is commonly weakest. To avoid running the floor-timbers into party walls, they are generally made to rest on the front and back, and the party-wall will often appear in better condition than the front. Immediately below the level of the intended floor, a timber scantling about 4½ in. by 3 in. is laid along the wall flush with its inner face, to receive the ends of the joists. The joists, let it be assumed, are about ten inches deep, notched to nine inches at the ends, so as to rise the hight of three courses of brick work. Here, then, bond-timber and joists together make a hight of 12 in., or four courses of brick work. The joists will have a bearing of 6 in. on the wall, and the wall may be supposed to be a brick and a half thick. Now wherever the joists occur, there is a complete interruption of the bond on the inner side of the work, while externally it appears unbroken, the outer face, in fact, being carried up half a brick in thickness, and looking as though the whole wall were perfectly solid and uniform; but the backing between the timbers too often consists of bats and small pieces put together in a mysterious though incongruous way. So long as the timber remains sound and of its full dimensions, all is well, but this is seldom very long. The manner of converting balk timber into scantlings precludes the permanent retention of its original form. When felled and squared in its native forests, it is thrown into the first lake or river, formed into rafts, and navigated to some port of shipment, where it is formed into cargoes for conveyance across the ocean. The sea voyage over, it may be assumed to the port of London, the timber is again immersed in the water, which usually constitutes its only place of storage till wanted for actual application to some building. As to deals, an architect may specify dryness as a necessary quality, but he must not expect it in timber. He may say that it shall be sound and well seasoned, but water seasoning is all that takes place previous to conversion, and this fact is noteworthy, because as the subsequent shrinkage may be estimated at three quarters of an inch in the foot, it becomes obvious that so far as the bond timber and joists are to be regarded as forming the inner material of the wall, a subsidence equal to the shrinkage must take place. But the wall does not depend on the woodwork alone, and the irregular filling up between the joists will receive the weight, and so the evil will be deferred. For the time there may be no other visible result than the dropping of the floor from the skirting, and when the latter is of wood, the simultaneous rising of the skirting from the floor. It is when the wooden bond, having shrunk to the minimum dimension of perfect dryness, enters upon its course of decay that the worst consequences of inserting timber constructionally in walls are developed. The inner face then sinks, and the statical conditions are disturbed, and bulging is inevitable.

It was a custom of by-gone days to insert timber very freely in walls. Foundations were fortified, as it was thought by the introduction of a "chain-bond" of large scantling, and many a goodly edifice has suffered from the practice. Great, therefore, have been the improvements adopted in the modern construction of walls. A solid basis is formed by the use of concrete; wrought iron hooping has advantageously displaced wooden bond, and the joists are kept as much as possible out of the walls, their ends being supported by brick or iron corbels. Thus all rapidly perishable matters are excluded, and a lasting character imparted to work so executed. Skirtings also are made of stucco instead of wood, and shrinkage in that quarter got rid of. Thus experience and science are gradually removing one of the old defects and disfigurements of buildings—the bulging of walls.—*Building News.*

DAVIS' PATENT FENCE.—We call attention to the advertisement published in another column of P. Davis' patent wire and picket fence, an illustrated description of which appeared in a recent number of this journal. We are informed that since that publication the demand for this excellent fence has so exceeded Mr. Davis' facilities, that he finds it necessary to dispose of more territory than was at first anticipated.

JOHN LA MOUNTAIN, the celebrated aeronaut, is dead.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisemets at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

N. K., of Ohio.—You can bleach broom corn brush as follows: Construct at some distance from your other buildings a small building of boards and batten the joints. Hang your brush on suitable frames within this building and make your door to shut pretty tight. At one end of the building and at the top construct a shelf with an outside door so that the shelf may be reached from the outside with a ladder. When the brush is placed in the building, place on the shelf in an open earthen pan, a mixture of four parts by weight of hydrochloric (muriatic) acid and one part black oxide of manganese with two parts of water. Set the vessel—which should be three or four times as large as will contain the mixture, and also broad and shallow—upon bricks, so that you can put under it a bit of candle capable of burning about five minutes before it goes out, the heat of which will start the reaction, then close the door leading to the shelf and leave the whole for twenty-four hours. The bleaching agent developed here is chlorine, and as it is poisonous when inhaled, the building should be ventilated before anyone enters it by opening the upper and lower doors, and removing the vessel from the shelf. The quantity of the mixture will depend on the size of the building, and this you must learn by experience. Too much bleaching will rot the brush.

T. K., of La.—A cistern wall laid up with a putty made of ground white lead with as much red lead as will make it of the proper consistence will probably remain tight under the circumstances you mention, if bricks or square stones are employed. It is only necessary to use it for an inch or two next the water; the rest of the joints may be filled with good water cement. If the water is used for drinking, we are informed that this cement may be used as above, and that no contamination of the water will occur if after the putty is perfectly dry the inside of the cistern be plastered.

C. G. B., of Pa.—If you will lay a cellar wall with the cement recommended in answer to T. K., of La., in this column, we think you will be able to keep it tolerably dry. You can ceil over with boards for an out-door cellar, leaving a foot or so of space to be filled in with dry moss, or a couple of feet filled in with shavings pressed in gently but not packed hard. If kept dry by a suitable roof this will keep out frost. Carry up the walls sufficiently high to prevent surface water from running in.

F. G. G., of Conn.—An excellent cement for broken glass and porcelain is shellac melted and run into small sticks. The broken edges must be warmed so that they will melt the cement, and the latter is then thinly spread over them. This cement resists moisture, but of course remelts when sufficient heat is applied. A cement that will resist heat but does not withstand moisture, is made of white of egg mixed with finely-powdered quicklime.

F. W. E., of N. Y.—We know of no roofing material that is without a fault of some kind, and it is too much to expect perfection in any human device. We think a flat roof can hardly be made to remain perfectly tight fifty years by any material now known. With sufficient inclination of roof we prefer slate to any other kind of roofing material.

D. F., of Mass.—The tensile strength of aluminum bronze is 73,000 pounds per square inch of section; that of steel in bars is 100,000 to 130,000. These figures are from Rankine's tables. Aluminum bronze is more ductile than steel, but its modulus of elasticity has, we believe, not yet been determined.

W. M. M.—You can use a thin wash of glue or isinglass before painting, into which small articles may be dipped and afterwards allowed to drain; but for articles to be exposed to wet, no sizing, but good linseed oil with red lead, messicot or litharge, will stand long without peeling off.

J. K., of Pa.—An inch of water will make 1,696 cubic inches of steam. Two volumes of hydrogen combine with one of oxygen to form water.

A. W. A., of N. Y.—With the best constructed hydraulic ram, and a fall of four feet, about two and four tenths per cent of the falling water can be elevated one hundred feet.

L. B., of Wis.—It would be impossible to give you a good idea of the shapes of different turning tools without engravings. Watson's "Manual of the Hand-Lathe" gives all necessary information. It is published by Henry Carey Baird, 406 Walnut street, Philadelphia, Pa.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.