THE BITRICYCLE, A FRENCH INVENTION.

We illustrate herewith a curious French invention, more on account of its unique character, than from any belief in the merit of the device. Our object also is to arouse the attention of inventors to the fact that there is still much room for improvement in construction of vehicles designed either for passengers, or the transport of wares and heavy materials for building and other purposes.

An attempt has been made in the construction of the "bitricyle" to secure immunity from overturning by broadening the base of the vehicle to such a degree that the center of gravity can in no instance fall outside of the base, and this is undoubtedly secured. The increased width of the vehicle resulting in the attainment of the above object, is an inconvenience for city travel, on account of the crowded state of the thoroughfares.

One smiles to think what a delightful snarl a crowd of these vehicles would produce in *any* of our New York thoroughfares, not to mention Broadway.

But an attempt has been made to carry out a correct principle in throwing the bulk of the weight upon wheels of very large size. It is well known that such wheels entail less work than small ones in proportion as roads are rough. With perfectly smooth and hard roads, perfectly round and inelastic wheels of different sizes would manifest no difference in draft, all other things being equal.

The plan of putting the large wheels in the center of the vehicle appears to us a very unmechanical contrivance, as it is manifest that on uneven surfaces the weight must be more or less unequally divided between the wheels—and it is easy to conceive of circumstances, in which only two of the wheels, or even the one central wheel on each axle, should temporarily bear all the load. The use of springs can only compensate for this irregularity to a certain extent; beyond that, we judge the rolling of this vessel upon her central wheels, over a rough road, would be something remarkable.

The inventor of this curious vehicle seems to have forgotten that immunity from overturning may be secured by lowering the center of gravity with a given width of base, as by widening the base while keeping the center of gravity at the same hight.

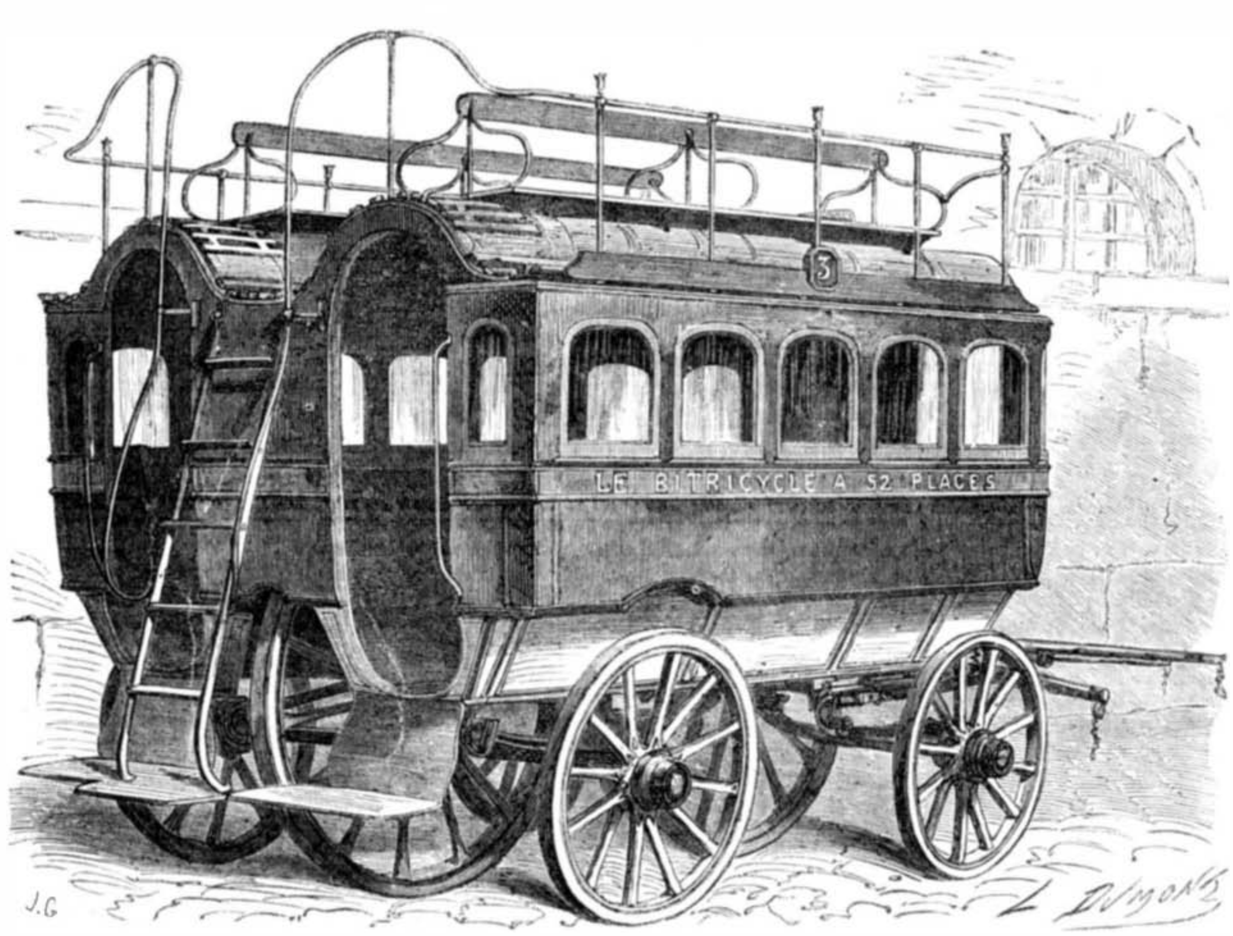
For all heavy draft vehicles, we believe that the hind wheels might be made much larger than at present is the case, with advantage; provided the construction of the vehicle is such as to throw the weight of the load mostly upon the larger wheels. The use of crank axles with such wheels would let down the body sufficiently to admit of easy loading.

We have seen this construction adopted for trucks used in moving heavy iron castings, blocks of stone, etc., with unquestionable advantage, and economy of labor, both to man and beast, yet for city trucking and farm work the high box or platform still prevails.

Of course the enlargement of the fore wheels cannot be carried beyond a certain point, on account of the resulting incapacity to turn shortly, a prime essential to a city truck; but it appears to us that the combination to be sought in the improvement of draft vehicles is the lowering of the load and the enlargement of the wheels.

In omnibuses likely to be run into by other vehicles, it seems necessary to raise the body so as to be in some measure out of the reach of injury from the contact of trucks, etc., which might endanger the passengers should they strike the body of the vehicle.

The vehicle we illustrate is made to carry fifty-two persons inside and out, the inside being divided into two compartments, as shown. A canopy, or awning, in hot and in wet weather, is used to shelter the outside passengers.



THE BYTRICYCLE.

THE BESSEMER PROCESS UNDER PRESSURE.

Our readers, who have read the article on page 184, current volume, SCIENTIFIC AMERICAN, entitled "A Visit to a Steel Manufactory," and who have felt sufficient interest in what is known as the Bessemer process, to have become familiar with its details, will at once understand the working of the improvement of which we give an engraving, and which has just been patented by Mr. Bessemer in the United States.

It has been found that when certain kinds of iron are treated after the Bessemer method the degree of heat attained upon the influx of air into the converters is very much inferior to that produced when other kinds are worked.

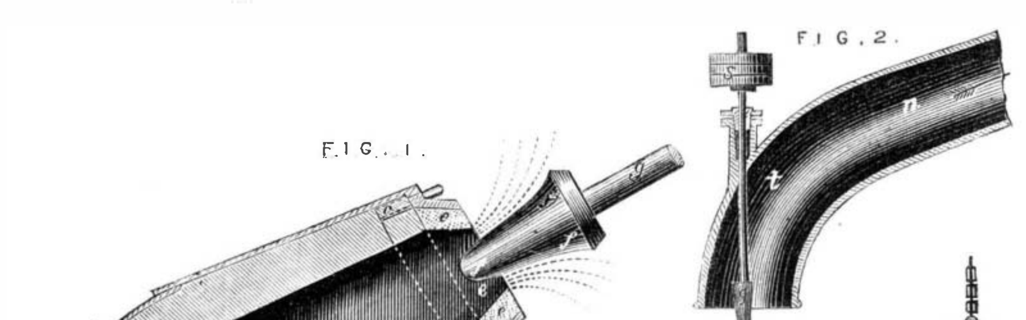
The object in the present invention is to force the air into the converters under pressure, and thereby to secure a greater volume of oxygen to support the combustion than is done in the ordinary way. The purer qualities of pig iron are advantageously worked in this way. In the old process the degree of heat obtained, when Swedish charcoal pig iron and some other varieties were worked, was insufficient to maintain fluidity in the mass until it could be poured into the ingot molds. Hence, a portion becoming hard gave rise to the formation of shells or "skulls"—as they are called—in the casting ladles. When malleable scrap or steel in solid state is worked with pig iron this evil is greatly increased.

The engraving which we copy from *Engineering* is accompanied with the following detailed description. Perhaps no invention of modern times illustrates better the fact that simplicity of construction may often secure the greatest advantages. This simple device of Mr. Bessemer is said to totally obviate the difficulty we have specified.

"Mr. Bessemer makes the converting vessel of great strength, securely riveting and caulking all the laps and joints so as to render it air tight as near as may be, and he, by preference, forms the mouth of the vessel circular instead of oval, and of a smaller size than usual, lining the mouth with a single ring of well-burnt fire clay, or composition of clay and plumbago. He also forms the metal part of the mouth of the converter with a movable dovetailed flanged ring, so that the fire-clay mouth of the vessel may be readily taken out and renewed, by unbolting or uncottering the iron ring which retains it in place.

"In the annexed engravings, Fig. 1 is a vertical section of a Bessemer converter constructed on this plan, *a* being the upper part of the converting vessel; *a** the lining of ganister, and *b* the strong riveted iron shell or vessel on the inside of the mouth of which the iron hoop, *c*, is riveted; while *d* is a flanged iron ring beveled on the inside, and secured by screwed studs or cotter bolts to the hoop, *c*. A molded ring, *e*, of fire brick or other suitable refractory material, forms the escape opening or mouth of the vessel; it is retained in place by means of the flanged ring, *d*, and when it is worn out or damaged the ring, *e*, may be renewed by unfastening the ring, *d*; a mixture of fire clay and ganister being first smeared over those parts of the ring, *e*, which come in contact with the lining, *a**, and with the beveled interior of the ring, *d*, for the purpose of making the joint air-tight.

"The aperture in the movable mouth of the vessel thus formed may in some cases be made small enough to retain the gaseous products, resulting from the combustion of the carbon or other matter contained in the pig iron, under a pressure much above that of the surrounding atmosphere, so that the combustion going on in the converting vessel may be under "high pressure," as described in our account of Mr. Bessemer's new melting furnaces, which appeared on pages 187 and 197 of our last volume. The contraction of the mouth of the vessel would in this case be greater than is shown in Fig. 1 for the purpose of retaining the gaseous products under considerable pressure, so that the gaseous products resulting from the combustion of carbon and other matters in or among the fluid metal would be prevented from expanding freely, and by reason of the combustion so taking place under a pressure much greater than that of the external atmosphere a more intense heat would be produced and imparted to the metal.



THE BESSEMER PROCESS UNDER PRESSURE.

"The amount of pressure thus obtained should vary with the heat-producing properties of the carburet of iron operated upon and the quantity of scrap or other unfused metal forming part of the charge, so that no precise rule can be laid down as to the pressure to be employed; but as a guide to the workmen, Mr. Bessemer states that for the conversion of the purer kinds of Swedish charcoal pig iron, and for mottled or white hematite pig iron mixed with gray, a back pressure in the vessel from 8 to 15 lbs. on the square inch will give good results, and in but few cases will a pressure of 20 lbs. per square inch be necessary; while a pressure as low as 3 or 4 lbs. will be of but little practical advantage, and below 2 lbs. per square inch he lays no claim to, as a useful effect. It will be understood that the pressure of the blast of air forced into the converting vessel must be increased in proportion to the back pressure caused by the penning up of the gases within the vessel.

"Mr. Bessemer, however, remarks that the mode of obtaining the required back pressure by simply diminishing the outlet, does not offer all the desired facility of regulating the pressure from time to time during the process, while at the same time the accumulation of slags in the aperture may in some cases reduce the area of outlet so much as to retard the inflow of air through the tweers. For these several reasons the opening in the mouth of the converting vessel may be made much too large, if left open to retain the gaseous matters in the converter at the high pressure desired; such larger sized mouth being provided with a conical stopper inserted in the opening, and so arranged as to be advanced or further withdrawn by being itself movable or by the motion of the vessel on its axis, the vessel being made to advance towards or recede from a fixed conical

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stopper. Mr. Bessemer, however, prefers to use a movable conical stopper attached to the end of an iron rod, as shown in Fig. 1. The conical piece of fire-brick, *f*, is circular in form, and spreads outward in a curved line at *f**, for the purpose of deflecting the flame and preventing its too powerful action on the iron rod, *g*, which supports the cone, *f*. The rod, *g*, protrudes through the back wall of the converting house, or may be supported on a bracket or piece of iron framing in connexion with the standards which support the vessel, and by means of a screw or lever, the cone, *f*, is made to advance further into or recede from the mouth of the converter, thus increasing or diminishing the area of the annular opening at *e**, and regulating the pressure of the confined gases in the vessel.

"In some cases it may be found desirable to render the stopper, *f*, self-acting by applying a spring or weighted lever to press it forward against the pressure of the escaping gases, so that either by reason of its enlargement by the accretion of slags on its surface or by being partially burned away it will occuppy such a position in the mouth of the vessel throughout the process as will give a sufficiently equal amount of back pressure, and prevent that pressure from exceeding what is necessary by any partial clogging up of the escape opening; or in lieu of employing a conical stopper a flat or other shaped surface may be employed, the object in either case being to enlarge or contract the opening for the escape of flame as found desirable at different stages of the process. The pressure of the confined gaseous products is indicated by a mercurial column. This gage will allow the workmen to employ from time to time such an amount of internal pressure in the vessel as the known qualities of the material he employs may render necessary.

"When crude molten iron, or remelted pig, or refined iron is decarburized, or partially decarburized, or converted into refined iron, or into malleable iron or steel by the action of nitrate of soda or potash, or by other oxidizing salts, or when such decarburation or conversion is effected by any other processes in which the decomposition of nitrate of soda or potash, or other oxygen yielding salts alone or mixed with metallic oxides takes place in, or below the fluid metal in a converting vessel or chamber, a large amount of heat is absorbed and rendered latent, thus tending to solidify the metal and rendering it unfit for forming into ingots or castings without being remelted.

"To obviate this and raise the temperature of metal (while so treated or converted) to such a degree as to allow it to be cast into ingots or other cast articles or masses prior to its solidification, Mr. Bessemer proposes to construct the vessels in which the process is to be carried on of great strength, preferring to use stout iron or steel plates well riveted and caulked, and, if needful, further strengthened by stout hoops. The mouth of the vessel is to be made very small, Mr. Bessemer preferring for that purpose to employ a well burned fire-brick ring, into which a long taper cone of the same material is placed. The cone is fastened to a long rod working in suitable guides, so as to keep it central with the mouth of the vessel. The space between the exterior of this cone and the interior of the fire-clay ring determines the area of outlet for the gaseous products given off during the time that the decomposition of the nitrate or other oxygen yielding materials is going on, and a weight or spring lever acting on the rod to which the fire-clay cone is attached may be made to regulate the amount of pressure required to lift the cone and permit the escape of the gaseous matters.

"The arrangement of which we have just spoken is illustrated in Fig. 2, which represents a vertical section of the upper portion of a converting vessel or chamber in which molten pig or other carburet of iron is to be treated either by the injection of the fluid nitrate into the molten metal, as patented by Mr. Bessemer in March last, or in which vessel the nitrates or other oxygen yielding salts or substances are so brought in contact with the hot metal as to be decomposed. The outer shell, *h*, of the vessel or chamber is made of thick plates of iron or steel securely riveted and caulked at all joints, and capable of withstanding safely a pressure of from five to ten or more atmospheres. For the convenience of lining the vessel, the upper part may be removed by unbolting the stout flanges, h^1, and one or more hoops, h^2, are riveted to the exterior of the vessel to strengthen it. A lining of fire-brick, ganister, or other refractory material, *i*, is used to defend the outer shell from the high temperature generated within, and previous to its use for conversion, Mr. Bessemer prefers to make a fire in the interior so as to highly heat the lining and lessen its power of absorbing heat from the metal.

"On the upper part of the dome an iron ring, *m*, is riveted, to which a flanged ring, *n*, is fitted. The inside of this ring is conical, and is made to embrace the conical fire-clay ring, *p*, through which the gaseous matters evolved during the process are allowed to escape. A cone of fire-clay or of iron, *g*, is attached to the guide rod, *r*, for the purpose of closing or diminishing the area of the outlet opening in the fire-clay ring, *p*, and on the upper end of the rod, *r*, are placed weights, *s*, to regulate the pressure. The rod, *r*, is guided vertically upward and downward by passing through the tubular guides and stuffing-box formed at *t t*, on the curved exit passage, *u*, which leads to a chimney, and conveys away the gaseous products escaping from the converting chamber.

"On one side of the vessel or chamber is a projection, *v*, on the upper part of which a ring of fire-brick, *w*, is retained in place by a conical flanged iron ring, *x*. The opening in the ring, *w*, serves for the admission of the molten metal to the vessel, after which the cone, *y*, smeared with fire-clay is lowered down into the opening of the molded fire-brick, *w*, and by means of the weight, *z*, is retained in place and prevents the escape of gaseous matters during the converting process.

"The cone, *y*, and its rod and weight, *z*, are suspended by a chain in the position shown during the period of running in the metal. When the metal so run in comes in contact with the nitrate or other oxygen yielding materials large volumes of gaseous matters are evolved, these matters instead of escaping freely from the converter rapidly accumulating in the vessel until the pressure within it is sufficient to raise the cone, *g*, and escape by the small annular opening thus made, the pressure being regulated by the weight, *s*. Hence the combustion of the carbon contained in the molten iron by reason of its union with oxygen derived from the decomposition of the nitrates or other oxygen yielding materials will be effected under considerable pressure; and the gaseous products, instead of expanding freely as under the ordinary conditions of combustion, will be in a highly condensed state, by which means their temperature will be considerably raised, and the intense heat so generated will be imparted to the metal and cause it to retain its fluidity."

Correspondence.

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

Straightening Chimneys.

MESSRS. EDITORS:—I was much interested in the account in your number of March 12, of straightening the tall chimney at Barmen, Prussia. Anything relating to building and maintaining chimneys of great hight involves questions of much interest to a great many people in these days of steam and machinery; and, judging from the numerous cases reported of the deflection of such chimneys from the perpendicular, and the methods adopted to straighten them, there is a want of more and better information on the subject.

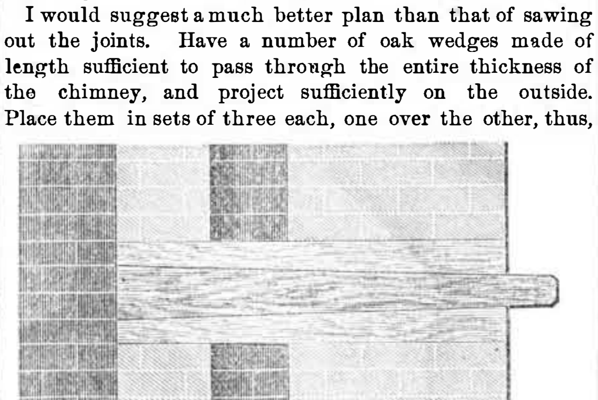
In reading the account above mentioned, I did not see any allusion to what is an indispensable part of all chimneys of that kind, namely, the inner chimney, or core. If that was absent, that fact alone would account for the deflection of the chimney.

Probably few outside of the trade are aware that the tall chimneys that surround us in cities and manufacturing towns are each composed of two separate and distinct chimneys, one inside the other. The inner one to conduct away the smoke, heat, and gases, and the outer one to support the inner one, and protect it from the weather. The reason is that if the outer chimney were subjected on the inside to heat more or less intense, and on the outside to the ordinary variations of temperature, the unequal expansion and contraction of the outside and inside of the same wall would soon cause its disintegration.

An interesting illustration of this principle was seen some years ago in this city, where a chimney was built with the core carried up inside, detached from the outer chimney, as it should be, until it reached the top, where, instead of dropping the inner chimney, and forming the coving, or crown, with the outer chimney, leaving the inner one free to expand or contract, they were connected with each other and built up together. The consequence was that when the fires were started and the inner chimney was subjected to heat, its expansion caused it to lift the whole crown up clear off the outer chimney, causing a horizontal fracture 3 or 4 inches in hight.

In regard to the Barmen chimney before mentioned, I would say that I consider the method adopted to straighten it as most unworkmanlike and dangerous, and I am not at all surprised that the chimney should vibrate to the extent that it did during the operation, or that the masons should "get frightened and leave the place."

I would suggest a much better plan than that of sawing out the joints. Have a number of oak wedges made of length sufficient to pass through the entire thickness of the chimney, and project sufficiently on the outside. Place them in sets of three each, one over the other, thus,



having the surfaces in contact straight and smooth, and blackleaded to diminish friction. Commence on the opposite side to that in which the chimney leans, cut through to the inside, insert one set of wedges, and wedge above and under them until they take a bearing. Repeat the process around the chimney, except on the lowest side, leaving spaces of a foot or more between each set of wedges. Then by driving the center wedge in each set inwards, as much of the chimney as rests on them is gradually lowered just at the places and to the amount required to bring it to an exact perpendicular. When that is done, brick up the intervening spaces, loosen and withdraw the wedges, and brick up in their places.

In conclusion I would say that my experience in that kind of work leads me to believe that sufficient care in planning and executing constructions of this kind is not always taken; and when a chimney like that at the Charlestown Navy Yard, in the building of which expense was a secondary consideration, swerves from the perpendicular, to the extent that it does, to say nothing of the large number of others that give trouble in many ways, it behooves those whose business requires tall chimneys, to look well to the construction thereof.

Boston, Mass. CHAS. A. FOX.

Matter and Motion.

MESSRS. EDITORS:—In your article on page 175, in reply to Mr. Blake, you quote from four writers, to show that the term inertia is not always used to mean the same thing; when, if I can understand them, they agree as to the definition of the word, though one of them denies the fact of which it is the expression.

Certainly it is to be expected that new discoveries in science will work some changes in our ideas of things, but it does seem a little startling to say that the idea of the inertness of matter is obsolete; for is it not a principle of philosophy that a conception the negation of which is inconceivable must be true?

Then with respect to such motions as are imparted to matter, is it conceivable that it moves itself? If not, what else can it be but inert?

But suppose it under some circumstances to move itself; how is it done but by the exertion of force? And are not the force and the resulting motion commensurate? Then it follows (why not?) that force and motion are correlative, and that a given force produces a commensurate motion and no more; because inertia is opposed to it, and an equivalent of inertia is exchanged for an equivalent of motion. Except for this plain and easily understood principle, what would prevent an infinite motion from ever so small a force?

So it appears to me that the argument of Mr. Nichols and your own from molecular motion to the denial of inertia is a pure *non sequitur*, as it does not seem to alter the case at all, to say that matter moves itself.

The absurdity of the alternative to which the denial of inertia forces you, namely, that it is a natural property of matter that it moves itself about from place to place, is too absurd not to be remarked.

As to the idea that matter does either as molecules or masses move itself, I simply wait for the proofs, which when they come will undoubtedly astonish the apostles of the new philosophy, as well as every body else.

S. H. WILDER.

Deep River, Ct.

[Our correspondent must not put his own language into other people's mouths. No one has to our knowledge said that "matter moves itself," any more than they have said "matter forms itself; matter extends itself; matter makes itself to be impenetrable." What those who deny the state of rest in matter, say, is simply that matter constantly moves; and that under certain conditions, the motion of portions of matter decreases simultaneously with increase of motion in other portions; the increase and decrease being equal in all cases. It is believed by many that motion is an essential property of matter, as much as extension; in fact, that the so-called essential properties of matter, are merely concomitants of motion; that matter and motion are co-existent, and that neither can be recognized by the human intelligence without the other.—EDS.

Relative Cost of Hoosac and Mt. Cenis Tunnels.

MESSRS. EDITORS:—Your recent article upon the Hoosac Tunnel, I think conveyed a wrong impression as to the relative cost of the Mt. Cenis tunnel and the Hoosac. You place the cost at Mt. Cenis at $1,500,000 per mile, and at Hoosac $1,900,000 per mile. By reference to Buffum's "Sights in France," etc., you will see that the cost of the Mt. Cenis tunnel is to be $26.000,000, of which France pays $20,000,000 and Italy $6,000,000, making the cost per mile over $3,355,-000. The American engineers claim that their drilling machinery is of much superior construction, enabling them to do the work quicker and cheaper, and there appears to be truth in this assertion. For example, in the book referred to, it is stated that the drills are used up pretty fast at Mt. Cenis, and that 2,000 drills will be broken up before the work is done; but at Hoosac it is stated that not more than 50 of the Burleigh drills have been employed, all told; all are still good, although some of them have been in use for over 3½ years. B.

Spontaneous Combustion of Oil Scrapings.

MESSRS. EDITORS:—On reading the article on Spontaneous Combustion, published in Vol. XXII., page 121, SCIENTIFIC AMERICAN, it instantly reminded me of what I myself saw about two years since. I was then engaged as foreman for a manufacturer of oil silk. In this process the belts of silk when dipped in the oil are hung upon hooks and part of the dripping oil falls to the floor. In the course of a few months the accumulation upon the floor is considerable. In the instance alluded to the proprietor ordered me to scrape the floor and put the scrapings in barrels and place them in a certain corner of the room up stairs. I refused to do it, explaining to him the danger of combustion, but my argument was ridiculed, and the scrapings were collected by the proprietor himself in three barrels and placed as described. They remained there but two days, and on the morning of the third I entered the rooms about six o'clock, A. M., and noticed a dense blue smoke. Feeling positive that the gas could not have produced it, I at once searched for the cause, and soon found it. I at once seized the nearest barrel which blazed from the bottom in a most terrific manner, and notwithstanding the intense heat, I succeeded in removing it out of the building. On returning I found it had set fire to the floor plank, an inch and a quarter thick. This extinguished, I drew away the second barrel, which also burst into a

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