DUGDALE'S UNIVERSAL CLOTHES WASHER.

The operation of hand washing is not only one of severe labor, but it also entails—when performed in the ordinary way—injury and great discomfort to the hands, which need constantly to be plunged in an alkaline liquid which attacks and dissolves the cuticle, acting with the friction to often remove the skin entirely from the more exposed parts. The water employed cannot in the ordinary way be raised above that point which the hands can endure, and it will be obvious upon a moment's consideration that could the friction be aided by a higher temperature than that commonly employed, and the consequent greater solvent power of the suds, the work of the laundry would be much lessened.

The accompanying engravings illustrate a device whereby

Fig. 1.

the hands are spared the discomfort and injury referred to, and the temperature of the suds may be maintained as high as is possible in an open tub.

The device is shown in detail in Fig. 2. It will be seen, it is simply a rubber, consisting of two parts in a suitable frame, which clasps the clothes when it is in use. The two parts when brought together present a rounded form, the exterior being fluted like a washboard, and the interior being made concave as shown, so that buttons, hooks, etc., may be clasped without damage.

Fig. 2

The upper part of that portion of the device which clasps the clothes, slides in grooves made in the side pieces of the frame, and is raised or opened by pressing back the bolt which locks it to its place, and pulling it upward by a knob or handle provided for that purpose.

The clothes are fastened in by pushing the knob down. Common tubs and zinc wash boards are used ; the wash board is temporarily fastened in the tub, upon which the clothes are alternately drawn, and pressed down against the bottom of the tub ; and they may be rubbed when required by applying one hand to the middle cross piece. This invention enables the operator to use suds hotter than the hands can bear, which dissolve the grease and dirt much more rapidly than suds at a lower temperature.

The device is very light, weighing only three pounds, and it is sold for introduction at a price within the reach of all.

Patented, January 18, 1870, by James K. Dugdale, of White Water, Indiana, who may be addressed for further information, and to whom orders for the universal clothes washer may be sent.

Artificial Ivory.—Tables for photography are made by mingling finely-pulverized sulphate of baryta or heavy spar with gelatin or albumen, compressing the product into sheets and drying it.

Improved Diamond-Pointed Steel Drill.

We have on various occasions called the attention of our readers to the great efficiency of opaque diamonds when applied to the cutting of hard materials. No existing substance can resist their action, and their durability when thus employed is very remarkable.

An annular drill used on the machine, which forms the subject of the present article, was recently employed in a tunnel of the Consolidated Bullion and Incas Silver Mining Company, Colorado, the tunnel having been at the time driven 600 feet into the mountain. This drill cut horizontally through 417½ feet of very hard quartz and feldspar rock ; the expense for diamonds in drilling this distance being only thirty dollars.

This is only one of the daily accumulating proofs of the wonderful industrial value of the opaque diamonds, or—as they are more commonly called—carbons and the great economy secured in their use for cutting and abrading the hardest materials.

We cannot, perhaps, place the defects of percussion drilling in a stronger light than by quoting from the report of the Commission to the Paris Universal Exposition.

The Commisson, after describing M. Sommeilier's machine—which has its solid steel drill attached direct to the engine piston, and conceding its manifest superiority over other percussion borers, proceed to say :

" Let us now inquire if this apparatus has answered the expectations of its author, and if this system of percussion will really render the service expected of it. We do not hesitate to express the opinion that it has not; and the following data will, we think, prove beyond a doubt that a percussion machine is not the one that should be employed in this kind of work.

" If we examine the staff employed in repairing the percussive tools, then used at the Mont Cenis tunnel, we remark that in 1863, for eight machines working there were sixty in the shops. At this time (1867), when the work is carried on both from the French and Italian sides, the number of engines working is sixteen, and the number of those in the workshops repairing is two hundred.

Fig. 1

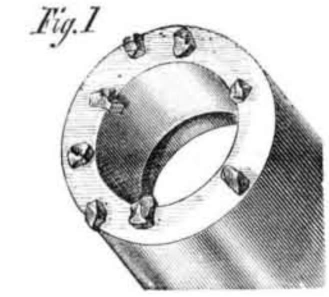
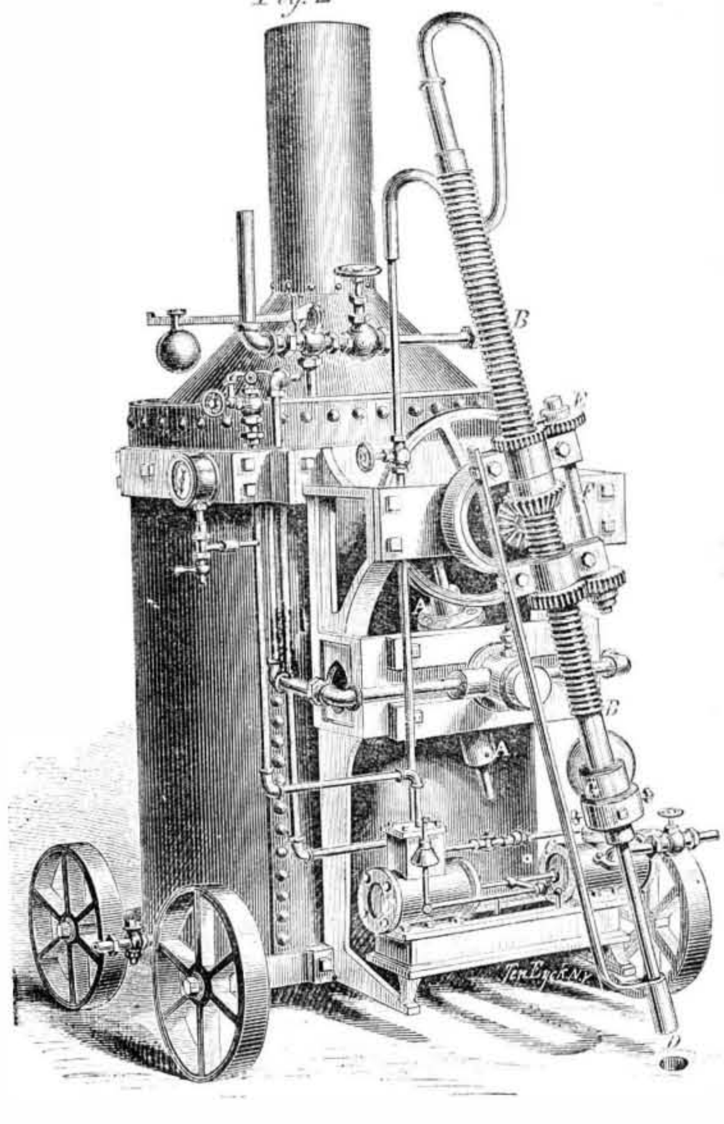


Fig. 2



LESCHOT'S DIAMOND-POINTED STEEL DRILL.

" Twenty-four men were constantly employed in repairing eight machines."

The Commission proceed to say, that, even admitting the possibility of constructing machines so that excessive repairing might be avoided, the percussion system is still liable to the objections that it makes an extravagant demand upon motive power, and that it cannot, on account of the great vibration be made to drill a circular hole to any great depth, which is a serious obstacle to the use of cartridges in blasting. They further express their conviction that the percussion system must eventually give place to the rotary system of drilling rocks, and warmly indorse the latter system as represented by the Leschot diamond annular drilling machine at the Exposition.

From the study of the imperfections of the system of percussion drilling, M. Leschot conceived the idea of setting diamonds in an annular cutter, the general form of which is shown in Fig. 1.

In the report of the Paris Exposition, before alluded to, the Commissioners make a comparison between the power required to penetate rock by means of this annular cutter, and that required by those drills which pulverize the rock to the full width of the hole, and pronounce the same to be in the proportion of 61 to 204.

This fundamental part of the device has, however, been improved upon since the introduction of the machine into this country. The diamonds are now securely fastened, and are set so as to give ample clearance, for the free descent of the drill, and the movement of the core through the tubular stem of the ring-cutter.

Great improvement has also been made in the various working parts of the apparatus. The original French machine only admitted the rotation of the drill at a speed of one fourth that now employed. The feed gear has also been greatly improved, so that the cut of the diamond tool may be, without delay, changed from the one hundredth part of an inch to the four hundredth part of an inch at each revolution of the drill ; and this gear is now so constructed as to automatically adjust the feed to varying hardness of the rock through which the drill successively penetrates, giving slower feed when hard *strata* are encountered, and resuming its rapid feed when the hard *stratum* is penetrated.

The oscillating cylinder engine has been substituted for the fixed cylinder engines, and is specially constructed to adapt it to this purpose ; securing superior speed, lightness steadiness, and durability.

A swivel head has also been added, by which the drill may be pointed in any direction ; and the drilling may proceed at any possible angle with the vertical axis of the entire apparatus.

The hollow screw shaft is also an American improvement, which, added to the numerous other minor improvements, renders the machine, as we herewith present it, in the accompanying engravings almost unrecognizable as the offspring of the original French machine.

The machines used in driving tunnels bore from three to five holes simultaneously, each in a different direction if desired.

Fig. 2 represents a " No. 1 Prospecting Drill," so called be cause of its general use in testing the character and value of mines and quarries. It consists of a small, upright boiler, to one side of which is firmly bolted the cast-iron frame which supports the engine and swivel drill-head, gears, and screw-shaft, as shown in the engraving. The engine—an oscillator of from five to seven-horse power—is shown at A, B is the screw-shaft with drill passing through it. This shaft is made of hydraulic pipe from five to seven feet in length, with a coarse thread cut on the outside. This thread runs the entire length of the shaft, which also carries a spline by which it is feathered to its upper sleeve-gear. This gear is double, and connects by its lower teeth with the beveled driving-gear, and by its upper teeth with the release-gear, E. This release-gear is feathered to the feed shaft, F, at the bottom of which is a frictional gear fitting the lower gear on the screw shaft, which has one or more teeth less than the frictional gear, whereby a differential feed is produced. This frictional gear is attached to bottom of feed shaft, F, by a friction nut ; thus producing a combined differential and frictional feed which renders the drill perfectly sensitive to the character of the rock through which it is passing, and maintains a uniform pressure upon the same. The severe and sudden strain upon the cutting points, incidental to drilling through soft into hard rock, with a positive feed, is thus avoided.

The drill proper (passing through the screw shaft, B), consists of a tubular boring bar, made of lap-weld pipe, with a steel bit or boring-head, D, screwed on to one end. This bit is a steel thimble about four inches in length, having three rows of black diamonds in their natural rough state firmly bedded therein, so that the edges of those in one row project forward from its face, while the edges of those in the other two rows project from the outer and inner peripheries respectively.

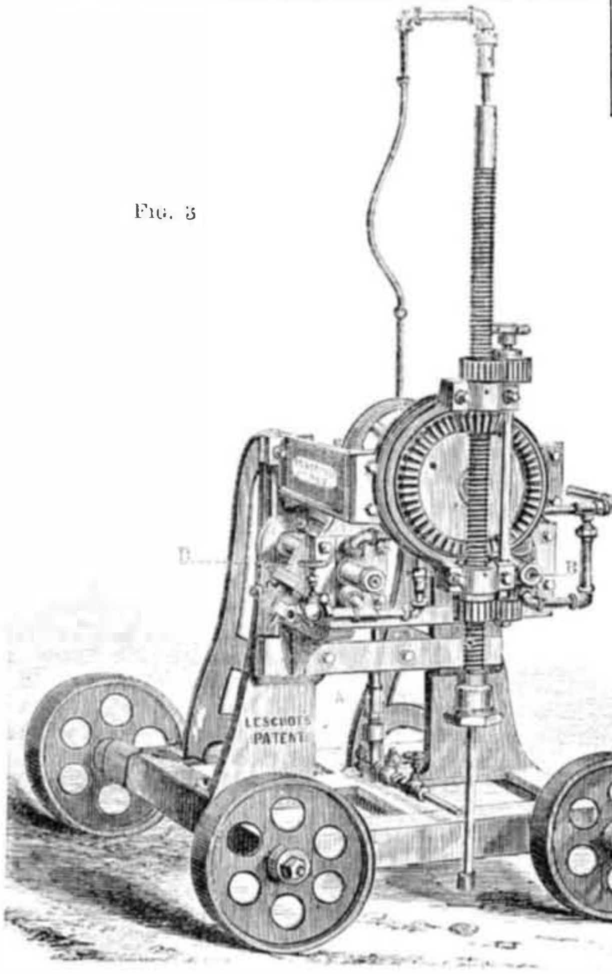
The diamonds of the first-mentioned row cut the path of the drill in its forward progress, while those upon the outer and inner periphery of the tool enlarge the cavity around the same, and admit the free ingress and egress of the water as hereafter described. As the drill passes into the rock, cutting an annular channel, that portion of stone encircled by this channel is of course undisturbed, and passes up into the drill in the form of a solid cylinder. This core is drawn out with the drill in sections of from 8 to 10 feet in length

The sides of the hollow bit are one fourth of an inch thick, and the diamonds of the inner row project about one eighth of an inch, so that the core or cylinder produced by a 2-inch drill (the ordinary size for testing) is one and a quarter inches in diameter.

Inside the bit, D, is placed a self-adjusting wedge which allows the core to pass up into the drill without hindrance, but which impinges upon and holds it fast when the action of the drill is reversed—thus breaking it off at the bottom and bringing it to the surface when the drill is withdrawn.

In order to withdraw the drill it is only necessary to throw

FIG. 3



OPEN CUT OR QUARRY DRILL.

out the release gear, E, by sliding it up the feed-shaft, F, to which it is feathered, when the drill runs up with the same motion of the engine which carried it down, but with a velocity sixty times greater; that is, the speed with which the drill leaves the rock, bringing the core with it, is to the speed with which it penetrates it as 60 to 1—the revolving velocity in both cases being the same.

The drill rod may be extended to any desirable length by simply adding fresh pieces of pipe. Common gas pipe is found to serve admirably for this purpose, the successive lengths being quickly coupled together by an inside coupling four inches long, with a hole through the center of each to admit the water. The drill is held firmly in its place by the chuck, G, at bottom of screw shaft.

The small steam pump, C C, is connected by rubber hose with any convenient stream or reservoir of water, and also with the outer end of the drill pipe, by a similar hose having a swivel joint, as shown in the cut. Through this hose a $\frac{1}{4}$-inch stream of water is forced by the pump into the drill from which it escapes between the diamond teeth at the bottom of the bit, D, and passes rapidly out of the hole at the surface of the rock carrying away all the grit and borings as fast as produced. Where water is scarce or difficult of access, a spout is laid from the mouth of the hole to the tank or rerservoir and a strainer attached to the connecting hose, so that the same water may be used over and over again with but little loss.

This pattern rotates the drill from 300 to 360 revolutions per minute.

Figs. 3, 4, and 5 represent, respectively, drilling machines of various kinds, designed for particular uses, but identical in all essential points with the one described.

Fig. 3 is an open-cut or quarry drill, designed for blasting and gadding purposes. It is also extensively used for railroad grading, surface mining, well-boring, etc., where it is necessary to have the boiler at a distance from the drill, or to connect with a stationary boiler on the premises. This machine is adapted to rotate its drill from 900 to 1,000 revolutions per minute.

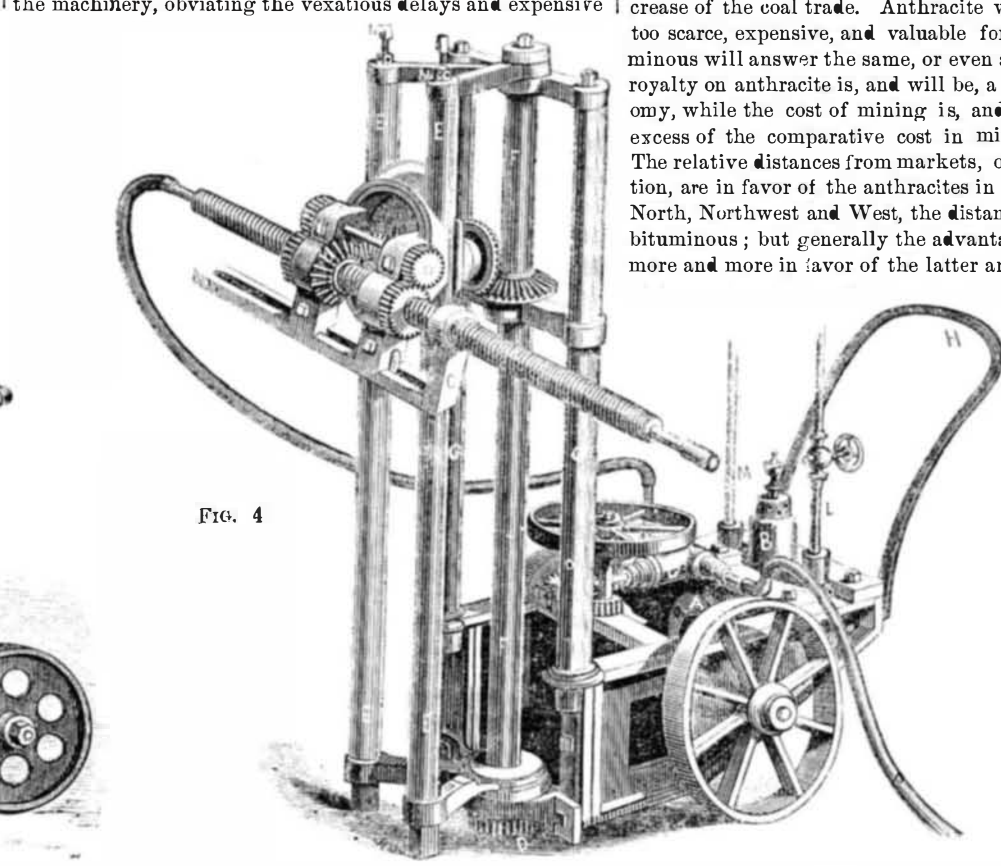
Fig. 4 represents a single-drill tunnel machine, constructed to work in tunnels of any hight, from four to sixteen feet; boring holes at any required angle, as near to the top or bottom of the heading as desired, and close to either side wall.

Fig. 5 exhibits the heaviest prospecting and well-boring machine. This machine bores holes from two to four inches in diameter, and to any depth within one thousand feet. We have personally witnessed the working of the drill, as herein described, and can say that nothing like its efficiency and rapidity of work, has been manifested by any other rock-drilling apparatus we have seen. A machine, like that shown in Fig. 2, cut through Hell Gate rock (very hard) at the rate of eight and one half inches in four and one half minutes, and through brown sandstone at the rate of thirteen inches in two and one fourth minutes in our presence, notwithstanding that its operation was retarded by the bad quality of the oil used for its lubrication, and want of sufficient steam to run at maximum speed.

In very hard trap-rock quartz or granite, eight feet per hour is found to be fair average rate of boring, where holes are not required to be over one hundred feet deep and two inches in diameter; while in sandstone, marble, slate, etc., fifteen feet per hour is easily bored.

These facts, together with the simplicity and solidity of the machinery, obviating the vexatious delays and expensive

FIG. 4



SINGLE DRILL TUNNEL MACHINE.

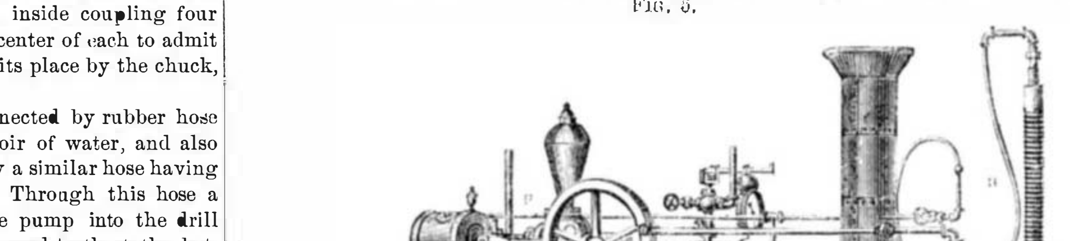
repairs incidental to percussion drilling, place these machines in the front rank of labor-saving inventions.

The first patent issued in America for this application of the diamond was granted to M. Leschot, July 14, 1863, and reissued to Messrs. A. J. Severance and W. T. Holt, Feb. 16, 1869, and October 26, 1869.

A second patent, covering the various mechanical devices employed in operating the tool, was granted to W. T. Holt and John North, June 22, 1869.

During the past two years—within which time the inven-

FIG. 5.



HEAVY PROSPECTING AND WELL-BORING MACHINE.

ion came into the hands of its present proprietors—all the above-mentioned improvements over the French machines have been made, and the drill successfully introduced into the principal Eastern, Middle, and Western States, and the Southern States of Maryland and Virginia.

For further information as to rights and machines, address Severance & Holt, 16 Wall street, New York.

The Future Supply of Bituminous to the Eastern Markets.

A brief glance at any geological map of the coal regions of Pennsylvania, which cover nearly one-third of the entire area of the State, will be sufficient to convince any one of the vast future importance of our bituminous coal-fields and the magnitude of their boundless resources; but only when compared with the insignificant areas of our anthracite coal-fields, can we appreciate the value of those immense deposits of the most available of fuels.

We possess, says the *Miners' Journal*, considerably less than 500 square miles of anthracite coal formation, and even this limited area has been ruinously encroached on and curtailed by wasteful and improvident mining. Yet those little basins now produce over 15,000,000 tuns of coal annually, or more than two-thirds of the entire coal production of the State.

We may live to see the time when the coal-fields of the State shall produce 50,000,000 tuns annually, since the yearly increase may reasonably be estimated at 2,500,000. Of course this cannot come from the anthracite mines. Our bituminous coal-fields must furnish the largest portion of the annual increase of the coal trade. Anthracite will, moreover, become too scarce, expensive, and valuable for use, when the bituminous will answer the same, or even a better purpose. The royalty on anthracite is, and will be, a large item of its economy, while the cost of mining is, and must be, greatly in excess of the comparative cost in mining bituminous coal. The relative distances from markets, or places of consumption, are in favor of the anthracites in the East, while in the North, Northwest and West, the distances are in favor of the bituminous; but generally the advantage will, in future, be more and more in favor of the latter and against the former, except in favored localities.

With 16,000 square miles of bituminous coal-fields, and less than 500 of anthracite, we must draw largely on the one to save the other in the future. Providentially, we find in bituminous coal the elements needed by science, pre-eminently, for the advancement of the industrial arts of the age.

A pure and rich bituminous fuel is adaptable to all the wants of society for the production of light, heat, and force. It may, or can take the place of anthracite in almost, if not every case, where fuel is required, but anthracite cannot so generally take the place of bituminous coal.

All coals undergo destructive distillation in their combustion, but anthracite, being mainly solid carbon, will only yield its gas, or ignite and burn, under a high temperature. But bituminous coal is readily converted into gas, ignites easily, and burns under a comparatively low temperature, and gas, however produced, will yield greater results in heat than can be obtained from any crude mineral fuel; while the gas is clean and pure, which can scarcely be said of our best coals in their raw state.

In the Siemen's and other similar processes, for the production of cheap gas as a fuel, from ordinary bituminous coal, and its application to the manufacturing arts, we must recognize a scientific improvement of great practical value, adaptable to an almost unlimited extent, and available, not only where intense heat and a pure fuel is required, but also in nearly all cases where coal is scarce and dear, and economy is a consideration.

We find in the statistics of the coal trade for the past year, that the production and consumption of bituminous coal is increasing in a greater ratio than the anthracite. This must continue in the future, until the bituminous column, which a few years ago was insignificant in amount, will lead the coal trade in Pennsylvania. It is now used in our rolling mills and forges, even in the midst of the anthracite mines. This seems like "carrying coals to Newcastle," but is nevertheless a fact; while for the production of illuminating gas, a rich bituminous is the only coal at present made use of.

Anthracite is a monopoly. It is limited and invaluable for certain important purposes, for use in the blast furnace, for domestic uses generally, and many other cases, where bituminous coal cannot come into competition in the Eastern markets; but the tendency of innovation is against the latter and in favor of the former. Bituminous coal may substitute anthracite in many cases, but anthracite will rarely replace bituminous in future.

Faraday's Titles.

Faraday had ninety-five titles and distinctions conferred upon him. One of them, namely, that of F. R. S., was sought for; all the rest were spontaneous expressions of respect and good-will from the societies named; but, after all, his best title was that of a true gentleman. All men spoke well of him. Although of humble birth, he never sought social distinctions; although born poor, he never coveted riches. In this respect he was very different from Sir Humphry Davy, who had vast ambition, and was eternally pining after rank. According to Sir Wm. Thomson, "Faraday had great kindness and unselfishness of disposition, clearness and singleness of purpose, brevity, simplicity, and discreetness—sympathy with his audience or his friend—perfect natural tact and good taste—thorough culture, and an indescribable quality of quickness and life."

Correspondence.

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

Do Locomotives Ever Die?

MESSRS. EDITORS:—From what I have seen I am led to believe that locomotives are kept in use till they are killed. Their weak and corroded shells are unable to withstand the pressure put upon them, and they finally explode, killing and wounding the attendants. Then the responsible parties are wont to put on an innocent and mysterious cast of countenance, and ejaculate "What an unaccountable mystery are these steam boiler explosions!" About three years ago a locomotive boiler exploded on the Richmond and Petersburg railroad. It had been in use *only* about eighteen years. Soon after one on the Virginia and Tennessee road *only* about sixteen years old. Two years ago I saw one within five minutes after it exploded, in Chattanooga, Tenn. The break was along the edge of the lap in the center sheet of the bonnet, and on the bottom at this point the iron was only about one eighth of an inch thick, with deep blotches of corrosion up to the water line, but deeper and clearer near the bottom. This boiler had been in use *only* about sixteen years. I have since seen another that exploded on the Virginia and Tennessee road. In this case the engineer refused to go longer on the machine knowing that it was unsafe. He was discharged and a green engineer put in his place. The result was that, within an hour, he and his fireman and the engine were torn into fragments. It is hardly necessary for me to write that the superintendent of motive power was not tried for murder, and this scrap heap was *only* about eighteen years old. Within a few weeks an engine exploded on the Chesapeake and Ohio road; the first point of rupture was along the edge of the longitudinal seam of the center sheet at the bottom of the bonnet; the piece taken out increased in width to the top, along the first point of rupture. The iron was not over the eighth of an inch thick, with deep blotches and furrows of corrosion; the boiler had been in use nearly eighteen years; the stay bolts were badly worn; the fire-box in none too good a shape; and yet the boiler is being repaired by putting a new bonnet to the old fire-box.

I hope others of your many readers will communicate the facts bearing on this subject, with a view to ascertain at what age of continuous use locomotive boilers are dangerous by reason of corrosion. E. A. DAYTON.

Richmond, Va.

Suggested Improvements in Sawing Lumber.

MESSRS. EDITORS:—The lumber system of the United States presents one of those curious problems that can only be accounted for by the bounteous provisions of nature, which has given us enough to use with a large surplus to waste. At least 25 per cent of the stuff after being "squared" goes into sawdust and shavings, making a direct waste of one fourth the timber, to say nothing of the cost of reducing it to shavings and sawdust.

Let us look into this system, and see if there is not some reform demanded, and where the remedy lies. In most other countries lumber is brought to market in squared logs or heavy planks, and, after seasoning, or partial seasoning, is reduced to special dimensions by re-sawing. In England, planing mills and all wood-working establishments, saw their stuff to order—forest-cut stuff of all sizes or thin boards is not known. Here lumber is sawed green, reduced to boards and stuff of all imaginable sizes, in the forest, and then brought to market to be worked on planers without seasoning. Let us consider the two systems, and see if there is not some way of saving stuff and reducing the cost of working it.

Under our American system, as before stated, the lumber is sawed into boards and scantlings when green, in the forest mills. An ordinary lumber mill makes a kerf one fourth inch wide, which in manufacturing inch boards, turns *one fifth* of the squared stick into sawdust. Then again to compensate for irregular seasoning and warping of the stuff, the deviation of the saws, etc., at least another tenth is wasted, making a total of three tenths of the stuff. This extra thickness mentioned has, with the exception of the shrinkage, to be planed off when the stuff is worked—planed off from a surface covered with grit, dust, and dirt of transportation. Stuff that has been rafted in our western rivers after being sawed into boards, almost defy the planing and other lumber-dressing machines, until the "crust is off."

Another evil of our lumber system is the large amount that our yards have to keep on hand to make an assortment; few of them have the appliances for "cutting out" a bill of stuff. Rafters, studding, joists, beams, etc.—in fact everything but the thinnest boards—have to be searched for among the forest-cut stuff. If a customer wants a lot of special pieces, his only resource is to go to the log mill, and get it green.

The attention of the writer was called to the difference between our own and the English plans of preparing lumber, by the character of the machines used for planing. While the English tools for re-sawing are much heavier than ours, their planers we would call toys, in fact, there are not made at this time in England any planers that would work our American lumber; the width of the belts (which may be taken as an exponent of their capacity) is about one half our standard, and yet they do all that is required of them; the secret being that they *saw* their stuff, we *plane* ours. To compare the two plans on a basis of economy in either material or power, would be superfluous. Their deal frames, as they are called, have gang saws of from 14 to 16 gage, making a kerf of about one-sixteenth inch in width; and the cost of re-sawing planks into deals or boards on their machines, is amply compensated for by the saving in the amount of timber consumed, to say nothing of what is gained in planing or shaping it afterwards.

The want of efficient machines for re-cuttting, that could be set up in our planing mills, has been the great hindrance to re-sawing in this country. A reciprocating saw with a single blade (which is generally used) makes re-sawing expensive, while nothing but permanent earth foundations will prevent them from jarring the buildings. It is to be hoped that the band saw mill will take their place and fill this want, and that our forest mills will in time stop the manufacture of any kind of lumber but planks and squared beams from the green log.

Philadelphia, Pa. J. R.

A Magic Square.

MESSRS. EDITORS:—The accompanying magic square is sent to you, not because it is formed on any new plan, but because it is different in some particulars from the more ordinary magic squares, and may be of interest to your readers.

The numbers used are 1 to 100. The whole square is a magic square, having the number 505 as the sum of its lines,

90	14	12	100	84	93	4	96	10	2
16	66	36	37	63	22	80	81	19	85
92	39	61	60	42	75	25	24	78	9
7	59	41	40	62	23	77	76	26	94
88	38	64	65	35	82	20	21	79	13
18	55	50	54	43	27	73	72	30	83
86	45	52	48	57	70	32	33	67	15
3	44	53	49	56	34	68	69	31	98
6	58	47	51	46	71	29	28	74	95
99	87	89	1	17	8	97	5	91	11

files, and diagonals. If the margin is disregarded, as indicated by the continuous line, the square will still be a magic square, having now 404 as the sum of its various lines. And if this square be divided into quarters, as indicated by the double lines, the four resulting squares will each be magic squares, having 202 as the sum of their lines.

Philadelphia, Pa. PFEIL.

Free Rail Joints.

MESSRS. EDITORS:—I know not to what extent this method of laying railway track has been adopted, but I have certainly never seen a railway which had a more satisfactory appearance after an extended use, than that portion of the Nashua road which is constructed upon this plan.

No chair is used, and there is no sleeper directly under the rail joints; but in addition to the usual simple and strong four-bolted "fish joint," two broad faced sleepers are employed, close together, and so as to bring the ends of the abutting rails between them. This arrangement insures a free and open joint by allowing all dirt and clogging material to fall out, which of course leaves the opening free to its legitimate purpose, the expansion of the rails. The base of each rail is notched about midway for the reception of a spike to hold the track in its true longitudinal position, and to bring the expansion of the rail each way from its center.

One of the chief causes of the derangement of railway track is doubtless the clogging up of rail joints; rails will expand and contract, and whatever opposes such expansion and contraction sufficiently will throw the track out of line.

The mere action of sun and frost causes a variation of about three feet in the length of every mile of rail; hence the importance of this provision for the unobstructed play of the rails endwise.

If track is laid during very warm weather, one sixteenth of an inch at each joint is ample; but if laid in cold weather, three sixteenths of an inch is not too much to allow at each joint or for each rod of track. F. G. WOODWARD.

Australian Climate.

MESSRS. EDITORS:—I should be glad if you could give some information on the following subject. Perhaps Capt. Maury will explain it to us.

I am unable to understand the cause of the dry climate of extra-tropical Australia in its summer season. It is long since I read Maury's excellent book, the "Physical Geography of the Sea," but I think it omits an explanation of this; and I have never seen one, that I am aware of. On the Bay of Bengal, the China Sea, and the Pacific, off the Philippines, the dry northeast monsoon, which is equivalent to the moisture-abounding northeast trade, blows from October to March. This, by Maury's theory, should rise about the equator and then blow, as an upper current of air, toward the southeast, above the southeast trade of the southern tropics. Then, as in the case of the trade winds, descending about the latitude of thirty degrees south, it ought to give summer rain, say, from November to April, in the southern half of the Australian continent.

I notice, however, in maps of physical geography that the northeast monsoon does not cease at the equator, but blows into the southern hemisphere, still as a surface wind, of course changing its direction and blowing from northwest. It rises and becomes an upper current only on reaching the latitude of the northern limits of Australia. Then, it may be, having gone so far south before rising, it does not again descend from the upper atmosphere and become a surface wind, till, in its southward course, it has passed the usual latitude of this change, or, till it is almost beyond the southern limits of the Australian continent. In this case it would only make the ocean region southwards of Australia rainy during its summer months.

But I notice by the maps that the southern parts of Australia are not included in the region of the southeast trades; and, I suppose, may therefore have northwest winds in their warmer months, which should be supplied by the moist air of the northeast monsoon from the East Indian and China seas.

In the case of the hot winds the air would seem to come from the central deserts. This must be replaced, one would think, by this wet upper current of air descending on these desert parts. They may be too hot to allow of its raining there, but on the wind going to the southwestward, in rear of the hot wind, it might rain.

Are the hot winds of southeast Australia thus followed by rain? Perhaps even the south of Australia is too warm in summer to condense this moisture. Should these suppositions be correct, it must follow that, during all the dry season, in the southern half of Australia the upper regions of its atmosphere must contain plenty of moisture, only prevented from descending by local peculiarities.

It may be the heated surface of Australia that draws the northeast monsoon as a surface wind across the equator, as the deserts of central Asia are supposed to cause the southwest monsoon during the other half of the year. Could the surface of the country be covered with any vegetation to prevent the reflection of heat from the bare ground—especially in the north and west central deserts—the monsoon might rise about the equator and descend again, about thirty degrees south, as a rain giving wind to all the land south of that.

But might not merely planting forests in the southern parts, to keep the ground and air cool, induce the moisture of the upper air to come down? Even in this wet district of Ceylon there seems a very evident difficulty for rain to begin to fall again after the ground has got well dried and hot. Could not the rain be brought down by any means in the shape of thunder showers? In this country, though the rain is mainly, and clearly, distributed in accordance with Maury's theory, still a great deal falls in the shape of thunder showers in the valleys in rear of the hills. Hills often, at this time, get less rain than the low valleys; the thunder showers seeming, in great measure, to avoid the hills. The moisture for these thunder showers seems to come down daily from the higher regions of the air.

I fear I have made this too long, and must stop at once. I would say that the great rains of Australia in winter are as much a puzzle to me as its dryness in summer. I should be glad to see an explanation of both by an able hand. If my explanation, so far as it goes, be wrong, I should be glad to see it corrected. J. TAYLOR.

Island of Ceylon.

The Darien Canal.

The New York *Journal of Commerce* enumerates the advantages of the proposed Darien Canal as follows:

As compared to the route *via* Cape Horn to Calcutta, there would be a saving of 9,600 miles; to Canton, 11,900 miles; to Shanghai, 11,600 miles; to Valparaiso, 8,100 miles; to Callao, 10,000 miles; to San Francisco, 14,000 miles; to Wellington, New Zealand, 2,620 miles; to Melbourne, Australia, 2,830 miles.

The saving, in comparison to the Cape of Good Hope route, would be, to Calcutta, 4,100 miles; to Canton, 8,900 miles; to Shanghai, 9,600 miles; to Wellington, 5,260 miles; to Melbourne, 3,340 miles.

For the English trade to India, the Suez Canal would offer better inducements, but the time and expense of English vessels to China, Japan, and Australia, would undoubtedly be abridged by the Darien Canal; at all events, the canal may be expected to take a share of England's traffic which now comes and goes through the Suez Canal. All American vessels trading with Japan, China, and Australia, and, of course, those bound to and from the Pacific coast, will seek the American Isthmus Canal. It advantageous effect upon American commerce and national prosperity would be immense.

IMPROVEMENTS IN LOCOMOTION.—Sir Joseph Whitworth, at a recent dinner of the Foremen Engineers, deprecated the use of horse tramways as unsuited to the times. He further intimated his opinion that "mechanical engineers have a right to enter their protest, considering the many obstructions there have been for many years past to the employment of road locomotives." Sir Joseph thinks it quite possible to produce a small, light locomotive, which would work quietly and effectively for use on roads; but, as a preparatory condition, he recommends that the roads should be better made, and kept in a proper state of surface by the use of steam-rollers, steam-sweeping machines, and other appliances.