## Business and Personal.

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Royalty — Manufacturers and Inventors, have your Machinery, &c., made in the west for western use. Extra inducements offered by Doty Manufacturing have Company, Janesville, Wis.

Iron Ore Crusher Jaws and Plates, Quartz Stamps, &c., cast to order by Pittsburgh Steel Casting Company. All work warranted.

Stave & Shingle Machinery. T.R.Bailey &Vail. Monitor Leather Belting you can always ely on. Sendfor Circular. C.W.Arny,301 Cherry st., Phila

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Buy First & Pryibil's Bandsaw machines hich are more used than any other in the country which Also, Shafting and Pulleys a specialty. 467 W. 40th St. New York City.

Hand

For Sale Cheap—Six Horse Power Portable Engine, mounted on truck, good as new; been used only two months. Address N. Abbott, Mansfield, Ohio.

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Tool Chests, with best tools only. Send for rcular. J. T. Pratt & Co., 58 Fulton St., New York.

To Let—For Manufacturing purposes—a brick building 126x50, with Water power 38 H.P. day and night on Morris Canal and Midland R.R., and but a short distance from the D. L. & W. and Erie R.R. Address Box 6704, New York Post Office.

Shafting and Pulleys a specialty. Small or-ders filled on as good terms as large. D. Frisble & Co. New Haven, Conn.

All Fruit-can Tools, Ferracute, Bridgeton, N.J. The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Bollers. I. B. Davis & Co., Hartford, Conn.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, forsale or rent. See advertisement,

Andrew's Patent, inside page. Hydraulic Presses and Jacks, new and sec ond hand. E. Lyon 470 Grand Street, New York.

Machinists—Price List of small Tools free Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 32 Cornhill, Boston, Mass.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes-Time and Automatic Re-cording Gauges-Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York,

The Berryma Steam Trap excels all others, The best is slways the chespest. Address I. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire -Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway. New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union 1 on Mills, Pittsburgh, l'a., for lithograph, etc.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines-awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use "-is offered for sale by the Mercht's M'f'g and Con-struction Co., 50 Broad St., New York. P. O. Box 6865.

Williamson's Road Steamer and Steam Plow, withrubber Tires. Address D. D. Williamson, 32 Broad-way, N. Y., or Box 1809.

Parties desiring Steam Machinery for quar rying stone. address Steam Stone Cutter Co., Rutland, Vt



A. P. asks: Is there an invention for ex-tracting watery matter from meat for the purpose of preserving the meat?

S. A. says: We have serious difficulty in drying glue in making petroleum barrels during hot southerly winds in summer. Can you tell us of any preparation that will facilitate the drying of glue and not nurethe ofl?

A. E. S. says: I tried to make ink by follow ing the recipe given in a recent number of your paper but as soon as I put in the bichromate of potash, the water and coloring separated, and no amount of gum would make them unite again. Why did I fail?

U.E. asks: What are the cause of and remedy for the cracking of taps, etc., when in process of hardening in water? Oil will not always make them hard enough. The same trouble occurs with cutters, which crack and split off from the outside circle. It is usually accompanied with a report, especially in the cutters

C. E. asks: Can you give me a reliable approximation of the horse power required to drive the different kinds of cotton machinery, namely, opening and lapping machines, cards, drawing, coarse, interme diate, and fine speeders, ring spinning, mule spinning, spooling, warping, slashing, weaving, etc.?

D. T. asks: What is the best process for imitating Russia leather?

R. C. K. desires to know the difference of strength, forfarm purposes, in ashes made from white wood and from oak, maple, and birch.

J. H. P. asks for a formula for determining with accuracy the contents of a barrel or cask when only partlyfull.

S. A. T. asks for a recipe for a dead black for making a " black board " on white pine. S. A. T. says: I should like a recipe for



J. B. asks how to prevent food, put in a cupboard newly painted inside and grained outside, from tasting of paint. Answer: Wait till the smell has passedaway, which will be when the paint, varnish, etc. are thoroughly dry.

E. J. M. says: Near here was a high pres-sure steam boller, with a low water indicator attached, as represented below. During a cold snap, the little globe marked B was found filled with ice, and a piece was broken out. It puzzles us to know how the globe could have been filled with water, when there was nothing to prevent its flowing back to the boiler as fast as condensed. One says the pipe, being only ½ inch diameter, filled up and froze first. There's the rub, as how did any more pass, so as to fill the globe? A friend says that he took the indicator down, and that there was nothing in the pipe at all, meither ice nor anything else. Answer: With a small pipe, the water would not be able to circulate within and to allow of the entrance of steam or air to displace it. The pipe should be made at least %, and straight from B down to the lower end.



J. B. D. says: 1. I heard some gentlemen have an argument about the rainbow. P. K. D. says the bow is in the clouds because God put it there, that all the nations of the earth might know that it would not be destroyed by water again. I contend that it is the sun shining on the rain, reflecting on the clouds, because the bow always shows in the opposite direction from the sun. The bow shows more plainly on the  $s_k y$  than on the clouds. I havenever seen a bow in the south or north. I once saw a very tall tree fallintos river. The watersplashed up about 40 feet high, and came down in a fine sprinkle; there was as fine a rainbow shown as ever I saw. 2. I have heard it said that the machinery of a water mill ran 25 per cent faster in the night than in the day time. The water appeared to be the same. What was the cause of it? 3. I want to know the cause of the knocking in an engine. One engineer says it is in the cross head, snother says it was an up and down or side knock in the wrist. Answers: 1. The cause of the rainbow is that supposed by our correspondent. The rays of light from the sun, reflected and refracted by the transparent rain drops, are brought to the eye in such a manner as to cause the beautiful colors that character-ize the rainbow. The center of the curve, the sun, and he conclusion in the call of the conclusion of t rainbow to appear. The physical conditions necessary to produce the rainbow may have first occurred as stated in the Scriptures. Scriptural truths and the truths of nature never conflict, although our interpro tation of the former often creates an apparent contra diction. 2. We do not know what is the cause of the nhenomenon noted. 3. We cannot guess, but a good engineer should be able to determine by examination.

G. C. H. says: W W' represent two weights of equal heft and size; one is suspended by two wire ropes, C C, the other by one continuous rope C', passing under pulleys with smooth flat faces. Some assume that these methods of suspension are equally strong others assert that the continuous rope will break quick.



Which is the strongest, if there be any difference? An swer: There would be no difference in the amount of strain on the rope, and one would be just as likely to part as the other, if the ropes are equally strong. The tension on C'must be equal throughout, at A as well as elsewhere, and equal to that on each part of C.

## [MAY 24, 1873.

F. O. C. says: 1. I claim that in order to get perfect combustion, you must not admit any more air under or through the fire than it will consume, for if you do, it will tend to deaden the fire, and to lose the heat that you would get if only the right quantity were ad-mitted. A friend claims that it does not matter how much air you admit to the fire, and that all the difference is, that the fireroars under my arrangement and not un-der the other; but still, he says, the fire is burning just as well as at first. 2. My friend says the classics are the foundation of everything in the matter of learning. I say they are not; and that, if a great part of the time spent on them were devoted to mathematics, mechanical drafting, drawing, natural philosophy and some other practical studies, there would be many less drones in the battle of life, and that we should have many more young men ready and willing to work. Many a father and mother will work to stuff their children with Latin, French and German; and when the parents drop by the way, dead, the children find their stay is gone. 3. My friend says the Christian Sabbath was not changed from the seventh to the first day of the week till a number of the seventh to the mist day of the week that in a number of centuries after Christ, and that by the Pope. I claim that Christ changed it when He arose from the dead, and that that day was in reality our Sabbath, and that it has been so regarded by historians ever since that time; and that nowhere in the New Testament, after the death of Christ, can you find it mentioned as any other than the first day of the week. 4. On page 251 of your current volume, the directions for making sealing wax do not say what the proportion of shellac should be. 5. A book on astronomy says that light moves 288,000 miles per second; I claim that it is from 188,000 to 192,000. Which is right? Answers: 1. Were it possible to reduce the temperature of escaping gases to that at which they en-tered the furnace, your friend would be correct. Actually, however, he is wrong. It is, however, found usu-ally necessary to supply about twice the quantity of air required to combine with the fuel, in order that complete combustion may take place. The excess causes some loss, but it is not so scrious as would be the loss from incomplete combustion, were a less quantity supplied. About 12 pounds of air per pound of fuel would be sufficient, could time be given it to find and unite with every atom of fuel. It is, however, necessary to supply usually 24 pounds, although in some cases of forced draft the quantity has been brought as low as 18 pounds. 2. To a man of fortune, or to the man who proposes to devote his life to study, we should say that his education would be incomplete did it not include a knowledge of the classics. To the man of business, to the working man, or to any one who must depend upon his own intelligence, energy and education for support and for success in life, we should commend a thoroughly practical, technical course of study. Were we desir-ous of fitting a son for a high position as a workman, and to take a valuable position as superintendent of a manufactory, we should send him to rome such school as the industrial School at Worcester, Mass. If he aspired to excellence as a professional mechanical engineer, we might give him a higher course of study in such a school of engineering as that of the Stevens Institute of Technology, at Hoboken, that of the Massachusetts Institute of Technology, in Boston, or that of the Sheffield School, at New Haven. To make him a good civil engi-neer, we should go to a special school of engineering like that at Troy, N. Y. The necessity of such schools has long been seen by us, and in answer to the rising demand they are springing up all over our country. Their success is one of the most encouraging signs of the times. 3. Your friend is about right. The change, how-ever, was a gradual one, beginning with the time of Constantine the Great, in the fourth century. 4. Six ounces 5. You are right.

E. W. G. says: 1. I have two engines run ning a circular saw mili. They have cylinders 8x22, set about 5 feet apart and connected by a crankon each end of shaft. The boller is an upright tubular. The steam pipe is 2 inches, about 30 feet from boller to near the cylinders; then it branches to each steam chest with 1% inch pipe. The question is: Is this 2 inch pipe large enoughfor the main pipe, and the 1% inch for the branch es? 2. The regulator valve is about half way along the main pipe; would it be better nearer the engines or the boiler? S. My steam gage shows 10 lbs. when at rest, and we usually run the engines at 60 lbs. by it. Do we really have 60 lbs., or only 50 lbs.? Is there any way of adjusting the gage? Answer: 1. We should make the main pipe about 2% inches diameter, and perhaps 3 inches, if the engine were running at high speed, and the branches 2 inches. 2. The regulator should always be as near thecylinder as possible. 3. Probably 50 lbs. Have the gage tested if you would be safe.

L. P. C. says: I would like to know how large a round chimney would be required for a boller with 38 three inch tubes. In other words, ought the chimney to contain the same number of inches in its area as the sum of theareas of the tubes? Answer: The chimney is usually made of somewhat less cross area than the collective cross section of the tubes. A common proportion, when natural draft is employed, gives the area over bridge wall one eighth the area of grate, one ninth through the tubes, and one tenth in the chimney.

H. B. B. says: I have a saw mill with 54 inch saw; the engine is of 11 inches bore x 4 feet stroke. There is a drum of wood 12 feet in diameter, connecting with countershaft, on which is a small drum, 22 inches in diameter, and a large drum about 3 feet in diameter. I use two cylinderboilers, no flues, \$4 inches in diameter and 24 feet long, and have considerable trouble in kceping up steam, with wood sometimes partly wet. The smoke stack is of iron, 26 inches diameter and 30 feet long What kind of grate surface should I have to burn saw dust and wet wood? Would a blast of air or steam help it? Which is best of the two, and at what point and in what way should it be applied? How many revolutions perminute should the saw make cutting soft cypress timber, and how much feed should there be to each revolution? Answer: Runthe saw about 60? revolutions per minute. There are many devices for burning wet saw dust and spent tan bark, few of them satisfactory, however. A blast must be used to burn them on ordinary grates, but it is better to make special furnaces for with large area of grate, and with provision for them. drying them before burning, and allowing considerable air to enter above the grate. S. B. E.asks: What injury, if any, would there be in oiling locomotives and other machinery with hot oil, say at boiling point? Which lens would be best fora ministure bull's eye lantern with very small fiame, plano-convex or double convex? Answers: 1. There should be no injury to the machinery from the high temperature, upless where the parts are case hardened. But hot oli has less body than cold, and would be less valuable as a lubricant. Using hot oil would compel running journal brasses quite slack, to prevent binding and overheating in consequence of expansion with the heat. 2. Plano-convex, with plane side toward th Cource of light

er at A, than the two ropes, C C, for reason that the

Hand Fire Engines, Frice about to ac, ou. Also, over 800 different Style Pumps for Tanners, Paper Mills, and Fire Purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

The Best Smutter and Separator Combined n America. Address M. Deal & Co., Bucyrus, Ohio

Steam Boiler and Pipe Covering—Economy Safety, and Durability. Saves from ten to twenty pe cent. Chalmers Spence Company, foot East 9th St., New York-1202 N. 2d St., St. Louis, Mo

Damper Regulators and Gage Cocks-For the best, address Murrill & Keizer, Baltimore, Md.

The Berryman Heater and Regulator for Steam Bollers-No one using Steam Bollers can afford to be without them. I. B. Davis & Co.

Circular Saw Mills, with Lane's Patent Sets; more than 1200 in operation. Send for descriptive pam phlet and price list. Lane, Pitkin & Brock, Montpe ier, Vermont.

Tree Pruners and Saw Mill Tools, improve-ments. Send for circulars. G.A.Prescott, Sandy Hill, N.Y.

Brown's Coalyard Quarry & Contractors' Apparatus forhoistingand conveying material by iron cable, W.D.Andrews & Bro. 414 Water st.N.Y.

Steam Fire Engines, R.J. Gould, Newark, N.J. Cabinet Makers' Machinery. T.R.Bailey&Vail.

Boring Machine for Pulleys-no limit to apacity. T. R. Bailey & Vail, Lockport, N. Y capacity.

naking hard soap for toilet use. say about 25 lbs. tity, colored and perfumed.

> W. H. R. asks: Can magnesium be obtained in a finely comminuted state? If so, where and at what price, and how are its characteristic qualities affected a

W. F.H. asks for the best method of cleaning empty cider barrels so that they will h wanted for use in the next fall.

J. H. W. asks: 1. If 100 gallons of proof spirit are mixed with 100 gallons of water, what will be the degree below proof and what the gravity? 2. How many gallons of water arerequired to reduce 100 gallons of spirit of 60 above proof to a spirit 20 below proof 3. Is there a rule for reducing a high proof liquor with one of lower proof?

B. L. B. asks: Is the temper of steel knives mpaired by cuttin apples or other fruit? If so, why?

B. L. B. says : I have noticed that my varnish (gum shellac and alcohol), after standing a while in tin cups, becomes of a dark muddy color. Does the tin affect it?

J. W. K. asks: Would there be any advan tage in using dry sponge as a filling for waterproof life preservers, rafts, etc.? Could sponge itself be made waterproof, so as to retain the buoyant properties of dry sponge?

J. B. P. says: A circular sawing machine, run by one or two men with cranks, has two light balance wheels, 29 inches in diameter. Would there be gain,orloss, by placing a large balance wheel beneath the floor, connected by a belt with the machine? If such a change is advisable, what size and weight of wheel wouldbe necessary? We use an 8 inch saw. Answer: We should not anticipate a gain, and the friction of the added apparatus would cause loss of power.

R. & S. say: We are running an engine 7 inches x 12, cutting off steam at half stroke, and running 175 revolutions per minute; we use a 20 horse power boiler, and carry 70 lbs. of steam. Please state how many lbs. of steam we should carry to give one half of the power as described above, and also how we should run the engine to produce its full power. Answer: Anwered in part on page 257 of our current volume. Probably 40 lbs.steam would give about half power. It can only be determined with certainty by the indicator of dynamometer.

E. says: One of our workmen from England gave us the following recipe for removing scale from boilers. Is there anything injurious to the iron or ob jectionable otherwise? Slbs. gum catechu, Slbs. black lead, 6 lbs. crystals soda. Answer: The mixture would do no harm, probably, unless when used in excess; the decomposition of the gum should produce vegetable acids. Let us know, if it succeeds, what kind of water you have, and the nature of the scale.

A. V. K. asks: How can the horse power of a boller of given dimensions be ascertained? Answer: Already answered in earlier numbers. Abont one horse power for each twelve feet of total heating surface is a common proportion in the bollers of good builders.

F. F. M. asks: 1. What diameter of cylinder and what length stroke must I give the engine for a horizoatal boiler 12 x 30, of ½ inch iron, with no flues? The engine is to run 100 to 150 per minute. 2. What pressure can ½ inch iron stand, and what horse power wouldsuch an engine be? Answer: 1. About a 1½ or 1½ inch cylinder by 8 or 4 inch stroke. 2. It would be safe, if the heads were well secured and work well done, at 175 lbs. 3. Perhaps ½ horse power.

H. C. J. asks: 1. Will a boiler, under which there may be the usual amount of fire, make or lose steam if the blow off or safety valve is suddenly opened wide, or the engine started in the same way. 2. Have you ever published a report of a trial in regard to loss of weight and heat in coal from being stored in the open air? If so, please tell me where I can find it. Answer: 1. The rapidity of generation of steam would be temporarily increased by opening the safety valve or increasing the speed of engine. The pressure would not be increased, although the mass of steam in motion may carry a quantity of water with it sufficient to strike a dangerous blow upon any surface against which it may be thrown. 2. We cannot call to mind any such trial.

J. T. says: I cannot understand the answer to the crankquestion: 1. What do you mean by a line perpendicular to both the lines of the shaft and of the crank? 2. Have I found the proper thickness of cylin ders in the two following cases, according to Van Buren's formula,  $t=03 \sqrt{DP}$ ? A 10 inch cylinder with 90 ble. pressure, I found to be 0.9 inches, and a 72 inch cyl-inder with 25 lb., pressure, 1.27. 3. Please give me a plain, simple rule for obtaining the right size of a wrought iron connecting rod for any pressure of steam and (4) also the right diameter and length of a parallel wrought bar to resist any pressure without deflexion. 5. Piease let me know where you get the 806,000 when calculating the collapse of flues. 6. How does Van Buren arrive at hisformula? In your answer draw all your rea soning right from the foundation or the strength of the material, so that I may know where and how every num ber is found. Answers: P. Put on another crankatright angles to the first, and it will be at right angles both to thatcrankand to the line of shaft. 2. We make  $03 \sqrt{DP}$ -0.9 and -1:33 for the two examples. 3. We know of no simpler rule than that given by Professor Thurston, in an

approximate formula:  $d = \sqrt{\frac{D^2pb^2}{20000}} + \frac{1}{60}D$ . Rule: Mul-

tiply together the square of the diameter of cylinder in inches, the maximum steam pressure, and the square of the length of the rod in feet, between centers; divide the product by 20,000 and extract the fourth root of the quotient. Add  $_{s\,\overline{s}}^{2}$  D, and the result is the diameter of the rod in inches at its middle. 4. No rod can be made to bear any pressure with absolutely no deflection. 5 806,000 is a coefficient derived by Mr. Fairbairnfrom experiment. 6. Van Buren's formulas are based upon the results of experiments made by trustworthy authorities, and by comparison with the experience of practical appl!cation.

J. G. H. says: I am using 3 plain cylinder boilers for grinding purposes, with a plain elide valve engine which works very well. The objection is that we use too much wood. Two of the boilers are side by side: the third is separated by a brick wall, and so con structed that we can shut off the feed water and steam connections, and use 2 boilers only; but we cannot keep up steam unless we have the best wood. What I wish to know is: Would it be safe to leave, and should I gain power by leaving, the steam pipe open from the boiler ith the feed pipe shut off and no fire under it? it answer for a steam dome, it being level with the boller, or would it be dangerous and disadvantageous What is the cause of the smoke stack getting red hot It is 3 inches in diameter, of 1/4 inch iron, 25 feet long horizontally, then 4 feet high. Answer: The trouble is, first, that a plain slide valve is not an economical ar rangement, although eminently satisfactory on the score of expense for repairs. If it has lap enough to cutoffatabouttwo thirdsstroke, and both piston and valves are tight, nothing can be done to improve it, prob ably. If the steam pipe and cylinder are lagged, to pre vent radiation of heatfrom them, the exterior is probably all right. The boilers have too little heating surface in proportion to the amount of wood burned, and there fore cannot absorb the heat generated which correquently escapes through the smoke stack, heating it as described. More heating surface is wanted. The arrangement proposed to increase steam space would, probably, simply result in filling that boiler with water rom condensed steam and priming. It would be better to keep both steam and feed pipes open, but even then we should not expect, on the whole, an advantage.

H. T. L. asks: How can I estimate centrif. ugal force? For instance, what will be the centrifugal force of a one pound weight, revolving at 100 revolutions per minute in a 4 foot circle around a perpendicular shaft, and what is the rule by which I can get at the force of any weight at any speed in any circle? Please give me an arithmetical answer, as I do not understand algebra Answer: Multiply the square of the number of revolutions per minute by the radius of the circle in which the body swings, and by its weight in pounds, and divide the pro duct by 100,000. Thirty-three times the resulting figure will be the centrifugal force in pounds. This rule, exalgebraically is: F-00038WRN<sup>2</sup>. In this case  $00038 \times 1 \times 2 \times 100 \times 100 = 6.6$  lbs. If our correspondent wer to take the time and do some hard work in learning the principles of algebra, he would never regret such use of his time. A little patience and earnest effort would ac complish a great deal even without teachers. W. W. says: 1. My employers and I appeal to you to decide a question about the horse power of a first class horizontal steam engine, cutting off steam a a point that will give it the most power. The size of cylinderis 10x18, pressure of steam 60 lbs. at boiler; the engine runs at 80 revolutions per minute, or 240 feet speed of platon; there is a 2 inch steam pipe 8 feet long. We are about ordering a new engine of a good firm, whence this dispute has arisen. I maintain it will give us nearly 20 horse power, if properly constructed. They say I am greatly in error in overestimating it. I also maintain that, if we speed it up to 100 revolutions, it will give us 24 horse power. 2. I would also like to know your opinion as to the most economical coalto use under a 25 horse power boiler (tubular) with a good draft. We are using large Lehigh. It is thought that a cheaper coal would be better. Answers: 1. We think our correct pondent right on the question of power. 2. It is generally economy to use the best coal. The difference in price is arely sufficient to compensate for the difference in heating power, and for the annoyances attending the use of poor coal.

C. S. C. 88Y8: I have a small English toy locomotive, and I cannot make it go. It is eighteen inches in length, and runs on eight wheels; two of them are the drivers. The cylinders are about two inches, and oscillate from the end. The trouble is as follows: When I get up steam sufficiently to run it, I turn on steam, but the engine will not go; if I lift it up so that it will not touch the track, the wheels go around with lightning speed; but as soon as I let it down on the track, they stop. I always keep onsufficient quantity of steam. Can you suggest a remedy? Answer: Probably the valve may, be set with too much lead.

D. K. asks for an explanation of the phe-omena of polar attraction and magnetic variation. In this latitude, 40° N., variation west has increased 1° in fourteen years. Why is it that the annual precession is not the same everywhere? As you are supposed to know everything, I think that you can give a more sat isfactory explanation than can be found in ordinary treatises on surveying. Answer: The directions of the magnetic and the geographical or true meridian do not coincide because the geographical and magnetic poles are many miles apart. The variation is westerly in the eastern states, and easterly in the western states. The line of no variation is nearly straight, passing in a north northwest direction from the extreme eastern point of South America, through Cape Hatteras, Cleveland, O., and Erie, Fa. The changes of variation are secular, annual, diurnal, and irregular. The latter may be comparatively great, are liable to occur at any time and are subject to no known law. The diurnal change though small in amount-a quarter of a degree at most -is quite enough to produce annoying differences in surveys of thesame line taken at different times of the day. This change of a quarter degree amounts to about 25 feet in a mile. Aunual changes of this diurnal variation are noticeable, this change being twice as great in summer as in winter. The secular variation extends over a period of centuries, and the amount of this change is, in Paris, where it has been longest observed, over 34 degrees. These changes correspond to and ac-company the solar movements. The irregular are frequently-although not invariably-produced by solar phenomena. The diurnal accompany the rotation of the earth, which thus presents its sides successively to the sun's rays; the annual follow the motion of the earthinher orbit, and the secular probably have a close correspondence in period with secular changes in the relation of the sun and the earth. These variations have different magnitudes at different points on the earth' surface, in consequence of the fact, already stated, that the geographical and magnetic poles and meridians do not coincide; and hence, while the needle at Cape Hat-terasmaypoint north, at the north pole it would point south. The north magnetic pole is in 70° N. lat. in the Earl of Ross Strait. If our correspondent will trace meridian from it on a globe, he will readily solve all the problems which occur to him.

J. R. L. Says: We have a gin connected with our mill. Is it possible to extinguish fire in a lint room with steam? If so, how should it be applied, with stationarypipeentering at bottom or top of room, or with hose? We only use forty pounds steam when ginning. 2. In cleaning out the furnace, I notice drops of water standing at one seam of boiler; is that a sign of rust or burning? It is clean and smooth inside. No

rust or burning? It is clean and smooth inside. No waterrunt after the fire is started. Answers: 1. Steam will extinguish fire in a lint room, or in any other apartoughly pervade the enclosed space. It would be best applied by leading pipes into the room and making them fixtures. In an emergency a hose pipe could be thrust through a small hole cut in the door or a partition, and steam carried by hose, of gum or well greased leather. The nozzle should, of course, be covered with canvas or other covering to enable it to be handled. For typounds pressure, or even four, would be ample for the purpose. 2. No.

H. S. M. wishes to know where an indicator can be purchased, what it will probably cost, how it should be applied, and what theresuitwill be. Answer: A treatise upon the construction, method of application, and the interpretation of the diagrams obtained by the steamengine indicator, would occupy far too much space for our columns. We have prepared a brief sketch for the general reader, but for such full accounts as every engineer should make himself familiar with, our correspondent must consult some such work as that of Chas. T. Porter on the Richards indicator. to be obtained through any bookseller. The instrument can be purchased of Elliott, of i ondon, or of the dealers in engineer's supplies in New York or Boston. A pair of good instruments cost about a hundred dollars.

C. B. N. sends the following solution of the problem proposed by E. C. M., who said: "A body weighing 5 lbs. descends vertically and draws a weight of 6 lbs. up a plane whose inclination is 45°," and wishes to know "how far the first body will descend in ten seconds." Let A BC, in the figure, represent the inclined



laws of falling bodies that the spacethrough which the body fails is equal to the acceleration multiplied by the square of the time and divided by two, or  $\lambda = \frac{1}{2}at^2$ . Substituting in this the value given for  $t (=10 \ \text{second} s)$  and the value of a from equation 4, we have: The distance  $= \lambda = 2\cdot 63 \times 100 + 2 =$ 181'5 feet. The principles involved in this problem are substantially the same as those upon which the action of the well known Atwood's machine is explained. Dyeing aniline black, J. Higgia...... Eggbeater, N. C. Miller..... Elevator, grain, H. Merrill. Evelte, S. W. Young.... Fabric selvages, uniting, T. Beven... File, paper, R. Henning.... File, paper, R. Henning...

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated :

H. W.-Bothare crystaline hornblende, of no value.

T. F.A.-Iron pyrites, of no value.

## COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects: On Fast Side Wheel Steamers. By M. N. L. On the Million Dollar Telescope. By O. M. and by F. C. V. On a Vacuum Balloon. By F. On Deep Sea Soundings. By H. N. C. On Increasing the Crops. By A. W. On Diving Bells. By Q. On the Wheel Question. By H. S. On the Aurora Borealis. By. A. C. C. On Air and Gas Engines. By F. G. W.

On Sugar Boiling Apparatus. By A.W. J. M. On Plows. By L. L. B.

On the Sea Urchin. By P. S.

On Tannate of Soda. By N. S. T.

On a Boiler Explosion. By W.J.S.

On Deep Sea Soundings. By A. R. On Science and Revelation. By J. W.

Also enquiries from the following :

E.J. M.-S. W. J.-E. W.-G. W. T.-H. N. J.-A. R. -D. J. R.-L. P. A.-C. F. S.-G. F. M.-C. M.B.-M. K. -C. K. C.-B. H. G.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amountsufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

## [OFFICIAL.] Index of Inventions FOR WHICH

FOR WHICH

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plane, and H and K the weights, jcined by a cord which ( works over a pulley at C. Let 1-length of the plane, ( h-hight of the plane. From H, draw a line H E, per-

pendicular to A B and let it represent the pressure of the weightat H. Then resolve H E into components, H F and F E, parallel and perpendicular to B C. The component F E will be counteracted by the reaction of the plane and only the component H F will produce tension on the cord. To find the value of H F, we have, HE: HF::1:h; or 6: IIF::  $\sqrt{2}$ : 1; or, HF-6+  $\sqrt{2}$ =3  $\sqrt{2}$ . To find the acceleration of the descending weight at K, we have the general principle that the mass multiplied by the acceleration is equal to the moving force: or,

representing the acceleration by a, Ma=f, or a= $\frac{\tau}{M}$  (1.)

In this case, f, the moving force, is the difference between the weight at K and HF, or f-5-(3  $\sqrt{2}$ ). (2.) The whole mass moved is equal to the sum of the weights K and H F divided by g, the acceleration due to gravity; D or  $M = (5+3 \sqrt{2})+g$ ; or, since  $g=32\frac{1}{2}$  feet at New York, H  $M = (5+3 \sqrt{2})+32\frac{1}{2}$ . (3.) Substituting the values of f and M (equations 2 and 3) in equation 1, we have  $a = \frac{f}{M} = (5-3 \sqrt{2})$  $+(5+3 \sqrt{2})\times32\frac{1}{2}=2\cdot63$  feet. 4.) Again we have from the

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Cultivator, J. Helm 138,085	Shoe fastening, I. Banister 189,117
Curtain fixture, T. Symonds 138,054	Shoemaker's finishing tool, Wilson & Foster 139,068
Curtain roller holder, B. G. Fitzhugh 138,014	Sizing compound, T. Gorrel 138,147
Cutter bars, holding, W. H. Daniels 138,136	Skate, roller, W. P. Gregg
Dentist's tool, C. P. Grout 138,150	Siate frames, finishing, J. H. & G. S. Coffin 138,005
Derrick, J. E. Walsh 138,215	Slate washer, W. Westlake 138,218
Desk and seat, A. E. Roberts 138,045	Snow shovel, H. C. Cole 138,076
Drawer, B. J. Greely 138,017	Soda water cock, etc., W. Gee 138,143
Dredger, E. B. Bishop 137,998	Soda water fountain attachment, W. R. Cady 138,002
Drill,grain, J. King 138,166	Soldering apparatus, J. Gulden (r) 5,962
Door lock, J. Scott 138,048	Spikes, pointing, Waldron & Moore 138.058