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

F. F. M. asks: 1. What diameter of cylinder and what length stroke must I give the engine for a horizontal boiler 12 x 30, of ⅜ inch iron, with no flues? The engine is to run 100 to 150 per minute. 2. What pressure can ⅜ inch iron stand, and what horse power would such an engine be? Answer: 1. About a 1¼ or 1½ inch cylinder by 3 or 4 inch stroke. 2. It would be safe, if the heads were well secured and work well done, at 175 lbs. 3. Perhaps ¼ 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 crank question: 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 cylinders in the two following cases, according to Van Buren's formula, $t = \cdot 08 \sqrt{DP}$? A 10 inch cylinder with 90 lbs. pressure, I found to be 0·9 inches, and a 72 inch cylinder with 25 lbs. 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. Please let me know where you get the 806,000 when calculating the collapse of flues. 6. How does Van Buren arrive at his formula? In your answer draw all your reasoning right from the foundation or the strength of the material, so that I may know where and how every number is found. Answers: 1. Put on another crank at right angles to the first, and it will be at right angles both to that crank and to the line of shaft. 2. We make $\cdot 08 \sqrt{DP} = 0{\cdot}9$ and $= 1{\cdot}33$ for the two examples. 3. We know of no simpler rule than that given by Professor Thurston, in an approximate formula: $d = \sqrt[4]{\frac{D^2 p b^2}{20000}} + \frac{1}{60} D$. Rule: Multiply 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 $\frac{1}{60}$ 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. Fairbairn from 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 application.

J. G. H. says: I am using 3 plain cylinder boilers for grinding purposes, with a plain slide 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 constructed 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, with the feed pipe shut off and no fire under it? Would it answer for a steam dome, it being level with the boiler, 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 ¼ inch iron, 25 feet long horizontally, then 4 feet high. Answer: The trouble is, first, that a plain slide valve is not an economical arrangement, although eminently satisfactory on the score of expense for repairs. If it has lap enough to cut off at about two thirds stroke, and both piston and valves are tight, nothing can be done to improve it, probably. If the steam pipe and cylinder are lagged, to prevent radiation of heat from them, the exterior is probably all right. The boilers have too little heating surface in proportion to the amount of wood burned, and therefore cannot absorb the heat generated, which consequently 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 from 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 centrifugal 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 product by 100,000. Thirty-three times the resulting figure will be the centrifugal force in pounds. This rule, expressed algebraically is: $F = \cdot 00033 WRN^2$. In this case, $F = \cdot 00033 \times 1 \times 2 \times 100 \times 100 = 6{\cdot}6$ lbs. If our correspondent were 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 accomplish 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 at a point that will give it the most power. The size of cylinder is 10x18, pressure of steam 60 lbs. at boiler; the engine runs at 80 revolutions per minute, or 240 feet speed of piston; 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 coal to 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 correspondent right on the question of power. 2. It is generally economy to use the best coal. The difference in price is rarely sufficient to compensate for the difference in heating power, and for the annoyances attending the use of poor coal.

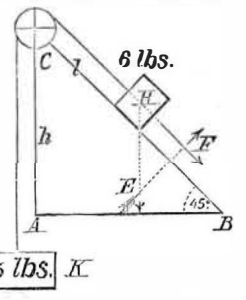
C. S. C. says: I have a small English toy locomotive, and I cannot make it go. It is eighteen inches in length, and runs on eight wheels; two of them are the drivers. The cylinders are about two inches, and oscillate from the end. The trouble is as follows: When I get up steam sufficiently to run it, 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 on sufficient 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 phenomena 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 satisfactory 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, Pa. 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 the same line taken at different times of the day. This change of a quarter degree amounts to about 25 feet in a mile. Annual 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 accompany 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 earth in her 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's 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 Hatteras may point 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 stationary pipe entering 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 water runs after the fire is started. Answers: 1. Steam will extinguish fire in a lint room, or in any other apartment where it can be sufficiently well confined to thoroughly 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. Forty pounds 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 the result will be. Answer: A treatise upon the construction, method of application, and the interpretation of the diagrams obtained by the steam engine 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 London, or of the dealers in engineers' 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 B C, in the figure, represent the inclined



plane, and H and K the weights, joined by a cord which works over a pulley at C. Let l—length of the plane, h—hight of the plane. From H, draw a line H E, perpendicular to A B and let it represent the pressure of the weight at 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 :: l : h; or 6 : HF :: $\sqrt{2}$: 1; or, HF = 6 ÷ $\sqrt{2}$ = 8 $\sqrt{2}$. 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 $a = \frac{f}{M}$ (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; or M = (5 + 3 $\sqrt{2}$) ÷ g; or, since g = 32⅛ feet at New York, M = (5 + 3 $\sqrt{2}$) ÷ 32⅛. (3.) Substituting the values of f and M (equations 2 and 3) in equation 1, we have $a = \frac{f}{M} = (5 - 3\sqrt{2}) \div (5 + 3\sqrt{2}) \times 32\frac{1}{8} = 2{\cdot}63$ feet. 4.) Again we have from the laws of falling bodies that the space through which the body falls is equal to the acceleration multiplied by the square of the time and divided by two, or $h = \frac{1}{2} a t^2$. Substituting in this the value given for t (=10 seconds) and the value of a from equation 4, we have: The distance = h = 2·63 × 100 ÷ 2 = 131·5 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.

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 amount sufficient 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

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

April 22, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents

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EXTENSIONS GRANTED.

23,750.—ANIMAL TRAP.—A. S. Blake.
23,771.—CUFFS, ETC.—W. E. Lockwood. Three patents.
23,792.—GAS PIPE CUTTER.—J. E. Stanwood.
23,795.—PUMP BOX.—F. & J. Stock.

DESIGNS PATENTED.

6,594.—CARPET.—J. Fisher, Enfield, Conn.
6,595.—COFFIN HANDLE.—N. Hayden, Essex, Conn.
6,596 to 6,602.—CARPETS.—H. Horan, Newark, N. J.
6,603.—REED ORGAN CASE.—J. R. Lomas, New Haven, Ct.
6,604 & 6,605.—CARPETS.—L. G. Malkin, New York city.
6,606 & 6,607.—CARPETS.—E. J. Ney, New York city.
6,608.—CARPET.—H. Nordmann, New York city.
6,609.—FRAME.—B. H. Slusser, L. Pearson, South Bend, Ind.
6,610 to 6,612.—CARPETS.—J. H. Smith, Enfield, Conn.

TRADE MARKS REGISTERED.

1,218.—SOAP.—R. W. Bell & Co., Buffalo, N. Y.
1,219 to 1,222.—WHISKIES.—Du Vivier & Co., N. Y. city.
1,223.—HAIR DRESSING.—E. A. E. Meyer, Watertown, N. Y.
1,224.—COSMETIC.—Miller Brothers, New York city.
1,225.—YEAST POWDER.—Preston & Merrill, Boston, Mass.
1,226.—STARCH.—Proctor & Gamble, Cincinnati, Ohio.
1,227.—CIGARS.—Seidenberg & Co., New Yok city.
1,228.—MINERAL WATER.—A. L. Kane, Milwaukee, Wis.
1,229.—FLOUR.—Jones, Williams & Faxon, Boston, Mass.
1,230.—GRINDING MILLS.—Straub Mill Co., Cincinnati, O.
1,231.—OPERA GLASSES, ETC.—Sussfield & Co., N. Y. city.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1851 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief, any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors 37 Park Row, New York.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information and for pamphlets of instruction and advice

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