S. H. D. says: 1. A safety plug to a steam boiler melted out when the boiler was being blown off; the fires were drawn and the steam gage indicated about 35 lbs. of steam: what was the cause? 2. Of what alloy or metal should a safety plug be composed? 3. How many years has the SCIENTIFIC AMERICAN been published? Answers: 1. It is quite probable that the iron was corroded around the plug, so that it was shaken out by the shock due to the contraction of the boiler. For a recipe for fusible metal, see p. 281, vol. 26. 3. The first number of the SCIENTIFIC AMERICAN was issued in August, 1845.

J. F. W. says: I wish to watch the inside of a small thin copper cylinder. Can I cut a slit in it, and then cement a piece of glass over the aperture so that it will stand 200 lbs to the square inch? I am afraid of unequal contraction and expansion. Could I cement it to any better advantage in a cast iron cylinder? Answer: The Committee of the Franklin Institute, who made experiments to determine the cause of boiler explosions, used a boiler having an opening covered with glass. We believe the glass was broken several times, under high pressures. Your best plan would probably be to make the joint with rubber.

E. J. C. asks: Will kerosene oil do in place of petroleum for steam boilers? Answer: We think not.

W. R. F. asks: 1. What is the best and cheapest way of making an exhaust air blower, to take the dust from a small emery grinder? 2. What is the cause of the clinking noise heard in cold steam pipes when steam is let on? 3. When does the Fair of the American Institute close? Answers: 1. It can be done by enclosing a shaft with vanes, in a box, having suitable openings. It will probably be more satisfactory for you to purchase a blower from an established manufacturer. 2. It is caused by the impulse of the condensed steam acting in a vacuum, and by the movement of the pipe as it expands. 3. On November 15, unless extended for one week by vote of the Board of Managers.

J. F. C. asks: 1. Could not drills be used with a rotary movement in boring rock, as is done in boring metals? 2. Could not some form of acid or solvent be used to facilitate the boring of rock? 3. What are the comparative advantages of the different forms of explosives for practical use in blasting? 4. In clearing fields of stone, would it save labor to use the more powerful explosives instead of ordinary blasting powder? Answers: 1. They would get dull too quickly. 2. Agents that would soften the rock might perform the same office for the drills, and in any case the process would probably be too expensive for general use. 3. Giant gunpowder is probably the most economical. 4. Yes.

J. R., Jr. asks: 1. What is the longest distance you have known steam to be conveyed from the boiler to the engine, as for steam pumps in shafts and mines? 2. How far do you think it could be conveyed to have an available working force, from a boiler of 125 lbs. pressure, if well boxed and packed? We wish to place a pump about 2,500 feet from the boiler. Answer: We think you can carry out this plan successfully if you use a large pipe, protect it carefully, arrange expansion joints at suitable intervals, and put in efficient traps to carry off the water. We advise you to have plans prepared by a competent engineer before putting up the pipe.

F. H. C. asks: What is the nominal horse power of the largest steamer on Long Island Sound, also what is the indicated horse power? Answer: Nominal horse power, by English Admiralty rule, 580. Indicated horse power, about 3,000.

C. J. H. asks: 1. At what surface speed should I run common emery wheels (wood covered with leather) to get the best result in grinding and polishing malleable cast iron? 2. Is there any better way to attach emery to leather, than with good glue? 3. Where is the best (sharpest) emery obtained from? 4. Can corundum be obtained in market, in grades like emery? Is it superior to emery in abrasive qualities, enough so to pay for the difference in cost? Answers: 1. About ¾ of a mile a minute. 2. We think so. 3 and 4. Where emery secured to leather is used, it stays on so short a time that the cheap grades of emery answer as well as the better qualities. Corundum can be obtained, but its use is not recommended in this case, for the reason given above.

M. W. says: By accident I got some zinc mixed with type metal. How can I separate them or can they be made to work together? There is only a small amount of zinc in it, just enough to give it the appearance of cold metal in the cast. Answer: The zinc can probably be separated by vaporizing it. This is, however, a rather difficult operation, and you will scarcely succeed unless you have had some experience in the method.

Y. E. asks: 1. In calculating the horse power of a boiler, do you count any of the breeching, or do you count nothing but the actual fire surface of the boiler? 2. What is the best dress to put on a circular saw when cutting pine timber? 3. How is naphtha oil manufactured? 4. What is benzine made from? 5. What horse power has an engine of the following dimensions: Cylinder 9 x 16 inches, working at 68 revolutions per minute, with a pressure of 70 lbs. to the square inch? 5. Did the great transatlantic balloon burst from the high pressure of gas, or did Professor Donaldson cut a hole in it? Answers: 1. Take only the effective heating surface. 2. It is hard to give a general rule, as much depends on the size and quality of the timber. 3. It is a natural product similar to petroleum. 4. It is ordinarily prepared from coal tar oil. 5. The data furnished are incomplete. Probably the mean pressure of steam is not 70 lbs., and there are some deductions to be made for back pressure and cushion. But using these figures, we have horse power = $68 \cdot 6 \times 70 \times 68 \times 2 \times 16 \div 33{,}000 \times 12 = 22 \cdot 7$ nearly. 6. We expect no one but Mr. Donaldson could give a correct reply to this question.

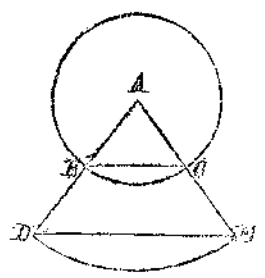
C. D. M. asks: 1. What horse power would a propeller engine, 8 inches in diameter x 8 inches stroke, have? 2. Would you advise using a square water tube boiler to supply steam for the above engine? It is to be used in a small yacht, 40 feet keel x 10 feet beam. 3. How large ought a boiler to be for this engine? Answers: 1. It depends on piston speed and steam pressure. 2. We think you had better use a cylindrical boiler, of the same general character as those now used on ocean steamers. 3. Allow from 18 to 20 square feet of heating surface per horse power.

J. S. asks: In constructing a compound microscope, what are the focal distances and diameters of the glasses to be used, to produce a magnifying power of 80? What are the distances that the glasses should be placed from each other? Answer: Use for the object glass a plano-convex lens, ⅛ inch focus, with its plane side towards the object and its aperture one fifteenth of an inch. At the distance of about 6 inches from this glass, place the eye glass, which, in its simplest form, is a double convex lens. The magnifying power can be increased somewhat by increasing the distance by means of a draw tube between the eye glass and the object glass, but this is at the sacrifice of distinctness.

G. K. M. asks: How can I make paint adhere to zinc? Answer: Dissolve 1 oz. nitrate of copper and 1 oz. sal ammoniac, in 64 ozs. water. Then add 1 oz. hydrochloric acid. Apply this mixture to the zinc; and when it is dry, paint it, using mineral paint. M. M. M. should use this recipe for painting galvanized iron.

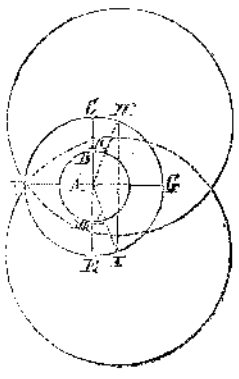
D. H. S. Jr. asks: 1. In fastening pulleys or straight gear to vertical shafting, ought the keys to be driven up or down? In securing bevel gear, ought the keys to be driven with or contrary to the thrust? By thrust I mean the tendency of the wheel to push out of mesh. 2, What scale of measurement is used in expressing the gage of a saw? Answers: 1. Drive the key so that the thrust of the wheel tends to tighten it. 2. There is a great lack of uniformity on the gage question, in the practice of different manufacturers. In ordering a saw, it is best to write to the maker and request him him to send a cut of the gage he uses.

J. O. R. asks: Will you please give a formula for finding the length of a lever for working a roll valve, diameter of steam chest, travel of valve and throw of eccentric being known? Answer: Let the circle described with A B as a radius represent the steam chest. Knowing the travel of the valve, the chord B C can be found. Then the chord, D E, which represents the throw of the eccentric, being given, A E, the length of



lever can be found by a simple proportion. Example: Diameter of steam chest = 6 inches. Travel of valve = 5 inches. Throw of eccentric = 11 inches. Angle B A C = $5 \times 360 \div 18 \cdot 8496 = 95°30'$ nearly. Chord B C = $6 \times 0 \cdot 672 = 4 \cdot 032$ inches. Lever A E = $3 \times 11 \div 4 \cdot 032 = 8 \cdot 18$ inches.

H. R., S. H., and H. C. say: Locomotive eccentrics sometimes slip round upon the shaft. Bourne, in his "Catechism of the Steam Engine," gives the following rule: "Draw upon a board two straight lines at right angles to one another, and from their point of intersection as a center describe two circles, one representing the circle of the eccentric, the other the crank shaft; draw a straight line parallel to one of the diameters, and distant from it the amount of the lap and lead; the points in which this parallel intersects the circle of the eccentric are the positions of the forward and backing eccentrics. Through these points draw straight lines from the center of the circle and mark the intersection of these lines with the circle of the crank shaft, measure with a pair of compasses the chord of the arc intercepted between either of these points, and the diameter which is at right angles with the crank, and the diameters being first marked on the shaft itself, then by transferring with the compasses the distances found in the diagram and marking the point, the eccentric may at any time be adjusted without difficulty." Can you make this a little clearer for us? Answer: In the accompanying diagram, let F G and E C be the two straight lines at right angles to each other, the circle described with A B as a radius be the end view of the shaft, the circle described with A C as a radius be the circle described by the center of the eccentrics, and H I the line parallel to E C, and distant from it the amount of the lap and lead. Then if F G represents the direction of the crank when on the center, H and I will be the positions of the centers of the eccentrics, according to the rule. If, then, the points K and L, in which the lines A H and A I intersect the circle representing the shaft, be transferred to the shaft, by laying off on its end the two diameters, and the chords B K and L M, the eccentrics can readily be set.



E. S. asks: Is hard rubber expansive in its nature when subjected to steam under pressure? Will an india rubber conical plug placed in a hole in the shell of a boiler, so that the steam pressure would make it faster in the plate, expand as fast as the hole increases in size by the expansion of the boiler? Answer: We think the proposed arrangement will answer the purpose very well.

R. asks: How can I take 4 or 5 copies of a letter written in copying ink? Answer: There are several varieties of copying ink in the market, which, their makers state, will take 5 or more copies; but you can probably make the ink you use at present effective by adding a little more sugar.

L. Z. R. says: I have a head of water of 7½ feet. During 3 months of winter, we cannot run, and I have tried means to use the water over again. Below me is a lake reservoir always full of water above is the lake which supplies my stream. My idea is to run a penstock, 4 feet deep and 3 feet wide, level with the lower lake, through and under my dam: and thence a penstock at right angles to this, 200 feet long, parallel to my dam. This admits the water of the lower lake in said penstock right into the water of the upper lake, whence it must be raised by power into the upper lake for use the second time. On this 200 feet (or longer if needed) penstock 12 or more large cheap windmills with 12 feet arms can be easily erected by simply driving 4 piles to form a frame; wood arms and sails would do, cheapness and strength being the only requisites. What kind of pump will discharge the most water, under 6½ feet head? I want simply a pump to raise the water from the penstock, discharging directly in the water above the penstock, the power being furnished by said windmills. Answer: Your plan is practicable, provided you can depend upon the wind. Probably simple piston pumps, double acting, will answer as well as anything.

H. says: I notice your answer to H. in reference to heating a room by gas. If a gas stove is put up properly, having not less than ⅜ inch connecting pipe, you can use it without any objectionable smell. There is, however, a great difference in gas stoves. In some, the combustion is more perfect than in others. The only secret is to have oxygen enough to mingle with the carbon to produce perfect combustion, free from odor.

R. A. M. says, in reply to C. M. N., who asked how to read the superscriptions on coins: Lay your coins upon a piece of hot iron; the dates will be so visible as to be plainly read. The iron must be red hot, and the coins must be read while hot.

H. says, in answer to S. W. G., who asked as to elevating water: A hydraulic ram is the most economical for your purpose. In order to elevate water 115 feet, you must have a fall of 12 feet from the spring or fountain head. You should excavate, at the exit of the springs, to 3 feet depth, and group together as many outlets of the springs as possible. Box the sides of the excavation with 2 inch plank and cover the same. Make a hole six inches square at the lower end of the box, in the trench or excavation. Cover this hole with a coarse wire gauze, conduct the water from this through a wooden box 4 inches square into a square box in which the ram should set, at the foot of the hill. Close the end of the wood supply pipe, and in this insert a piece of iron pipe 2 inches in diameter to connect with the ram. The supply or wood pipe should be from 25 to 50 feet long. This will take a No. 5 ram, which will receive from 6 to 14 gallons water per minute. The iron discharge pipe that runs up the hill to the reservoir should not be less than 1 inch. The end of this 1 inch pipe at the top of the hill should be inserted in a close, heavy, iron bound 10 gallon cask, at the lowest point. At the opposite point of the cask, insert another piece of pipe 1 inch in diameter, and continue to the fountain or reservoir. The cask is to equalize pressure. The ram will discharge one seventh of the water it receives into the reservoir. For every foot descent in the supply or drive pipe, you have a raising power of 10 feet in the discharge pipe. The object in having the discharge pipe large is to avoid friction; for when the pipes are smaller, there is more friction, the ram labors heavily and is more liable to get out of order. The box in which the ram sets should be made double, with a space of 10 inches, filled with sawdust, to prevent freezing. The discharge pipe and cask should be buried in the ground below freezing point. Avoid sharp angles.

T. L. M. says, in reply to several enquiries as to leaf printing: The bichromate of potash photographic process spoken of by your correspondent J. N. Q. gives but a faint picture, even after lengthened exposure to the sun. The image may be reddened by a dilute solution of nitrate of silver. Blue leaf prints are obtained by floating paper on a strong solution of ferricyanide of potassium, commercially called the red prussiate of potash. They are fixed by simple washing. By Obernetter's process, using salts of copper, pictures may be obtained in different tints of deep red and violet, with intermediate shades; but five different solutions are required, and the process, though not difficult, is rather tedious. Leaf prints of the greatest beauty and delicacy may easily be made by amateurs by the ordinary processes of photography on paper, scarcely any utensils being needed besides those found in any household. Make a solution of sixty grains of nitrate of silver and sixty grains nitrate of ammonia to the ounce of water. Float pieces of albumen paper, obtainable at any photographic supply store, on this solution for half a minute or a minute; pin up to dry in the dark. When dry, lay the paper on a thin board, the leaf on the albumen surface, and upon this a pane of glass. Fasten all together with spring clothes pins, and expose to the sun till the darkened albumen paper begins to show a metallic marbling; then remove from the glass, wash, immerse in a solution of chloride of gold. For a ten cent sheet of albumen paper, 18 by 22 inches, a grain and a half of chloride of gold is needful. Dissolve in a pint of warm water, add a teaspoonful of salt and a little chalk to remove the acidity; leave the washed leaf prints in this till they have assumed a pleasing shade (ten or fifteen minutes will be sufficient); then immerse ten minutes in a solution of hyposulphite of soda, two ounces in ten of water, remove and wash thoroughly; if possible, leave over night in running water. These prints are very pretty. In experimenting with them, I obtained beautiful results by soaking them in aniline dyes; the color does not show on the black ground, but the leaves shine out like exquisite paintings on ebony. The entire expense for chemicals (excepting the aniline colors) is $2.50, for this process; this will be enough for twenty square feet of pictures.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Electricity *vs.* Yellow Fever. By O.

On a New Theory of the Universe. By D. L. S.

On Cement Water Pipes. By M. S.

On Richmond, Va. By H. E. C.

On Compressed Air Cars. By J. P.

On Propylamin. By C. D. D.

Also enquiries from the following:

J. T. T.—J. M. S. Jr.—H. Z. T.—M. F.—C. W.—J. P. L.—F. D. B.—F. C. D.—J. M.—P. L.—S. N.—A. L. B.

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

October 28, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

27,020.—ENGINE EXHAUST PIPE.—G. Edwards. Jan. 14.
27,0?3.—CALENDAR CLOCK.—E. M. Mix *et al.* Jan. 14.
27,034.—HARVESTER.—J. Butler. Jan. 21.
27,319.—BENDING SHEET METAL.—O. W. Stow. Feb. 11.

EXTENSIONS GRANTED.

25,936.—CUT-OFF VALVE.—E. R. Arnold.
25,978.—TACKLE BLOCK.—I. E. Palmer.
25,984.—BIT BRACE.—N. Spofford.
26,003.—TELEGRAPHIC MACHINE.—G. M. Phelps.

DESIGNS PATENTED.

6,966.—TOY TARGET.—S. Hamm, Philadelphia, Pa.
6,9?7.—SPOON HANDLE.—B. D. Beiderhase, New York city.
6,968.—FLY TRAP.—D. K. Thompson, Clark, Pa.
6,969.—SPOON, ETC.—G. Wilkinson, Providence, R. I.

TRADE MARKS REGISTERED.

1,511.—SHINGLES.—L. M. M. Blakely. New York city.
1,512.—FLOUR.—Haxall & Co., Richmond, Va.
1,513.—FLOUR.—Haxall & Co., Richmond, Va.
1,514.—FISH.—Ocean Trout Co., Port Monmouth, N. J.
1,515.—GLASS SHADES, ETC.—S. J. Pardessus & Co., N.Y.

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