vessel. Two large gangways of extra width, provided with cranes, are also formed at each side for the landing of heavy timbers, plates, etc. The open sides admit of the air and light circulating freely round the work, so that paint dries and hardens much more quickly than in a sunken dock. From the same cause, repairs can be executed in a much more prompt and satisfactory manner than in a stone dock.

In exposed positions, it is proposed to submerge the dock entirely whenever it appears to be endangered by a cyclone or by stress of weather. The tubular sides afford great facilities for this operation; compressed air is pumped into them at leisure and kept stored up ready for use; after the dock is submerged, the opening of the valves will at any time allow it to expand and raise the dock to the surface. This use of stored-up power is also employed whenever it is desired to raise vessels rapidly—as, for example, in examining bottoms or screws; the power being stored up and ready for use, the docking of a vessel occupies but little time; by opening communication with the water in the tubes, the air expands and expels the water, and the vessel is immediately raised.

Fig. 1 shows a general elevation of the dock, with a vessel supported upon it by bilge blocks and shoring frames; Fig. 2 shows an end elevation and section of the same.

The floating dock appears to occupy an intermediate place between the old stone graving dock and the hydraulic lift dock. Where the number of vessels to be lifted is very great, preference will probably be given to the latter; but the floating dock has advantages of its own. In the first place, its greatly reduced cost renders it suitable for many positions in which the business is insufficient to warrant the cost of a stone dock or an hydraulic lift dock. There are several cases in which floating docks of the ordinary construction are paying dividends of 20 or 30 per cent, in positions in which stone docks would be impossible, or in which their cost would entirely preclude their adoption. It is not always easy to find a suitable position for an ordinary graving dock, and even the hydraulic lift system requires water of a certain limited depth; but a floating dock can be placed anywhere where there is sufficient depth for a vessel to approach, and can be transported from place to place. It has been stated that the tubular dock is raised and lowered by pneumatic means; there is, of course, no theoretical reason why it should not be worked by ordinary water pumps in the usual manner.

Floating docks appear likely to be applied in future to another purpose, to which sufficient attention has hitherto not been drawn. We allude to their employment as building slips for the construction or lengthening of vessels. On the ordinary system it is necessary that a building yard should be closely adjoining deep water, and that the vessel should be constructed and launched on inclined ways, a process not always devoid of risk. By building on pontoons this risk is almost entirely avoided; any shallow river or creek may be utilized, whatever its distance from deep water, and the ways may be laid on a pontoon, either floating in shallow water or resting on the ground in a shallow dry dock temporarily prepared for the purpose; and when the vessel is ready for launching, the water may be admitted to the dock, the valves closed, and the vessel floated out into deep water. In fact, floating docks have not yet assumed their proper place in the naval service. Constructed often in a temporary manner of wood or iron, and from imperfect designs, they have sometimes met with indifferent success or even with disaster; but experience has shown at once both their defects and their merits, and there is no doubt they are destined in future to become one of the most important elements both in navigation and in naval construction.—*Naval Science.*

Correspondence.

The Second Mill River Disaster.

To the Editor of the Scientific American:

I have seen, in one of your city papers, concerning the late break in Hayden, Gere & Co.'s dam on Mill river, the question: If a dam constructed as this one was is not safe, what can be built that will stand?

The dimensions of the dam as stated were: Length 141 feet; width at base, 13 feet; width at top, 6 feet; head of water, 20 feet. I consider those proportions entirely inadequate for that head of water. A dam for a head of 20 feet should have at least 30 feet width of base up stream, from a right angle with the breast or break-over of the water; and whatever width is given to the wall on top must be added to the length of base, thus: If the wall is 6 feet wide at top, the base must be 36 feet, provided the front wall is plumb; if it is angled, the base must be made still wider to suit; but the main things are to make the base up stream at least 1½ feet for every foot in hight of head, and to make the upper wall or sheeting as tight as possible, leaving the front comparatively open; for if the front wall is made perfectly tight and the other loose or open, the pressure really comes on the front wall, as the balance of the work is made much lighter by being in the water. By this way of building a dam, the weight of the water bears down on the work and not against it, as it does on a wall narrow at the base.

We have a dam here, built in 1852. It is 100 feet between the abutments, with a head of 20 feet. It is built of pine timber, on the above described principle; but it is constructed of trestle work, each trestle being entirely independent of the others, except as to sheathing plank laid across them; and they are in no way anchored to the abutments. It has never needed any repairs, and has never shown the least sign of moving. A. W. IRWIN.

Arroyo, Elk county, Pa.

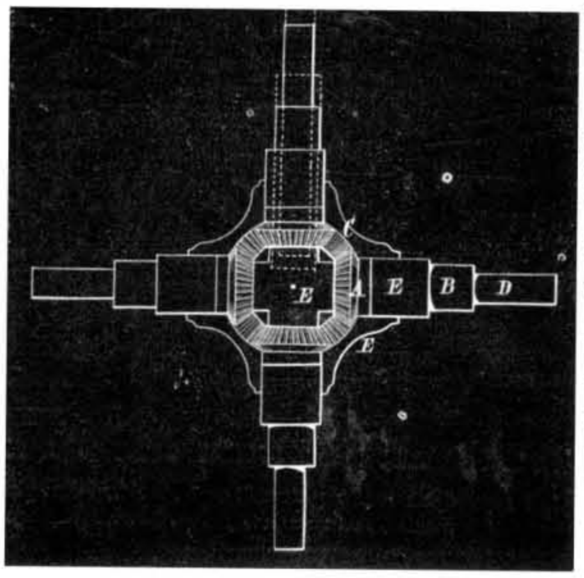
Placing Engine Cylinders in Line.

To the Editor of the Scientific American:

I notice a query in a late issue of your journal as to the best method of placing locomotive cylinders in line.

The most approved modern practice leaves but little to do in placing a cylinder in line, either in stationary or locomotive work, after the cylinder and its bedpiece leave the lathe and planer, except to test the accuracy of the draftsmen and machinists. If the machinists have accurate vertical and horizontal plan drawings for their guide, and work exactly accordingly, no after cutting or trimming will be needed to bring the cylinder into line. In locomotive work, one of the most difficult jobs is to fit the bedpiece to the boiler so that the two faces, upon which the cylinders are to be bolted, shall be exactly in their true position, which are usually indicated to the workman by the drawings.

In order to test the accuracy of the work after the bedpiece has been permanently fixed to the boiler, clamp a cylinder to its seat on the bedpiece and fit a wooden cross (with a pin hole through its center) to the bore of the cylinder at its front end; then pass a fine strong line through the hole, and extend it back so that it shall occupy a point exactly at the intersection of the central line of the driver axle with the vertical plane of motion of the center of the crank pin and connecting rod: draw the line taut and fasten it in this position;



then apply calipers or a gage at the rear end of the cylinder, between the surface of the bore and the line, above and below and right and left of the line; and if the cylinder is in line, the four distances will of course be exactly the same. It is essential that the two horizontal distances should coincide exactly, and that the central lines of the two cylinders of a locomotive should be exactly parallel with each other, but for obvious reason the exact coincidence of the two vertical distances is not essential to the efficiency or correct working of the engine.

Instead of a wooden cross, as above mentioned, a more convenient instrument, made of metal, may be provided, consisting of four bevel gears, A, which serve also as nuts, which work four sockets, B, with threads cut on their inner ends, all neatly fitted to a light casting, E, having a fine central hole for the line, as shown. A central gear, C, works the four gears, of course all at the same time. Several sets of steel rods, D, may be provided if necessary, of different lengths, and thus render the instrument universal in its application, each set of rods serving for cylinders varying two inches, more or less, in the diameters of their bores.

To determine whether a cylinder of an old engine is in line: Remove the front head of the cylinder, the piston, the stuffing box gland, and the crosshead; apply the cross and line, as above directed, extending the line, through the piston rod hole in the rear head, to a point exactly central with the crank pin when the crank is at its dead point; draw the line taut, and, if the cylinder is correctly in range, the line will occupy a central position in the stuffing box, which may be determined as before directed. If the crosshead guides are parallel with the line, both vertically and laterally, they are also correct. F. G. WOODWARD.

Worcester, Mass.

Grit Wanted.

To the Editor of the Scientific American:

Little things in universal use, like the American postal card, are often of great importance. A small portion of silica or alumina, or any other grit, added to the sizing, would convert our cards into tablets which could be written upon with a metallic point, and from which no ordinary friction will erase the writing. The writing with the metallic point would also be more legible than the writing with most inks or pencils.

The addition of the small amount of grit required does not injure the surface for writing with a pen, and could not add appreciably to the expense of their manufacture. The government furnishes the cards. Let it furnish also miniature metallic-pointed pencils for the vest pocket at one cent a piece. The government would make money by doing so, and a single pencil would carry on an ordinary citizen's card correspondence for a year.

These metallic points should be made of lead with a small percentage of bismuth. There are two ways of making such pencils. A cylinder of the alloy two inches long and one eighth of an inch in diameter can be wound with fancy paper until the diameter equals one sixth of an inch; the paper might be put on wet, compressed in a mold (*maché*) and varnished. Or a polished wooden cylinder, two and a half inches long and one fifth of an inch in diameter, can have a metallic point inserted at one end in the common way.

The present postal card can be written on with a soft metal point, but not with an alloy hard enough to give a fine, black, permanent mark. W. F. C.

Small Steam Engines.

To the Editor of the Scientific American:

I will give you the result of my experience with a smal boat engine, the vessel being 47 feet long, 11½ feet wide, and 4½ feet deep. She has a three-bladed screw, 4½ feet in diameter with 6 feet pitch, which is made to rise or fall in the water. The engine has two 6 x 10 inches cylinders, running at 120 revolutions per minute, with 70 lbs. steam. The engine exhausts into 75 feet of two-inch pipe, 60 feet of which is in the water outside of the boat, coming in again to conduct the water to the hot well. The pump takes the water to the boiler at 190° Fah. This arrangement makes a very good condenser. The boiler is 7½ feet x 4½ feet, with 120 two-inch tubes.

I have with this boat towed a ship of 700 tuns at 4 miles an hour, with 60 lbs. of coal per hour, and I can make 9 miles an hour when not towing. The mistake generally made by those who have not had experience with boat engines is that they do not give sufficient boiler capacity; and I find that the ample boiler power above described gives an excellent result as to fuel consumption with my small engine.

P. M. BLATCHLEY.

Guilford, Conn.

Splicing Large Belts.

To the Editor of the Scientific American:

There is in the Upper Mills here, in which I am engaged, a 26 inch, 8 ply rubber belt, doing the following duty: It runs off the fly wheel of a 24x48 inch engine, the fly wheel being 18 feet in diameter and making 65 revolutions per minute, driving an overhead line of shafting and two lines at right angles to it, said shafting driving two 8 inch guide mills by an 18 inch rubber belt to each, one at 230, the other at 280, per minute. Each mill finishes sixteen tuns gross of finished iron every 24 hours. Two pairs little mill shears, one pair bar mill shears, and one 36 inch circular saw for hot iron are also driven by the main belt.

In the early part of last summer, an accident occurred by which the above mentioned belt was torn into several pieces and ripped into strips. Knowing that it was impossible to obtain a new belt without ordering it from the makers, we had to do the best we could with what we had; so we patched up a ragged-edged strip of the torn belt (averaging 12 inches wide), thinking to run a part of the above machinery with it. Some laughed at the idea of attempting to run any part of it with such a cord as that looked to be; but to the surprise of all, it performed the entire duty of the original belt, and in so satisfactory a manner that the new belt was on hand some four weeks before a favorable opportunity was afforded to put it on.

A member of the firm here adopted some years ago what was then a new way of fastening the ends of and splicing large belts; it has proved a cheap and reliable way, and is now in general use in this vicinity: Cut your belt perfectly square on the ends and to the proper length: then cut a piece of belt of the same width and thickness, about 3 feet long. Bring the ends of the belt together, and put the short piece on the back of the joint, or outside, and bolt the belt and piece together with what are known as elevator bolts, used for fastening the buckets to elevator bands. The tools required are a brace and bit to bore the holes and a small pair of blacksmith's tongs to tighten up the nuts with.

When a belt becomes dry or glazed, I have always found that a liberal dose of castor oil was a specific; and I have never known a belt to be mutilated by rats or other vermin if it had castor oil on.

Pittsburgh, Pa. T. J. B.

[For the Scientific American.]

A NEW METHOD OF MEASURING SURFACES, APPLIED TO THE CIRCLE.

The fact that the modern chemical balance gives a greater degree of accuracy in the determination of weights, and with much more facility than is the case with any other kind of measurement, especially that of curved lines, has given rise to a method of determining irregularly shaped surfaces of land in square miles or acres, by tracing them on paper of uniform thickness, cutting it out to the correct shape, and comparing the weight of the piece of paper thus obtained with that of a piece cut to the size of a square mile or of an acre, of the same kind of paper, to the same scale. By calculating how often the weight of the latter piece is contained in that of the former, it will give the number of square miles or acres contained in the land in question. This calculation consists, of course, in only a simple division. I can recommend this method fully, as, when carefully applied, it gives results the correctness of which is not surpassed by those of any other method whatsoever. This may be verified by taking regularly shaped forms, easily measured by the ordinary methods. I have in this way determined the surface of islands and continents in square miles, of farms in acres and rods, etc., and am compelled to testify that the method is far superior, in the correctness of its results, to that by means of the graphic method, with the help of Amsler's polar planimeter, now so excellently made in Switzerland and to be obtained in our large cities. The method by the help of the balance gives not much more trouble, less calculation, and less liability to error than the use of the instrument in ques-