sure cylinders alone can overcome. In such a case, the by-pass valves can be opened, when the water flows through them into the opposite chambers, the pressure on the opposite ends of the plungers is in a measure equalized, and the engine is enabled to start. As soon as it is fairly in motion, these valves are closed. They are available, also, when the motion of the engines required to supply the demand for water would be so slow that, on account of the insufficiency of the flywheel, it could not be maintained with the desired regularity, or perhaps not at all. Then, by partially opening these valves, the engines are enabled to run faster, and so to maintain their motion satisfactorily, the excess of water displaced by the plungers passing through them into the chambers that are filling.

The principal dimensions of the pumps are:

	Feet.	Inches.
Aggregate length of the two chambers in each pump..	7	6
Width of the two chambers in each pump.....	2	3
Height of the two chambers in each pump.....	2	11
Capacity of each pump chamber, in cubic feet	25	
Diameter of plunger.....	0	20
Diameter of rod	0	4
Area of plunger, mean of two faces...	307·88 sq. in.	
Stroke of plunger....	36 in.	

As a beautiful as well as most effective specimen of machinery, admirably adapted for the purposes for which it was constructed, the Gaskill pumping engines at Saratoga are well worth the critical examination of all who are interested in obtaining an efficient and economical water supply for cities and villages.

The Umbrellas and Chairs of Lulu Hurst.

For several months Southern papers have been describing the wonderful performances of a young girl known as Lulu Hurst. These reports have stated that she possessed a unique and extraordinary "force."

We were pleased, therefore, to receive recently a very careful and conscientiously written account of this phenomenon from Dr. Seth N. Jordan, of Columbus, Ga. Dr. Jordan states that, in company with Drs. George Grimes and Carlisle Terry, he examined Miss Hurst, and that they are all agreed that she is not a fraud, but possesses some extraordinary and occult power. He writes that she is fifteen years of age, five feet four inches high, weighs one hundred and twenty-five pounds, is of moderate muscular development, in good general health, has menstruated regularly, is of an intelligent and amiable disposition. She first became aware of the possession of her "force" last September, and it has continued ever since, with the exception of a brief interval when she had a "cold."

Drs. Jordan, Terry, and Grimes, having purchased a new umbrella, experimented with her for four hours in the room of a hotel. The phenomena developed were somewhat as follows: Two or three scientific persons take hold of the handle of an open umbrella, and hold it fast; Miss Lulu then touches it with her open palm, when, presto! the umbrella is turned inside out, or snatched away despite every effort. Meanwhile other persons find that no muscular contractions have taken place in Lulu's arms.

Three strong and scientific men lift up a chair, and hold it in the air. Lulu places her hand upon it, and it sinks to the floor despite every effort. Dr. Jordan and others took hold of a long stick, the phenomenon touched the other end and it rapidly revolved, or pulled the three experimentalists roughly about the room. Miss Hurst's "force" seems to have a peculiar "penchant" for umbrellas and canes, so that she cannot carry the former article at all, the mystical something snatching it away and leaving her out in the wet.

With the exception of the production of knocks and raps, the above are the chief phenomena exhibited and described.

We fully believe that Dr. Jordan has described them correctly, and that Miss Hurst is a remarkable girl. But there is one feature in all her performances which no one, not even Dr. Jordan, seems to have noticed or, at all events, carefully studied. This is, that all the exhibitions of her wonderful force are exhibited in opposing voluntary muscular effort in others. This force has no power over dead matter, but only over living, conscious, muscular exertions. This fact explains, we believe, the mysterious energy which the Georgian phenomenon appears to develop. It is the experimenters, not the subject, who knock themselves and the umbrellas about. At any rate, the matter ought to be investigated from this standpoint. It will probably be found that Miss Hurst's exhibitions are only another phase of the hypnotic phenomena.—*Medical Record.*

Lecture Room Apparatus.

It is impossible, of course, to make very much headway in a science without a thorough grounding in its theories; still, there can be little doubt that one of the best ways to impart knowledge is to connect in the student's mind some practical application of it. Sometimes this is difficult, if not out of one's power altogether; but still, where feasible, it is the best way of giving instruction. A student, if he once gets interested in the application of a science, will then follow it of his own accord, and require no further incentive. This is exemplified in the lecture room every day; if there is nothing visible but the green baize lecture table and a glass of water, the young student fails to interest from the commencement; if, however, there are plans and diagrams or apparatus and models visible, to supplement the lecturer's words, then scholars are all attention from the commencement. The *Photographic News* (London) claims that photography is a wonderful incentive to the chemical student, just as telegraphy is to the student of physics; and concludes that every one who takes to a branch of applied science of this character ceases at once to be a passive student, and becomes an active one.

IMPROVED PROPELLER WHEEL.

In the annexed engraving we present the method of Mr. H. C. Pearson, of Ferrysburg, Mich., of improving propeller wheels. He says:

The practice which prevails, the world over, of sharpening both edges of propeller wheel blades, on the forward side of the same, introduces a waste, or loss of power, which has hitherto escaped notice.

The annexed illustration, which shows where and what this leak is, will be readily understood.

Conceive a wheel-blade, Fig. 1, to be intersected by the surface of a cylinder, whose axis coincides with the center of the propeller wheel-shaft. And in Fig. 2 let the sectional area A C E represent the developed section thus produced.

Then, the line A B being drawn perpendicular, and the line B C parallel with the shaft, B C will represent the pitch corresponding to width of blade.

Then, if from C we set down the slip (in this case about 18 per cent) to D, B D will represent the net pitch; and the line A D will represent the developed helix, and the direction in which the point A travels in its revolution around the shaft. And, as every point in the section travels in a helix which, when developed, is parallel with the line A D, it follows that a portion of the blade *takes water on the forward side, as from C to E, Fig.* 2 (Fig. 2 shows

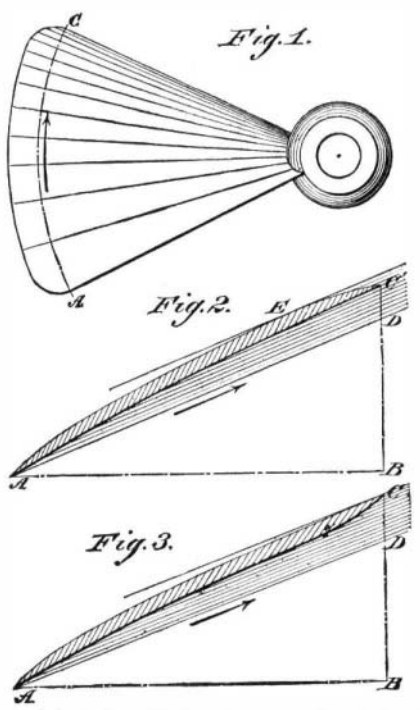

Fig. 2.—Section showing the modern method of sharpening propeller wheel blades. Fig. 3.—Section showing Pearson's method of sharpening wheel blades. Patented February 19, 1884.

PEARSON'S IMPROVED PROPELLER WHEEL.

from actual measurement a section of a blade made by one of the most popular manufacturers of the country.)

This work on the forward side of blade is the waste referred to. To avoid this loss, sharpen the forward edge of blade on the after side, or face, as illustrated in Fig. 3.

In this manner, a saving of 10 to 15 per cent of the fuel may be made, which is an important consideration to vessels on long voyages.

This saving will be more conspicuous in the fuel account than in the speed, as a saving of 25 per cent of the power would show a gain of only about ¾ of a mile per hour, on a speed of 10 miles per hour.

The cost to the manufacturer is no more than for the ordinary wheel, the only difference in the construction being in the shifting of the bevel that sharpens the forward edge of blade on to the after side, or face, of the same.

Another important advantage gained by this method of sharpening is that we can get hold of the water with a *smaller* pitch-angle, and thereby incur *less slip* and *less loss of power* by oblique action of blade.

This is found to be a very *superior backing wheel*, a quality that will be appreciated by those in charge of harbor towing steamers. In Fig. 3, the curve for the forward side of section should be tangent at C, with a line parallel to A D, for the best results. Mr. Pearson obtained a patent for the above in February of the present year.

Machine for Curing Tea.

The new tea curing machine is the only one for which a patent (No. 295,290) has ever been granted. Mechanical skill applied to tea curing is as novel as it is desirable. It does away with the slovenly, not to say filthy, practice of rolling and twisting the leaf by hand. It shows the progress the arts are making in ministering to domestic wants. Machine curing undoubtedly supplies a want. The tea treated by it is said to be remarkable for uniformity and cleanness.

Correspondence.

Common Troubles with Steam Heating Apparatus.

To the Editor of the Scientific American:

We are using a steam heating apparatus, low pressure boiler, horizontal tubular, 50 inches diameter, 16 feet long, with 30 4-inch flues. The furnace is built for *wood* or *coal;* but if I burn coal exclusively for four or five hours, so that the grates become somewhat choked up, the water falls in the gauge glass, and can be heard passing over in the steam pipe. Jarring the doors stops this, nor does it occur when the fire is clean, even when generating steam more rapidly, as in the morning, when raising steam. It takes place, however, later on, when steam is on all the coils. By keeping a space of 2 inches on the sides and front of fire free to admit air through the grates, said action is prevented. We have asked several practical men about the cause, but they do not agree. What we desire to know is this: What is the cause of priming in steam boilers, and its remedy?"

Respectfully, R. D.

St. Mary's, Kan., April 30, 1884.

REMARKS.

There are at times some very interesting phenomena observed in the action of steam, water, fire, and the products of combustion, in a low pressure steam heating apparatus. Many of its irregularities are caused by disproportion between the boiler and the work that it has to do, as well also to the relative size of grate and arrangement for draught.

There are some essential points that are not noticed in the phenomena alluded to that are important factors in its cause. The action of the steam gauge and its indication of pressure should have been observed. A combined pressure and vacuum gauge is often necessary as an indicator of what is going on upon the inside of the boiler. We have often seen a closed circulation heating apparatus under full action as to heat, with the steam gauge index at 5 inches on the vacuum scale, *i. e.*, 2½ pounds less than no pressure, with the water so much in agitation as to be plainly heard, as in a boiling condition. At such times the water in the gauge will vibrate in the same manner as when a boiler is said to be priming.

The height at which the water is kept above the tubes, or the proportion of steam room, as well as the ratio of steam liberating surface to its generating surface, has much to do with the intensity of these actions. Some engineers are in the habit, through a mistaken idea in regard to safety, of carrying the water very high, even to more than half the distance between the tubes and the top of the shell, in cylindrical tubular boilers, which largely increases their disposition to foam by the decreased area of water surface and steam space.

When the heating apparatus is under full steam, and all of the radiators free from air, with air cocks closed, if the fire is allowed to slacken, either by burning out or opening the fire doors, the steam gauge hand will be noticed to move back to zero; and if a vacuum gauge is used, the hand will often move back upon the vacuum side of the zero point, while the radiators will still continue hot for a time; then if the ingress of air could be prevented, the apparatus would continue to steam at a slightly decreased temperature for an indefinite time. For a short time while the pressure is falling the phenomena of foaming or priming takes place, when the boiler will sing like a tea kettle. The foaming under this condition is because the condition and capacity of the radiating surfaces of the apparatus remain in full operation, while the capacity of the boiler for generating steam is slackened, thus drawing away steam and carrying the pressure to less than nothing; thereby lowering the boiling point of the water due to pressure, and setting it into strong ebullition, in order to equalize the latent heat stored in the water at the higher pressure.

This only continues for a short time, or until the equilibrium is restored. This is no part of the phenomenon observed in boilers that foam when the water is foul with sediment and gummy substances accumulating from feed water holding mineral or vegetable matter in solution.

Boilers that are too small for the work they are sometimes forced to do, or that have too small water surface in proportion to their heating surface, are easy foamers when forced up to their nominal capacity. The supposed foaming, mentioned by our correspondent as being checked by jarring the fire door, was probably caused by what is commonly called (we think erroneously) "back draught," or the *vibration* of the gases or products of combustion in the fire chamber and tubes, which acts much in the same manner as the vibrating air within the great pipes of our largest church organs, which are equal to the setting of a large edifice into a synchronal vibration. The vibration of gases under the shell and within the tubes soon extends its influence to the boiler and also to the water. The sudden starting of a vibratory movement within a boiler while steaming tends to increase the liberation of steam for a moment, until an equilibrium is established, during which the foaming may be observed by the action of the water gauge. This is injurious to boilers, and should not be permitted. The cause of the vibration may arise from various conditions, such as a strong draught with solid fire and loosely fitted doors; the air rushing by the edges of the doors sets them to vibrating, which in turn starts a synchronal vibration through all the passages and also to the boiler.

THE percentage of recruits in the Italian army who can neither read nor write varies from 27 in Piedmont to 74 in Sicily.