### DIRECT STEAM PROPULSION.

*To the Editor of the Scientific American:*

In your last issue is a bold and novel scheme for propelling ocean steamers by the use of jets of live steam. While there is nothing like a direct experiment for determining the actual value of such a system, yet a knowledge of what is known and of what has been done is sufficient to deter capitalists from undertaking it. Jet propellers, in which the jet was water, have been tried by the British navy; but, as theory indicates, the efficiency was low. In these cases, the jet was produced by a turbine or centrifugal wheel, and the machinery and pipes occupied too much room. (See Seaton on "Marine Engineering," page 274.)

Mr. Ayres proposes to dispense with all machinery, and cause the steam jets to issue directly from the boilers. It will not beclaimed that a steam jet will be any more efficient than a water jet, for the amount of pressure will vary directly as the mass of the fluid flowing out of the orifice. A brief discussion of the jet propeller is given in the writer's "Analytical Mechanics," page 344. It is there shown that the mechanical power developed per second will be:

$$Pu = \frac{W}{g}\left(\sqrt{u^2 + v^2} - u\right) u$$

When—

W = the weight of the water discharged,
$v$ = the velocity of the jet due to the pressure,
$u$ = the velocity of the vessel.

Let us apply this to the water jet for a vessel on which is developed 5,000 horse power, running 15 miles per hour, and determine the weight of the water forced through the pipes. According to practice, the velocity $v$ should equal $u$, which, at 15 miles per hour, is about 22 feet per second. We have from the formula—

$$W = \frac{5{,}000 \times 550}{(\sqrt{22^2 + 22^2} - 22)\ 22}\ 32 =$$

$$\frac{5{,}000 \times 550 \times 32}{484\ (\sqrt{2} - 1)} = 440{,}000 \text{ lb., nearly.}$$

Or, say, 220 tons per second, or nearly 800,000 tons of water moved about 21 miles ($u \sqrt{2}$) per hour in reference to the orifice. If it requires this weight of water, how much steam would it require to produce the same effect? It is plain that it would require so much that all the space now occupied by the machinery will be required for the coal necessary to generate the steam. The quantity is so large we will not stop to figure it, but look at the problem of steam use directly. The formula for the efficiency is:

$$e = \frac{2\ u}{\sqrt{u^2 + v^2} + u}$$

the symbols being the same as before. If the steam in the boilers be 90 pounds absolute, and the jets about 30, or say 20, feet under water, the effective head for driving the steam will be about, say, 3 atmospheres; and if the coefficient of discharge be 0·60, the velocity of exit due to the head will be, with sufficient accuracy for this case:

$$v = 0{\cdot}60 \times 8 \sqrt{34 \times \frac{62\frac{1}{2}}{0{\cdot}2}} = 480 \text{ ft. per second;}$$

and if the velocity of the steamer be 15 miles per hour, its velocity per second will be, as before stated, about 22 feet per second; hence substituting $u = 22$ and $v = 480$, we have for the efficiency:

$$e = \frac{2 \times 22}{\sqrt{22^2 + 480^2} + 22} = \frac{1}{11}$$

At 10 miles per hour, the theoretical efficiency would be about one-sixteenth.

This small efficiency will be fatal to the scheme. It is the efficiency of the jet only, and does not include the effect of condensation, the friction of the pipes, the coefficient of discharge, nor other losses. In the use of the steam jet, only the momentum of the steam flowing out will be utilized, and all the power of the heat will be wasted; whereas, in the steam engine, no value is attributed to the momentum of the steam, and everything to the heat utilized in the cylinder. We intended to consider the effect of condensation, but it seems unnecessary to do so beyond a mere notice of the fact that its effect will be still further prejudicial.

DE VOLSON WOOD.

### The Anchor Brake.

The *Railroad Gazette* proposes the following: To have an anchor to drop from the rear end of train and engage with the ties. Provision for preventing the bending of the ties "under the strain brought upon them" might probably be devised as simply as for the axles; and by having a good long spring to ease the shock when the anchor came to a bearing, in addition to the relief which would come from the draw springs of the entire train without any expense at all, a train might easily be brought to a stop within 15 or 20 feet from an ordinary passenger speed, if something did not give way.

### A Remarkable Boiler Explosion.

The explosion of the locomotive boiler at Jersey Shore, Pa., on the Beech Creek Railway, on the afternoon of December 9, 1886, is another added to the long list of mysterious explosions, every one of the four men on the locomotive meeting instant death. The master mechanic of the road, Lamott Ames, is positive that the disaster was not from any defect in the boiler itself. The locomotive came new from the Schenectady shops three years ago, and had just been repaired at an expense of about $2,200. The overhauling of the engine was done under Mr. Ames' personal supervision. This gentleman has had an experience of thirty years with locomotives, and previous to taking his present position, less than a year ago, was road foreman of engines for the Northern Central Railway, at Elmira.

The locomotive was one of the heaviest kind, known as a "consolidated" engine, having four drive wheels on a side, and weighing 106,000 pounds. The repairs were general, 120 of the 220 flues being replaced in the boiler, and between 150 and 180 stay bolts or rivets being renewed. Before leaving the shops, a test of 150 pounds to the square inch had been made with cold water. The Schenectady people wanted Mr. Ames to make the test 180 pounds, but he considered that more than was necessary, as the boiler would never be allowed to carry more than 125 pounds.

The engine was run out of the shop, as near as can be ascertained, about 2 P.M., with slight pressure. Philip Knight, the engineer, was instructed to take the locomotive to a stretch of track not much used, to oil the machinery, to set the pop valve in the dome at 125 pounds, to run the locomotive up and down the track a few times to see that it worked satisfactorily, and then return for Mr. Ames, to make the trial trip of 12 or 15 miles. Meantime Mr. Ames was occupied supervising the setting of a new stationary engine, and he did not see the explosion. The blower of the locomotive was turned on a long time, as learned from those who saw it.

About fifteen minutes prior to the explosion, the Fallbrook passenger train went by the new locomotive, and the engineer of the train remarked to the fireman that "Number four" had a high pressure, as indicated by the noise of blower. Joseph C. Fields, the machinist, sat on top of the cab, screwing down the pop valve and waiting for the signal from Engineer Knight, when the steam gauge should show a pressure of 125 pounds. The locomotive had been standing still for at least 25 minutes. John Stapleton, another machinist, was on the ground on the right side of the engine, under the cylinder, adjusting a cylinder cock. The only warning observed by any of the men was the bursting of the "branch pipe," at the point where it had been brazed. This was noticed by Stapleton, who called the attention of Engineer Knight to it. The next instant the explosion occurred. The enormous force which steam exerts at the high pressure that must have existed in this case is as well illustrated by this disaster, doubtless, as by any that has ever occurred. The boiler was of steel, and pronounced by all to be perfectly sound. The wagon top, dome, and side sheets remained together. The engine was facing east, and this piece of the boiler, weighing about a ton and a half, was blown at an angle of about thirty-five degrees from a perpendicular so far into the air that it looked like a mere speck in the sky. It was found a quarter of a mile away, over the ridge of a hill about 400 feet high, to the north. Near it, and within a circle of fifteen rods, were found the mangled bodies of Fields, the machinist. Allen Ramsay, the fireman, and James Warren, an engineer off duty, who had got on board the locomotive, on Knight's invitation, to ride to the Junction, to get his pay. The body of Knight was found a half mile from the others, in an opposite direction from the wreck. No part of the locomotive was near him. His silver watch was badly battered, and stopped at 14 minutes after 3. The switch keys in his pocket were bent out of useful shape.

Stapleton was protected by the cylinder, steam chest, and the strongest parts of the locomotive. He was blown twenty or thirty feet forward down the embankment, but was confined to his bed only a day or two. He was able to walk home. He had not been in the cab for some time, and did not know what the condition of affairs was there. Not a particle of the boiler remained in the frame, which was broken in many places. The forward axle was broken in two, and the other axles bent badly. The only useful portions of the engine remaining are the tires and wheel sets. The flues were scattered all over the neighborhood, one of them having been driven clear through a frame cottage twenty-five rods away. No piece of the cylinder part of the boiler has yet been found. Of the smoke-stack, only the saddle has been found. From the broken axle it is assumed that the first break in the boiler was in the cylinder part. Fragments of the bell have been picked up, and small splinters of the cab. The firebox fell within a few rods of the wreck. One of the cylinders was badly broken, the other enough to be useless. The rails beneath the wheels were bent in a dozen places, and a large excavation was made in the roadbed. A lady sitting at a window in a cottage twenty-five rods away was admiring the brilliant paint and bright polish of the locomotive when the explosion occurred. A puff of steam, a heavy concussion, and it was all over. Several persons were attracted by the explosion in time to see the heavy wagon top with its three human bodies sailing far into the air, distinguishable only as a moving black spot against the sky. Pieces of the locomotive have been found a mile away, and the explosion was distinctly heard at Williamsport, twelve miles away.

The only theory that Master Mechanic Ames can offer is that the cock in the tube connecting the steam gauge with the boiler was partially turned, shutting off half or two-thirds of the actual pressure. He believes the pressure must have been three to four hundred pounds to the square inch. The fact that two experienced engineers were in the cab helps to make the affair more mysterious, as it would seem that they would notice anything wrong there. The pathetic part of the accident was that Fields, Warren, and Ramsay had been husbands less than a year, and that Knight left a widow and five children unprovided for. The lesson to be drawn is visibly apparent: "In the use of steam, be wise and watchful." Of a score of explosions that have come under the observation of Mr. Ames, he says this is the most frightful in the force displayed he has ever seen.

MARK BACUITT.

Elmira, N. Y.

### How to Prevent a Cold.

Under this title Dr. Brown-Sequard makes a contribution to the Societe de Biologie which will be read with interest. Everybody catches cold more or less often, and nobody wishes to do so; hence Brown-Sequard's "method" ought to be popular. Under the name of a "cold" are included a number of acute catarrhal inflammations affecting the nasal, pharyngeal, laryngeal, tracheal, or bronchial mucous membrane. In this country we even apply the term to acute affections of the middle ear, the eye, the stomach, intestines, or bladder. The cause of these so-called "colds" is the influence of cold, damp air upon sensitive portions of the body, producing thereby a disturbance of the vascular equilibrium. The result is a congestion which settles down, perhaps with the help of microbes, as the late Dr. Austin Flint believed, into an inflammation.

The most sensitive parts of the skin, according to Dr. Brown-Sequard, the catarrhal genetic areas, are the neck and the feet. In order to prevent "colds," therefore, one has only to harden these areas and destroy their sensitiveness. This is done by daily blowing a stream of cool air, by means of an elastic bag, upon the neck, and by immersing the feet in cool water. The air is at first only slightly cool, but is each day made colder, until the neck can stand an Arctic blast with impunity. The feet are immersed in water which is at first at a temperature of about 90° Fah., and this is gradually reduced to 38° Fah.

Dr. Brown-Sequard's method is only a more rigid and elaborate form of a very well-known practice, viz., that of daily bathing in cool water. It will, no doubt, be useful if the person is not aged or weak. Such methods, however, seem after a time to lose their efficacy.—*Medical Record.*

### Air in Greenhouses.

The circulation of air is one of the most important provisions in all kinds of horticultural buildings. Nothing but that will fairly exclude damp, or in any damp weather counteract its effects. It is not enough to open every front window. It would be far better to open only one and let down a top light a little. In all cases there should be an outlet as well as an inlet, and for want of this many houses do not answer well for plants. A circulation of air causes a more rapid evaporation, and it is a common thing among good gardeners to open a lower window even in wet, cloudy weather. Let down one of the top lights a little, and light a fire. By this a free circulation is created and the house dried, although it were in the midst of rains and cloudy weather. It is too common a thing to see the top lights let down to give air to a house, and no other part opened. This is all wrong; for there should be a draught. On the other hand, we see all the front windows and no top lights down. Many persons build pits three or four feet high at the back and half the height in front, and no air but what can be obtained at the top. We would always provide air holes at the bottom, as without such there can be no draught, no free circulation. When pits are built without this provision, the best mode of giving air is to pull up one light to let in air at the foot of it, and push down the next to open at top, and so on alternately through the whole range of lights, however long the pit may be. It is the same in giving air to a hotbed, only that when the air is rarefied, as it is inside, tilting the light a little lets out the steam, and the cool air will get in somewhere; but sometimes when a frame is made too close and the glass is puttied at the joints, things fog off in spite of tilting, because there is no circulation.