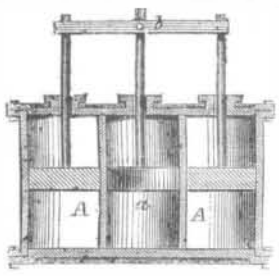
Our Correspondence.

Expansion of Steam.

Messrs. Editors:—Allow me space in your valuable journal for some statements, different from the "Erie Experiments," on the expansion of steam. I have selected a double annular expansion cylinder for my illustration, but the advantage of expansion is precisely the same in one single cylinder, if employed to the same extent.

This figure represents the annular expansion double cylinder The. outer cylinder, A A, is annular, the same as that made by Maudsley, of London; but in this case it is employed only for expansion, and the inner cylinder, *a*, is used for high pressure. It is so arranged, by steam valves and ports, that the high pressure steam is acting the whole stroke on the small piston, *a*, after which it is conducted to the annular cylinder where it acts expansively on the large piston, A A. The two pistons being connected by rods to one common crosshead, *b*, from which motion is given by a connecting rod to the crank. Engines of this kind are now made in Europe with a view to economize fuel and to extend the utility of expansion. Mr. Taegerfelt, in Nykoping, Sweden, I believe, was the first engineer who successfully carried out this plan.



The inner cylinder can be considered an ordinary high pressure engine, where steam is set free into the atmosphere at the end of each stroke; but, in this case, the exhaust steam accomplishes a second engagement in the annular cylinder, which, according to the grade of expansion, may greatly exceed the original effect imparted in the small cylinder during the first engagement. By this means, I will endeavor to prove the utility of expansion, which is now under discussion by engineers in this country.

Let us assume the area of the high pressure cylinder piston, a=254.4 square inches, the annular cylinder piston, A=763.2 square inches stroke of pistons=3 feet; the high steam pressure including the atmosphere=60 lbs. per square inch, and 12 lbs. vacuum, we shall have the grade of expansion=$1-\frac{763}{2\,5\,4}.\frac{2}{4}=\frac{2}{3}$, for which the mean pressure during the expansion on the annular piston will be 32.62 lbs.

The effective pressure on the annular piston will then be 763.2 (32.6+12—14.7)=22834.9 lbs. On the small piston, the effective pressure will be 254.4 (60—32.62)=6965.4 lbs.

By this, we find that the effective pressure of the expanded steam on the annular piston is greater than that on the small piston, even if we omit the back pressure of 32.62 lbs. per square inch. The collective pressure on both pistons will be 22834.9+6965.4=29,800 lbs.

Suppose the pistons to make 65 double strokes per minute, we shall have the actual horse-power, deducting 25 per cent for friction and working pumps: H=(29800×3×65)÷22000=264 horses.

Now we will reject the annular expansion cylinder, and take the effect of the steam without expansion, when the effectual pressure on the small piston will be 60—14.7=45.3 lbs. per square inch, and the actual horse power, deducting 13 per cent for friction and working pumps, will be H=(254.4×3×45.3×65)÷19000=118 horses.

If we consider the last result as a unit, we shall have 264—118=146 horses, or nearly 124 per cent gained by the expansion.

In the first case, about 11 per cent was gained by vacuum, but that advantage is rather in favor of the utility of expansion, because the high steam cannot so well be introduced into the condenser. I do not mean to maintain that this high per centage of economy is always fully realized in practice, as I am well aware of cases where expansion is of little use, owing to misconception and carelessness in its employment.

I will now refer to a case which happened in Russia with a steamer which I built for the river Dnieper and the Black Sea. The packings of the pistons were not tight; the valves were set to cut off the steam at one-fourth of the stroke; and, when the piston reached half-stroke, most of the steam had leaked through into the condenser, and the engine would hardly go around; and it was then reported that expansion would not answer. When the slide valves of an engine are not right, or when the air pumps are too small, or other things of that kind, they play the mischief with engineering practice. Without expansion, the leakage of the pistons in the engine would not have been noticed, because steam is supplied throughout the stroke; but then the steamer could not have come up to its intended performance.

There are many circumstances about an engine which are in favor of the expansion; for instance, the steam ports between the main valve and the cylinder, and the clearance between the piston and cylinder heads, contain a great deal of steam which is a total loss for each stroke; but when expansion is used, that steam expands into the cylinder, and is consequently utilized. The expanded exhaust also require a smaller air pump than would be necessary for high steam introduced in the condenser.

I suppose it will now be pronounced by the anti-expansionists that this is all theory; but I will also turn my attention to practice. In the steamers which I built for the river Volga, they were so arranged that, with one single lever placed in different positions, the engines were managed to work ahead and back, with or without expansion, at pleasure. When the engines were started, it was necessary to give one or two double strokes with full steam, and then operate with expansion. It sometimes happened, however, that the engineer neglected to turn on the expansion. If this happened when going against the stream, the steamer soon stopped, and we could not possibly keep sufficient steam in the boilers, so that we were obliged to stop the engines; but with expansion, the steamer went from 20 to 24 versts per hour.

John W. Nystrom.

Philadelphia, Pa., Jan. 25, 1861.

Preventing Accidents from Machinery.

Messrs. Editors:—In view of the many accidents occurring from carelessness in the use of machinery, I deem it of vital importance that effectual means should be provided to prevent their occurrence. It is common to run machinery with cog gearing and belts, so exposed that the workmen are constantly in danger of being caught and crushed or torn to pieces. The majority of accidents from these causes would be prevented by a little judicious boxing up of belts and wheels. Take, for instance, threshing machines, by which accidents have, within the past few months, occurred among my acquaintances. One was caught by a shaft, and his life saved only by the loss and almost total destruction of his clothing; two lost legs by their pantaloons being caught with couplings on the ground shaft; one lost a foot by getting it in a wheel; and one had his hand so torn that lockjaw and death ensued.

These are but a few of the many cases of this class; but all of these accidents could have been prevented by a little boxing. The expense would be but trifling, while it would really improve the appearance of some machines. Humanity calls loudly for a remedy for such evils, and manufacturers and proprietors of machinery of various classes should be compelled, by an act of Congress, to box up belts, cog gearing, flywheels, &c., whenever practicable. It is surprising that such accidents are not even more frequent.

But a few days ago, a man fell into a large cog wheel in a distillery in Brown county, Ohio, and was literally mashed to a jelly instantly. An outlay of twenty-five cents would have prevented this awful catastrophe. Manufactories, mills and portable machines are full of "man traps." Let us have them covered up; the columns of the Scientific American are the proper medium to agitate this question and bring about a reform.

Jas. M. Goodwin.

Felicity, Ohio, Jan. 23, 1861.

[We fully indorse the opinions of our correspondent respecting the humanity of this subject. There should be laws in all the States (Congress has not the jurisdiction), compelling those who run dangerous machinery to box up the exposed parts. Such a law has been in force in England for six or seven years, with the most happy results.—Eds.

Rifles and Rifle Shooting.

Messrs. Editors:—In your article on rifles on page 57, present volume of the Scientific American, I notice that you approve the use of "close grained cast steel for barrels," and indorse the Wesson and other Eastern makers, whose barrels are not only close-grained cast steel, but are tempered to the hardest possible point. This may all be very well in the abstract, but can you sell one of these rifles to Kentucky marksmen? No, sir; not one. They want, and will have, an ordinary soft steel barrel, and it must be annealed soft enough to enable them to chip the barrel (the under side) with a penknife without dulling the blade; and they often take their pieces to the gunmaker, to have them annealed again and again; to use their expression, they "want a barrel soft as lead." They are very careful in handling their rifles, so as not to "spring them out of true."

There is no doubt that the Kentuckians are the best off-hand shots in the world: this is true of Western men generally, consequently they are the most effective in war. This excellence is due, first, to the peculiar manner of holding their pieces, by which every muscle is taut and steady; second, to the fact that they, in the commencement of training, invariably shoot without rests, at "arms' length;" third, they take a distance (say, first, of ten paces), and confine themselves to it until they can "drive a tack" every shot; then they double the distance, and never allow themselves to vary it until they perfect themselves in it; and so on, to the longest distance, until they reach the point of their ambition.

At their barbecues, it is not uncommon to see middle aged men and boys of sixteen making their mark at ten, twenty, forty, eighty, and one hundred and sixty paces.

B.

New York, Jan. 26, 1861.

[Our Western riflemen may be prejudiced in favor of soft rifle barrels, but they may be in error. It is by constant practice, as described by our correspondent, that they attain to such proficiency as marksmen. A hard steel barrel takes a finer polish, we think, than a soft one, and this is an advantage. There may be reasons on the other side, with respect to soft steel for rifle barrels being the best, but we have yet to learn what they are.—Eds.

More About Hair Snakes.

Messrs. Editors:—As the subject of hair snakes has been before the public of late, perhaps I can add something that may be of interest and, by the way, throw some light on the subject, thereby helping to remove the doubts of the skeptical, or rather to offer something that may be positive testimony, provided my word be taken as proof. I have seen several animals that had been thrown into a brook or a bay or piece of quiet water adjoining the brook, where they had apparently lain from one to three weeks, when every hair was seen waving. Upon examination, I found that every hair on the animal (a cat, in particular, I have in mind) was a hair snake, with his head fast in the cat's skin. This I regard as a knock-down argument. I don't know what these snakes make of themselves or what becomes of them. I have examined them with the microscope, but find no eyes; they have a mouth, merely a round hole, somewhat tunnel-shaped, and every side alike. The head is flat, and very broad at the extreme end. Their skin is without scales, like the trout or sturgeon. Many suppose that the fleshy matter collected in the hair is but a mass of small insects or animalcula, clinging to the sides of the hair. But if so, how can they give the snake-motion to the hair? and why do they make the hair run head first (or always the same way) in the water? and why do these water insects clinging to the hair, leave the water with the hair, and make their appearance on dry land as I have seen them.

A. G. Bisbee.

Chester Cross Roads, Ohio, Jan. 19, 1861.

[We are still skeptical. We have no doubt of the existence of little worms resembling hairs, but do not yet believe that they change from hairs.—Eds.

The Force of Steam Explosions.

Messrs. Editors:—I have read several times in the Scientific American of large pieces of metal being thrown to considerable distances by explosions, still I am of opinion that but very few persons are really aware of the great force of some steam boiler explosions. I will relate one to which I was an eye-witness, and the facts which I will give have never before appeared in print. When the steamboat *Moselle* blew up near Cincinnati, about 25 years ago, I was in plain sight of the disaster, being only about 60 rods distant. After the explosion, the air was at once filled for

several hundred feet around with fragments of the wreck. I instantly started on a run, hoping to render some assistance. Having looked up hurriedly to see if anything was above me, I saw what seemed a mere speck nearly overhead, and very high, coming down. After running two or three rods I looked up again, and saw another thing of nearly the same appearance as the first coming down, and then both fell but a few rods apart. The first object I saw proved to be a piece of boiler, which weighed about 330 lbs.; it struck the brick sidewalk, in which it made a very large hole. This piece was taken to a museum in the city, where it remained several years. The other was also a piece of boiler, but much larger; I think it was 9 or 10 feet by 12 or 13, nearly square, but very much bent up. It fell on the gable end of a stone stable, and demolished the wall. I concluded that the second piece had gone up so high that it was out of sight when I first looked up, otherwise I must have seen them both at once. The weather was clear, and I don't remember seeing any clouds overhead. It was said at the time that the engineer of the steamboat was drunk, and had allowed the water to get down while the fires were kept up. The persons said to be scalded did not look so to me; their skin was quite brown and crisp, and it looked more like a burn from gunpowder. Query, was it steam or gas that exploded? There were five boilers, all burst with one deep, heavy sound, and not as if several explosions had taken place in rapid succession. I suppose no other human eyes but mine saw the phenomenon described.

DANIEL EDWARDS.

Little Genesee, N. Y., Jan. 20, 1861.

Inflating Balloons.

MESSRS. EDITORS:—In looking over my file of the SCIENTIFIC AMERICAN, I noticed, on page 280 of your last volume, an article headed "A French Apparatus for Lighting Cities with Hot Wire." I intend building a machine on this principle for the purpose of manufacturing hydrogen gas, provided I can gain sufficient knowledge to insure me some success. Can you give me any more information than what I have already found in this article? I wish to ascertain the figures and proportions of a machine capable of manufacturing 2,000 feet of gas per hour, and also any other information which will aid me in building such a machine. My intention is to manufacture gas for inflating balloons on this principle.

JOHN LA MOUNTAIN, Aeronaut.

Lansingburgh, N. Y., Jan. 24, 1861.

[It is a curious fact that the article which we translated did not give the dimensions of the apparatus though it did give the amount of gas which it would produce. We are not surprised that our aeronauts are making arrangements to use hydrogen gas instead of illuminating gas to inflate their balloons, as a balloon for the same lifting power will require to be only about half the size; 100 cubic inches of atmospheric air weighs 31.01 grains, being 14½ times heavier than hydrogen, and not quite twice as heavy as illuminating gas. Hence, it would require about 14 cubic feet of hydrogen to raise 1 lb. in the air, and about 28 feet of illuminating gas.—EDS.

Chemical Analysis by Spectrum Observations.

MESSRS. EDITORS:—This is one of the most important inventions of the present century.

Professor Robert Bunsen, of Heidelberg, one of the most ingenious chemists of our cotemporaries, has now published the first precise investigations in this direction, the consequences of which can scarcely yet be realized; their beginning though is sufficient to indicate that they may probably lead to the solution of hitherto inaccessible problems.

The following experiment speaks best for the sensitiveness of the reaction:—3 milligrammes of nitrate of soda were exploded with a little powdered charcoal in the corner of a large room, while in the other corner was placed an apparatus containing a lamp and a camera, for the production of the spectrum. In a very short time, the smoke of the soda-saltpeter reached the flame and exhibited in its spectrum the peculiar lines and colors which result from the burning of this substance. From the weight of the deflagrated salt and the size of the room could be calculated what quantity of it was contained in the air, and as the reaction was observed every consecutive second, and calculating the access of the air to the flame, *only the three-millionth part of a milligramme of sodium* could therefore have penetrated and be indicated by the flame. This minimum, then, can yet be recognized! To give a better definition, it might be added that a milligramme is somewhat less than the thirty-fourth thousandth part of an ounce. Similar experiments demonstrated that chloride of sodium (common salt) is a scarcely-ever-failing ingredient of the atmospheric air—a fact very easily understood when we consider that two-thirds of our globe is covered with salt water, which, by evaporation as well as mechanical force, is scattered through the air. We may, with right, expect that by spectral analysis of the air we shall yet succeed in acquiring information on the progress of epidemic diseases, as they are perhaps due to the absence or presence of such substances as have hitherto escaped our observation. The incandescent luminous vapor of lithium combinations gives two very distinct and sharply defined lines; the one very feeble yellow—the other of a red shining color. By the aid of this process, the unexpected fact was demonstrated that lithium, which was believed to be one of the rarest elements, pertains to the most distributed substances of nature, as small particles of it were found in many minerals, in sea and spring waters, in the ashes of plants, in the air, &c. We possess already the full assurance that substances which have hitherto been unknown to us are present in water as well as in the air, and only by these means we are enabled to discover their presence. Once the cause of certain injurious influences on the organism is discovered, the second step, their separation, gives comparatively little trouble.

A. L. FLEURY.
FR. RUSCHHAUPT.

24½ Third-avenue, New York.

A Subscriber for Life---Singular Proposition.

We have received a letter from a correspondent in Georgia, saying that, from the peculiarities of his position, it is very inconvenient for him to mail his subscription money every year, and that he should like to make one job of it, so that it will give him no further trouble for the remainder of his days. He therefore proposes to send us $20, to be received by us as payment for his subscription for life. [He is 50 years of age, and probably a bachelor, for he says he would not like our lady readers to be informed upon this point; but as we omit his name, we trust he will pardon us for this breach of confidence.] We have written, accepting his proposition, on condition that he will write to us every year to let us know that the term of his subscription has not expired. Among all the thousand newspapers in the country, is there any, except the SCIENTIFIC AMERICAN, that has a subscriber for life?

It will be observed that this proposal, coming from the heart of the secession movement, shows the most absolute faith in the continued friendly and business intercourse between the North and the South, whatever may be the fate of our political connection. We are happy to state that it is only one of innumerable evidences which we are constantly receiving of the same feeling, and which are the most gratifying of anything that is occurring in the present eventful period of our history.

ALLEGED CURE FOR HYDROPHOBIA.—The *Presse Médicale Belge* states, on the authority of Father Legrand de la Liray, late interpreter to Admiral Rigault de Gonouilly, one of the oldest and most venerable missionaries in Tonquin and Cochin-China, that in those countries hydrophobia is cured with complete success by boiling a handful of the leaves of datura stramonium, or thorny apple, in a litre of water, until reduced to one-half, and then administering the potion to the patient all at one time. A violent paroxysm of rage ensues, which lasts but a short time, and the patient is cured in twenty-four hours. For the benefit of our readers we may state, that the leaves of the stramonium are highly narcotic, and, as such, are recommended in asthma under the form of cigars, to be smoked as usual; but that the same leaves, taken in large quantities, whether in powder or under the form of decoction, will produce temporary idiotcy. As to its efficacy in confirmed hydrophobia, it seems to be earnestly recommended by Father Legrand, who declares that he has tried it several times, and invariably with success. The great difficulty will, of course, consist in administering the remedy to the patient, which probably must be done by main force, with the aid of a horn; but on this subject the *Presse Médicale* is silent.

Column of Varieties.

The immense appetite of London is fed every year by about 270,300 oxen, besides 30,000 calves, 1,500,000 sheep, and 30,000 swine.

The enduring odor of musk is astonishing. When Justinian in 538 rebuilt what is now the mosque of St. Sophia, the mortar was charged with musk, and to this very day the atmosphere is filled with the odor.

On the river Clyde, Scotland, 88 iron vessels were built during 1860, the gross tunnage of which was 47,700 tuns, and there are now on the stocks 46 vessels, the tunnage of which will amount to 44,900 tuns.

The Massachusetts Arms Company's manufactory at Chicopee Falls, was consumed by fire on the night of the 18th ult. The loss was $60,000, of which $30,000 was covered by insurance.

Take an ordinary paint-brush or sponge, and run over the glass once or twice a day a little alcohol, and it will keep the glass as free from ice as in the middle o summer, and it will also give as good a polish as can be got in any other way.

A portable sundial, recently patented in Berlin, consists of a hollow metallic hemisphere, representing in its shape the visible firmament. By means of a pendulum and a sort of meridian circle, it may be so placed at any moment, in the sunshine, as to indicate the hour and minute of the day.

Among the curiosities of London life is the appearance of Lord Caithness in that metropolis, guiding his steam carriage. He has driven through the most crowded parts without frightening the horses, and threaded the vehicles, thickly strewn as they are in the city, with ease and elegance.

Our country has increased in size more than threefold since the close of the Revolutionary War. The United States have a territorial extent nearly ten times as large as that of Great Britain and France combined. The American republic is one-sixth only less in extent than the area covered by the fifty-nine empires, states and republics of Europe.

The sensibility of the nerve of smelling is blunted and perverted by all irritating odors and substances. Hence those who would preserve all the senses which God has given them should avoid snuff, smelling-salts, &c., as is manifest to those who have been troubled much with cold in the head.

Along the coasts of the Atlantic and Pacific Oceans and the Gulf of Mexico, the United States have 223 lighthouses, exhibiting 369 lights, and 42 lightboats, with 55 lights, making a total of 365 stations and 421 lights. The whole number of stations 466, number of lights, 539.

M. Duroy, of Paris, announces the discovery of a new neutral colorless iodide of starch. When iodine and starch are mixed together they form an iodide of starch of a blue color. Iodine has therefore been considered a chemical test for the presence of starch in any substance. By bringing a starch iodide into contact with yeast, it is deprived of its blue color, and becomes sweet, gummy, and very soluble in water.

Col. Foster, the head of the land department of the Illinois Central Railroad Company, estimates the wheat crop of Illinois last year at not less than 25 millions of bushels. At a low estimate the corn crop of Illinois will amount to 110 millions of bushels, worth at least $25,000,000 to the producers, being of wheat and corn more than ten times the quantity produced by the whole of New England. The value of live stock is estimated at one hundred millions of dollars.

Tin is increasing in value yearly. The British exports last year amounted to 2,804 tuns, and the mean average price for the year has been £130 18s. ($634.46.) There has been an increased speculation in the tin mines of England. The whole of the metallic tin trade of the world is in the hands of the Dutch and English, but the latter control the former.

The produce of Scotch pig iron during the past year was 1,000,000 tuns, being an increase of 50,000 over the previous year. This augmentation has not been due to an increase of furnaces, but intrinsic improvements in the process of manufacture. Our molders have not yet found a true substitute for this kind of iron for castings, but it appears that some of the American iron ores—for they are very numerous—should yield similar iron if heated with the hot blast and coke fuel. The shipments to the United States of Scotch pig iron amounted to 77,632 tuns in 1860.