THE

Scientific American.

MUNN & COMPANY, Editors & Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

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☞ "The American News Company," agents 121 Nassau street, New York.

☞ Messrs. Sampson Low, Son & Co, Booksellers, 47 Ludgate Hill London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. X. NO. 25....[NEW SERIES.]....*Twentieth Year.*

NEW YORK, SATURDAY, JUNE 18, 1864.

Contents:

(Illustrations are indicated by an Asterisk.)

TO OUR READERS.

The present volume of the SCIENTIFIC AMERICAN, being the tenth of the new series, closes on the 25th of June, and we would remind all those whose subscriptions expire at that time, of the importance of promptly renewing them in order that they may not lose any of the numbers by delay. Our subscription list is now larger than at any period since the breaking-out of the war, and this in the face of the fact that many of our regular readers are now in the service of the country. To continue the interest in our journal we have spared neither time, exertion nor labor, and we think we may point to the three last volumes in support of the truth of this assertion.

The personal experience of the editors, and the frequent suggestion of useful ideas by correspondents, makes the SCIENTIFIC AMERICAN unequaled as a source of practical mechanical information. In its peculiar province this journal stands alone, and aims to be a faithful record of the genius, inventive talent and energy of the age we live in. From time to time we have published illustrated articles on tools and workshop economy, which have been most favorably received, and it is our intention to continue this subject in the ensuing volume. There is no other journal in the country which gives such full and specific information upon the enginery of war (frequently illustrated by diagrams received from official sources) as the SCIENTIFIC AMERICAN; in this respect the non-professional or general reader will find it of great interest. We need not enumerate special features, however, to convince our friends that we are working for their benefit, and endeavor to not only fulfill our contract, but to give good measure, heaped up and running over. We hope that all those whose subscriptions expire with this volume will not only renew them promptly but induce others to become subscribers also.

MAJOR GENERAL WINFIELD SCOTT HANCOCK, whose brilliant services in the army of General Grant have won so much praise—has been honored by the award of the army sword at the St. Louis Sanitary Fair. His competitor was General McClellan

FINISHING STEAM-ENGINE WORK.

Many persons in giving orders for steam engines expressly stipulate that no extra finish shall be put on them. The builders take advantage of this, and not being confined to polish certain parts, omit to finish any, and a rough, clumsy, and uncouth-looking engine is the result of their labors. The point taken by purchasers is that polish costs too much money, and after all adds nothing to the economic value of the engine. In some respects this is an erroneous view; radiation goes on rapidly from dead black surfaces, such as unpolished cylinders and their covers, steam chests, valve bonnets, and the like, while the reverse is true of bright parts. A loss of heat is experienced which is as certainly money as a bank bill. This is not the only evil effect. Unpolished surfaces make coarse-looking work, and are much harder to keep clean; grease runs down on them and burns in so that in time it is absolutely irremovable.

We are not arguing for the mere appearance of the steam engine when unfinished, for we feel that something more than externals suffer when such work is allowed to go out of the shop. The purchaser naturally and properly wishes to get the price he pays for his machine in radical improvements—those relating to a lessened consumption of fuel, better materials and workmanship; but we are very certain that if steam engine work could be polished handsomely and properly in a cheap way, we should hear of few orders for rough engines, except for special purposes. Polishing machines are wanted. We saw a man in a machine shop, the other day, lounging on a lathe and slowly grating off, with a stubby old tool, the scale from a cylinder cover; we could understand very well why finishing was costly. At the rate of procedure mentioned it would take a day to finish a plain cylinder head for a ten-inch cylinder, when it ought to be done by proper machines in two hours. There should be lathes made for the purpose. A rough cut should be run over and a finishing cut afterwards. The lathe should be so constructed that a scourer could be put in, oil and emery applied of different grades, and the work set in motion rapidly. The scourer should have an epicycloidal motion, or one resembling the curves teeth of gears describe when leaving each other. In a short time, without superintendence, other than that of an apprentice, a finish would be imparted that no hand-work could approach. When we say *lathe*, we mean a machine resembling it, the details must be worked out by those interested.

There is no reason why automatic machines for polishing cylinder heads, or circular metal work of any kind, should not be invented and introduced. For flat surfaces, such as steam chest covers or slide bars, we have the emery wheel. When properly handled, work done by it is of the first quality, and only requires a little brushing up with emery paper afterward to look better than hand work. We are confident that many hundred dollars may be annually saved in machine shops by the use of such tools as we have adverted to in this article.

A GOOD THING TO BREATHE.

The great mass of the inhabitants of the Northern United States live in better houses, wear better clothes, and eat better food than the mass of any other nation, but they breathe the worst air of any people in the world. They like bad air. Every man chooses to have his clothes and food prepared fresh and new for himself, but he likes to have his air breathed over a few times by his neighbors before he takes it into his own lungs. In this process its oxygen is diminished, its carbonic acid is increased, it gets a little warm, and moist, and dirty, and then it just suits the American taste.

All through the winter months our city railroad cars are literally packed with passengers, and the doors, windows and ventilators are kept tightly closed. If any passenger ventures to open one of the little narrow ventilators in the upper part of the car, some very nice gentleman, with a clean collar, white teeth, and a carefully-dressed wig, who is drawing in at every breath quarts of air loaded with tobacco fumes, and animal matter from the lungs of his fellow passengers, is sure to give a shiver, and request that the minute opening may be closed.

In our churches the congregations generally have air in the forenoon which is quite tolerable, but in the afternoon their consciences and good manners are subjected to a constant strain in efforts to resist the stupefying effects of the noxious gases with which the church has become filled during the morning service.

But the worst effect of this national predelection is seen in our schools. Hundreds of little boys and girls are confined in close rooms for three hours at a time, breathing over and over again the same air, constantly diminishing its oxygen which is the supporter of life, thus reducing the force of the vital functions; while at the same time the brain, that inevitably shares the enervating influence, is stimulated by the most exciting ambition to exertions too great for even its undiminished strength. By this course hundreds of helpless children, each the pride and joy of its home, have been doomed to lingering disease and early death.

There is no necessity for breathing poisonous gases. We are placed in a great ocean of air which has been prepared by nature in just the proper proportions of oxygen, nitrogen and watery vapor to adapt it to the structure of our lungs and the healthful action of all our organs. We know that by breathing constantly this atmosphere, taking a fresh and pure supply at every breath, our physical system will attain to the highest degree of health and strength of which it is capable. It is only by laborious effort that we can box ourselves in, so that we can obtain the foul air of which we are so fond.

There may be, however, a few persons in the community who prefer fresh and pure air to that which has been breathed over a number of times. To these we commend Dr. Reid's work on ventilation recently republished by John Wiley, 535 Broadway, New York. It is a small book of 120 pages, and discusses the subject with an intelligence which is the result of a long series of investigations. The various methods of bringing in and distributing the fresh air, and of removing the noxious gases, are treated with a rare combination of profound scientific knowledge and practical common sense.

THE THEORY OF BOILER EXPLOSIONS FROM THE DECOMPOSITION OF WATER.

Among those who are wedded to the opinion that the explosions of steam boilers are generally produced by some mysterious force, a very favorite theory is that of the decomposition of water. It is well known that when steam is brought in contact with red-hot iron, it is decomposed, the oxygen entering the iron to form oxide of iron, and the hydrogen being set free as a gas. It is also well known that when hydrogen and oxygen gases are mixed together in the proportion of 8 lbs. of oxygen to one of hydrogen, and set on fire, an explosion results. It has been argued by some very intelligent writers that these operations take place in steam boilers, and are the most common cause of explosions.

There is no doubt that if a portion of a steam boiler becomes red hot, and steam is then brought in contact with it, the steam will be decomposed; the oxygen of the steam combining with the iron, and the hydrogen being set free. But the quantity of water thus decomposed in a steam boiler must be very limited. The oxide of iron which is formed in this case is the magnetic oxide, in which 3 atoms of iron combine with 4 of oxygen, $Fe_3 O_4$. As the atom of iron weighs 28 and the atom of oxygen 8, the proportions are 84 lbs. of iron to 32 of oxygen, or 21 of iron to 8 of oxygen. As 8 lbs. of oxygen combine with 1 of hydrogen to form water, it follows that 21 lbs. of iron will be oxidized to produce 1 lb. of hydrogen gas. This whole 21 lbs. must be upon the surface, for as soon as a thin scale of oxide is formed it becomes a protecting coating to the metal beneath, and prevents further action.

If the 1 lb. of hydrogen is mixed with 8 lbs. of oxygen, and set on fire, the two elements will immediately combine to form 9 lbs. of water, and the amount of heat generated by the combustion will be sufficient to raise the temperature of 1 lb. of water 42,480 degrees, or to raise the temperature of the 9 lbs. 4,720 degrees. Consequently, the water would be in the condition of very highly superheated steam Though it is uncertain whether at this high temperature steam expands in the same ratio that it does a the lower temperatures and pressures which are more easily measured, there can be little doubt that th