Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included.....$27 00
Over ten copies, same rate each, postage included..... 2 70

☞By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from he receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII., No. 24. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, DECEMBER 11, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. Three numbers (including the present) and the year will be ended. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the continuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper

To save our friends all the trouble possible, we also inclose an envelope with our address printed thereon, so that all the subscriber and getter-up of a club has to do, is to place his name or list of subscribers in the envelope, with the postal order, draft, or money, put a 3 cent stamp on the former, and drop it into his post office.

The terms of subscription remain as heretofore—$3.20 per annum, postage prepaid by us, for single subscribers, with discount for a number. See terms for clubs in special prospectus. All news dealers throughout the country will, as usual, receive subscriptions and have our publications on sale.

THE railway to the Hot Springs, Ark., has been opened to within seven miles of the locality, and will be finished to the Springs by January 1. This will open, to the convenient access of the public, one of the most remarkable places on the globe.

WHAT IS HARD MONEY?

The Director of the United States Mint has recently made his report to the Secretary of the Treasury, in which he shows the amount of metallic currency in existence at the expiration of the fiscal year ending June, 1875: Gold, $33,553,965; silver, $10,070,368, and minor pieces, $230,375. This is a small supply of currency for so great a country, and doubtless statisticians find little difficulty in tracing its course during the period of its circulation. Small as the amount is, however, it will serve to illustrate a curious fact. Leaving the nickels and pennies out of consideration, suppose that the aggregate sums mentioned of gold and silver could be thrown into circulation on some given day—say June 1, 1875—instead of at divers times, as of course was the case. Suppose, further, that on June 1, 1876, the total could again be collected and delivered at the mint. It might naturally be inferred that, the mint having regained exactly, to all appearances, the sum it sent forth, it would be financially as it was prior to emitting said sum—no poorer, no richer. The fact would be, however, that, if the mint should receive back the gold and silver at face value, the government would lose over $100,000; for it would pay for gold and silver never returned, for precious metal not non-existent but distributed in the metal of cash boxes, the wood of tills, in the skin of human hands, in the threads of clothing, in the dust, in the air—lost by the unavoidable waste of almost imperceptible wear. The five dollar gold piece which we put in our pockets in the morning is not the same as the five dollar gold piece we take out at night, although the coin may never have left its receptacle in the interval. Probably no balance is sufficiently delicate to indicate the loss; but loss there is, and one which becomes an appreciable quantity after a month's carriage.

A better idea of the amount of deficiency in coins due to wear, can be obtained by considering the currency of England: Gold sovereigns are composed of one twelfth alloy of silver and copper to eleven twelfths gold. American dollars consist of nine tenths gold to one tenth similar silver alloy. It has been determined by actual experiment, conducted several years ago under government auspices by Messrs. Cavendish and Hatchett, of the Royal Society, that the English gold standard, as above given, is the best combination in point of power to resist friction. During these tests, alloys of silver, copper, platinum, iron, tin, lead, bismuth, manganese, nickel, cobalt, zinc, arsenic, and antimony were made with gold, and plates of the various metals were rotated for long periods in tumbling barrels, and were rubbed together on an average of half a million times each. Toward the close of the last century, trials were made to determine the loss of metal of the coins, more especially of gold, and these tests have since been frequently repeated. The average result, according to the best authorities, and reached by taking an average of all the gold coins in the country and an average of all the hard usage to which coins are exposed, shows that each coin bears an annual loss of about 1-90C by friction. In silver the loss is supposed to be five or six times greater, owing to the more unceasing circulation of silver than gold, and the less degree of fitness of the metal to bear friction. At the close of 1872, a careful estimate of the coin in circulation in Great Britain and Ireland placed the gold at £84,551,000 and silver at £15,000,000, from which it will be seen that, in the three years which have passed on the amounts above noted, there has been on the gold an annual loss of £93,945·5, and on the silver £99,996, or, for the entire period, the sum of nearly $2,900,000 has been absolutely wasted. Calculating in similar manner for the circulation in United States coin gives over $100,000 for the yearly loss, but this, of course, is merely approximate, owing to the difference in composition of alloys, and to the fact that British gold coin is intrinsically more valuable than ours in the proportion of $55 to $54.

The loss due to wear falls generally upon the last user of the coin. In England, where the exchange of gold for Bank of England notes is constantly going on, the person who presents a light piece is the sufferer. A number of clerks of the bank examine the pieces and weigh them in bulk with very carefully adjusted scales. If the standard weight is lifted, notes are given. Should, however, the scale not turn, a few light coins are picked out by inspection and others of full weight added to make the balance, the person asking the exchange being charged with the difference in value. Should, however, a person presenting light coins, on finding the pieces to be below weight, change his mind and conclude not to take the notes, the law steps in and ruins his coin so far as its circulating utility is concerned. The clerk unceremoniously clips each piece by cutting a gash nearly through and across its diameter, and hands it back to the presenter, despite his protests. If he chooses to pay a small tax, usually from two pence to four pence on a sovereign, the spoiled coins are redeemed by new sovereigns. While the bank may thus in the course of business receive light pieces in bulk with others, it never pays them out. Quantities of coin are thrown into a wonderfully delicate machine, which weighs the pieces at the rate of 3,000 per hour with unfailing accuracy, and automatically separates the light from the full weight coins. The former go to the mint for recoinage, and the government reimburses the bank, the wear and tear of such coin being compensated for by national taxation.

When subjected to such tests it will be evident that the legal lifetime of a sovereign, which is nearly the size of our five dollar gold piece, is quite short. The average weight is 0·2562 ounce, and one year's wear, as already shown, reduces it 0·023 ounce, a quantity very readily distinguishable by the balance, so that indeed the continuous circulation of the piece for a much briefer period is sufficient to render it open to rejection as light. Mr. Palmer, the Deputy Governor of the Bank of England, recently informed a Committee of the House of Commons that last year the Bank weighed coin to the amount of £23,100,000 and rejected £840,000, or about 3.6 per cent, as being light gold. For this amount the Bank paid the value, making a deduction for the deficiency in weight, which, at the rate of three pence per pound sterling, would show a loss of some $250,000 in our money on the above amount. It was also stated, says the London *Times*, referring to Mr. Palmer's report, that boxes of correctly weighed gold, sent by the Bank of England to Scotland, frequently came back without having been opened, and Mr. Palmer stated that there is then some reduction for light weight. He explained this by adding that the mere shaking of the sovereigns on the journey will make a slight difference. There is a point at which every sovereign becomes light, and many sovereigns turn that point on the journey. Mr. Hodgson, M. P., a bank director, stated that, in a box of 5,000 sovereigns, the number which would be found to have turned the point would generally be about eight if they had not been disturbed.

The resumption of specie payments in this country, which it is to be hoped may not long be deferred, will of course result in an enormously increased circulation of coin, and as a result the waste referred to in the United States will be augmented. Whether it ever will be possible so to treat or combine precious metals as to render them sufficiently hard to resist friction, better than the alloys now do, is a question for inventors, and one perhaps worthy of renewed investigation.

MECHANICAL DRAWING.

In compliance with the desires of large numbers of our readers for the publication of Practical Instruction in Mechanical Drawing, we shall, in the first number of the SCIENTIFIC AMERICAN SUPPLEMENT, begin a series of valuable lessons on the subject, by experienced teachers and draftsmen. These instructions will commence *at the beginning*, at the most elementary point, and their aim will be to show how *any person*, young or old, whether naturally skilled or not, *may learn to draw*. We are convinced that there are thousands who would be glad to avail themselves of simple and plain directions, periodically continued, with plentiful examples for practice, provided such practice involves no expense.

We propose to point out, in these papers, by precept and ocular example, how wide is the range of useful practice that is open to any faithful learner in mechanical drawing by the use of a simple rule and pencil or pen. When we say that these instructions will be such that they can be taken up for practice or dropped at any time; that they are specially adapted for leisure hours or minutes, and are intended to be made so plain that the simplest minds may easily follow them, we think that those who neglect so excellent an opportunity for learning will be without excuse. We suggest to the heads of families that they cannot do a better thing for their boys than to make them a present of a year's subscription to the SCIENTIFIC AMERICAN SUPPLEMENT, and encourage them to follow these lessons in drawing. See prospectus elsewhere.

We also suggest to young men the propriety of devoting their leisure time to the practice of drawing, instead of wasting their evenings in useless loafing at the country store.

To all, whether young or old, we suggest the propriety of *learning to draw*. Its practice quickens the mental perceptions and insensibly promotes a taste for other useful studies, of which many, suggested from time to time in our paper, may be readily acquired.

The life of the late Henry Wilson, Vice President of the United States, is a striking example of the progress in knowledge that any faithful learner may make, even when he begins late in life, and under toilsome discouragements, such as those encountered by a poor shoemaker.

EXPLOSION AT THE PULLMAN CAR WORKS.

On November 10, a strange explosion took place in the Pullman car works in Detroit, which dangerously injured several workmen. We give some details about it, as the event conveys a useful lesson to establishments where similar arrangements are in operation, and because it is a verification of the scientific theory concerning the nature of explosive gaseous mixtures.

In this establishment, the furnace under the boilers is fed by the refuse matter of the workshops (shavings, sawdust, etc.), which is swept into openings in the floors of the different rooms. These openings communicate with a large brick shaft or flue, reaching from the top to the bottom of the building; inside this flue is an iron pipe through which the sawdust and small shavings, from several woodworking machines on the different floors, are blown. This material is collected by means of a fan blower, which, exhausting the air from funnels over the machines, carries it along by suction, and then sends it by pressure down the iron pipe into the furnace below, performing the double function of blowing the fire and furnishing fuel in the form of dust. When this dust fuel is not needed, the connection of this pipe with the furnace is closed, and the blast sent up through the surrounding flue, while the exit of the dust and shavings out through the roof is prevented by a wire grating or screen in a cupola on the roof, wherein this dust is retained. This cupola has to be cleaned out from time to time, the dust being thrown down the large brick flue. Workmen thus employed discovered that the material on the bottom was on fire, having been ignited through a defect in the closing of