SCIENTIFIC AND PRACTICAL INFORMATION.

FIREPROOF BUILDINGS.

An English architect proposes the building of floors of sheet iron and fire clay tubes, using these as a skeleton construction, and agglomerating the whole into a mass with concrete. This floor, he claims, is a non-conductor of heat and is entirely fireproof, and the hollow tubes can be employed for ventilation or for distributing the heat of a furnace, all over the floor of each room. Experiments on the strength of this flooring are said to have given satisfactory results.

DEXTRIN.

The *Polytechnisches Journal* recommends the preparation of dextrin by mixing 500 parts potato starch, 1,500 parts cold distilled water, and 8 parts pure oxalic acid in a vessel on a water bath, and heating till the mixture does not show the starch reaction when tested with iodine. When this point is reached, the vessel is removed from the water bath, and the liquid neutralized with pure carbonate of lime. Having stood for two days, the liquid should be filtered, and the filtrate evaporated on a water bath till it becomes of a pasty consistency. It can then be removed with a knife and dried into a cake in a warm place. Two hundred and twenty parts of pure dextrin are thus obtained.

STEEL HEADED RAILS.

The steel headed rails have been found, on trial by the engineer of the Reading railroad, Pa., to separate at the welds to an extent of 25 per cent of the rails laid down. It may be predicted that the use of the compound article is likely to be discontinued, especially as the price of steel has been brought so near to that of iron.

Ramie.

At the Exhibition of the Mechanics' Institute in San Francisco last year, the Pacific Ramie Company exhibited a single plant of this new textile. Like all the nettle family, to which it belongs, it makes a very vigorous growth in California soils.

From experiences with the plants now in growth, producers can count on two crops a year, making one tun of clear raw fiber to the acre, worth $350 in England. The plant is perennial and is propagated from roots, one planting lasting for years.

After the first year, the cost of cultivation is small, for the vigorous plant outgrows all weeds—from twenty-five to one hundred stalks springing up from a single root. The bark yields the fiber, which is of great strength, and from which a fine and durable quality of drsss goods, usually interwoven with wool or silk, are manufactured. It takes a permanent dye.

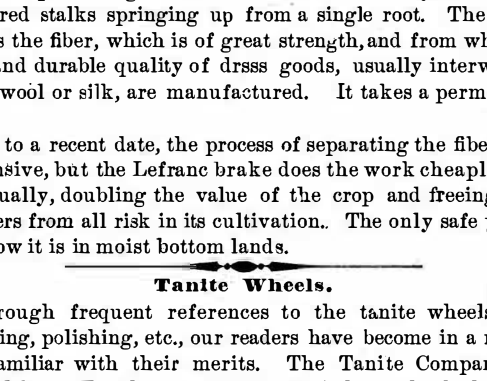
Up to a recent date, the process of separating the fiber was expensive, but the Lefranc brake does the work cheaply and effectually, doubling the value of the crop and freeing our farmers from all risk in its cultivation. The only safe place to grow it is in moist bottom lands.

Tanite Wheels.

Through frequent references to the tanite wheels, for grinding, polishing, etc., our readers have become in a measure familiar with their merits. The Tanite Company, of Stroudsburg, Pa., the manufacturers of these wheels, having ceased the contract system, now make all their own machines and are extending their works to meet the increasing demand for them. A false impression has obtained in some quarters, owing to this change in their method of doing business, that their machines are now put upon the market for the first time. This is not the case. Their merits have long been practically proved by use in many large establishments. The Company have now reduced both the manufacture of the wheels and of the machines to a system, and are employing the best mechanical skill, not only to maintain the character of their work at its present high standard, but to improve it if possible.

CLOTHES LINE REEL.

This is a new construction of the supporting frame of the reel, the frame having attached at one of its ends a dovetail tenon, A, for the purpose of connecting it to a corresponding dovetail mortise made on or attached to the post or building. The opposite end of the frame is provided with a guide, B, for the line as it passes on to or off from the reel. With the reel and frame are combined a friction plate to arrest the motion of the reel, so that, when the line is being drawn out, sufficient resistance will be offered to prevent any portion of it from dragging on the ground and thus becoming soiled. In ordinary reels, this precaution has been overlooked, and it is difficult to draw out the line without having it sag so as to touch the ground.



This invention was patented Nov. 21, 1871, by Mr. Charles H. Staffin, of Boston, Mass.

[For the Scientific American.]

FRICTIONAL GEARING.

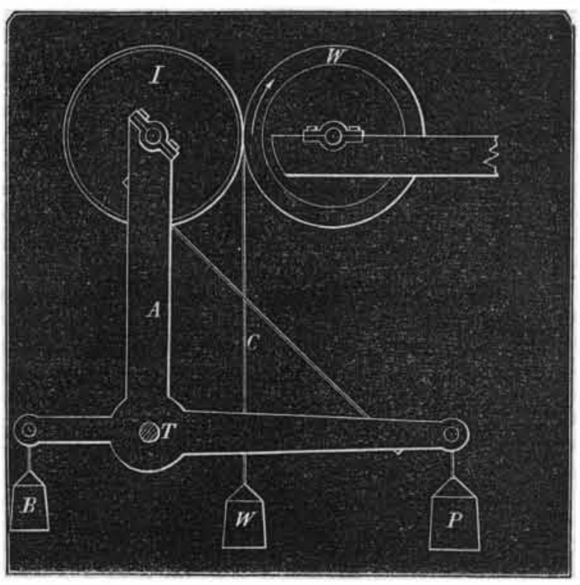
BY E. S. WICKLIN.

NUMBER III.

In the practice of mechanics, we are generally satisfied with an old and familiar principle, without giving ourselves any great trouble to inquire into the comparative degree of its efficiency. But this does not satisfy the requirements of science; nor is it sufficient for the practical mechanic when applied to principles less familiar.

When new modes are introduced as rivals of the old, the question of comparative efficiency is at once raised, and should be met by crucial experiment. But unfortunately for both science and practice, these questions are not generally so met. Too few experiments are made, and those without sufficient care and accuracy to establish principles or remove doubts. No experiment is, however, without some degree of interest, and when all the conditions of a test are known it is not difficult to estimate approximately the value of results. With this view, the conditions and results of a few experiments, made to test the tractive power of smooth-faced friction pulleys, are here given. These experiments, when made, were not meant for publication or for the benefit of science, but to establish rules for private practice. They should be repeated by others before being taken as conclusive.

For the experiments, two pulleys were made in the usual way, one being of wood—soft maple—and the other of iron. Both were accurately and smoothly finished. These pulleys were each seventeen inches in diameter and of six inches face, and were put up as shown in the annexed diagram.



A, in the diagram, is a double bell crank frame, with arms two feet long. The ends of the upright arms receive the bearings for the iron pulley, I. The journals of this pulley are one and a half inches in diameter and three inches long, and run in Babbitt boxes. The frame is hung upon journals or trunnions, *t*, and balanced by the weight, B. W and P are strong packing boxes, which are filled with scrap iron to the extent required. The face of the pulley, I, is extended beyond the six inches to receive the cord, C, for which purpose a shallow groove is cut in the pulley so as to bring the center of the cord just to the periphery. The driving pulley, W, is put upon a shaft where it may be made to revolve slowly in the direction of the arrow.

It will be seen that the weight in the box, P, upon the horizontal arm will bring the pulleys together with a pressure just equal to the weight. The wooden pulley being in motion, the pressure, when sufficient, will roll the other pulley and raise the weight, W.

The manner of experimenting was to put a given weight upon the cord, C, and, while the driving pulley was moving, to load the box, P, until the weight, W, was carried up. The machinery was then stopped, when the weight would slowly descend, slipping the iron pulley backwards upon the wood. The weight in the pressure box was now noted; the weight was again raised, and the pressure increased sufficiently to hold the weight from slipping down, and the pressure again noted.

In the following table, the figures on the left show the weights raised. The second column gives the pressure just sufficient to bring the weight up; and the third column shows the weight necessary to raise and hold the weight, without slip.

After these experiments were made and twice repeated with the pulleys, the frame, A, was reversed, so that the weight in the pressure box would tend to separate the pulleys. They were then connected by a six inch leather belt, and the experiments repeated with the results given in the fourth and fifth columns of figures.

FRICTION PULLEYS.			BELTED PULLEYS.	
Weight raised	Pressure required to just raise the weight.	Pressure required to raise the weight without slip.	Pressure required to raise the weight.	Pressure required to raise the weight without slip.
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
10	29	33	30	34
20	58	65	60	69
30	87	96	91	120
40	115	125	121	159
50	143	154	153	199
60	171	185	183	242
70	199	214	213	247
80	225	244	239	332
90	264	289	278	375
100	295	312	310	419
120	354	387	372	487
140	416	433	442	563
160	477	499	524	652
180	538	561	592	731

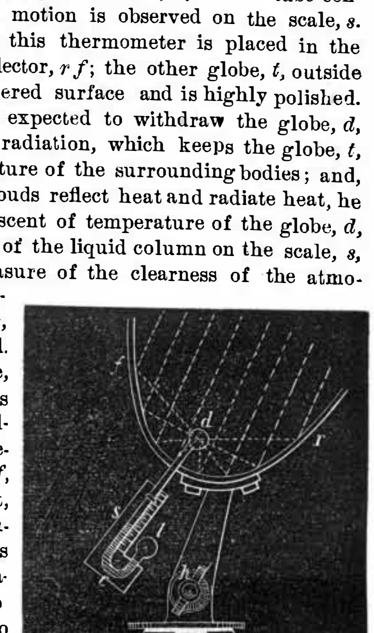
It will be seen that, in this test, the traction of the friction wheels was greater than that of the belted pulleys, and considerably more than is usually supposed to be obtained from belts upon pulleys of either wood or iron; and that, while there is a marked falling off in the adhesion of the belt as the work increases, that of the friction increases as the labor becomes greater. Also, that the difference in the pressure required to just do the work, and that necessary to do it without loss or slip, advances in an increasing ratio with the work of the belt; but in the friction it is almost constant throughout the whole range of experiments. The figures applied to the friction wheels are the mean results of repeated experiments; those applied to the belted pulleys are each of a single test. It is not thought that these experiments were sufficient to fully establish all that the figures show; but they were enough to prove that smooth faced wheels possess a much higher tractive power than has been generally supposed. They are given without further deduction or comment.

And now a word as to some of the advantages of friction gearing. Being always arranged with a movable shaft, so that the wheels may be thrown together or apart with the greatest ease, the machine driven by it is started and stopped at any moment while the driving wheel remains in motion. And when stopped, the separation is complete, and may so remain for any number of minutes or months without attention, and may be again started at any moment without the least inconvenience or injury. So slight is the separation required that it is done almost without an effort. And by it, we entirely dispense with the nuisance of loose pulleys, belt shifters, and idle running belts; and with the risk of throwing off and putting on belts. It obviates the delay and labor of shipping and unshipping pinions, and the rattle and bang and frequent breaking of clutches. It is durable, and requires no repairs; it is compact, and economizes room. It does not increase the pressure on journals when the speed is quickened, as is the case with belts running with great velocity, but remains constant at all speeds. And it will transmit any amount of power, from a hundredth part of a horse power to one hundred horse power, with no greater per centage of loss, and with less pressure on journals than can be done by belts.

It is not contended that this style of gearing should supersede the belt. There are hundreds of situations in which nothing can take the place of belts. The ease with which they can be carried in almost in any direction, and to any reasonable distance, will perhaps always place them foremost as a means of transmitting power. But where several machines, that must be run independently of each other and be stopped and started without interference, are driven by the same motor, one connection, at least, should be frictional; and that, if practicable, should be the connection nearest the motor. Where the motions are slow and the occasions for stopping few, this is of less importance; but where the speed is considerable, and the stoppages are frequent, it will be found a very great convenience.

MEASURING THE CLEARNESS OF THE SKY.

John Leslie invented, in the beginning of this century, an apparatus intended to measure the amount of clearness of the sky, and he called it therefore an aethrioscope. It consisted of a differential thermometer, *d t*, which operated as usual by the difference of expansion of the air in two glass globes, thus moving the liquid column, *c*, in the tube connecting them; and this motion is observed on the scale, *s*. One of the globes, *d*, of this thermometer is placed in the focus of a parabolic reflector, *r f*; the other globe, *t*, outside the reflector, has a silvered surface and is highly polished. By those means, Leslie expected to withdraw the globe, *d*, totally from terrestrial radiation, which keeps the globe, *t*, at the constant temperature of the surrounding bodies; and, as he had found that clouds reflect heat and radiate heat, he anticipated that the descent of temperature of the globe, *d*, and the consequent rise of the liquid column on the scale, *s*, would be a direct measure of the clearness of the atmosphere. His anticipations were, however, only partially fulfilled. He found, for instance, that when the sky was cloudy, the liquid column did not move, whether the reflector, *r f*, was covered or not, proving that the radiation from the clouds counterbalanced the radiation of the mirror towards them; but he also found that the amount of cloudiness had very little influence on the instrument, and that even a total absence of clouds showed sometimes little radiation; while at other times with an equally clear sky, very powerful upward radiation manifested itself by the cooling of the bulb, *d*, and the rise of the liquid column. This utterly perplexed him, and he publicly expressed his inability to interpret the indications of his instrument, which, he said, "sometimes under a fine blue sky will indicate a cold of 50°, while, on other days when the sky is equally bright, the effect is scarcely 30°." The instrument was thus useless, for more than half a century; but recently, by investigation concern



ing the different powers of absorption by gases and vapors of the radiant heat passing through them, the apparent difficulty was perfectly explained, and Leslie's aethrioscope became a direct measure for the amount of totally invisible vapor in the atmosphere in the inaccessible upper strata.

In order to make this clear, we will first notice that the heat, when accompanied by powerful light, will pass through many transparent substances which will not transmit this heat when radiating without this light. So the solar rays will radiate with most of the sun's heat through the glass panes of a hot house, while the heat without that light cannot return and be radiated upward; such glass acts thus as it were like a check valve, letting the solar heat in, but preventing its return in the opposite direction. Our atmosphere acts in a similar way; notwithstanding some of the heat and light is absorbed in passing through its strata, we are the gainers, as it prevents the return of the heat, by being a powerful check to the obscure radiation of the same. The intense cold prevailing high up on the tops of mountains, where the atmosphere is very rare, and higher up still on the moon, where, practically, there is no atmosphere at all, is partially due to this cause.

In the second place, it must be remarked that a perfectly dry atmosphere is quite transparent for obscure radiant heat; this explains several facts which otherwise would be difficult to understand; for instance, the nights in Persia and still more in the desert of Sahara are so cold, for the simple reason that the atmosphere is so dry and gives an easy egress to the obscure caloric rays which, during the night time, radiate upwards to the celestial space. This effect is still stronger in high regions where the air, besides being very dry, is more rarefied than it is lower down. So the accounts of our countryman, Mr. Squiers, who was sent by the United States Government to the high lands of Bolivia, South America, inform us that, after a burning hot sun during the day, night frosts devastate the vegetable kingdom to such a degree that only grasses fit for cattle can continue their existence, and no forests can keep alive; people live mostly on animal food, and use the droppings of the cattle for fuel to cook it. At the other hand, Louisiana, especially New Orleans and the country south of it, is always covered with such a moist atmosphere that night frosts are very rare, even in midwinter, and we find the most luxurious subtropical vegetation, for the double reason of a moist atmosphere being favorable to vegetable growth, by the continual supply of a kind of irrigation in the state of vapor, and the preservation of the surface heat during the night, the moist atmosphere covering the ground and preserving the heat like a blanket on a sleeping couch. The phenomenon of the dew, formerly so ill understood, is also easily explained by the radiation of obscure heat through a transparent cloudless atmosphere, which radiation cools the surface of the earth to such a degree that the air, in contact with that surface and cooled by it, loses its capacity for watery vapor, becomes foggy, and deposits water on the surface of the ground.

Several investigators have occupied themselves to determine the amount of absorption which different kinds of vapors and gases offer to radiant heat. Tyndall, in his late publication "On Radiation," gives a comparative table from which we extract the following:

Name of gas or vapor.	Amount of absorption.
Dry air	1
Geranium vapor	33
Lavender "	60
Oil of laurel "	80
Oil of cassia "	109
Oil of aniseed "	372

These figures have been found by passing the obscure radiant heat over a bibulous paper which was moistened with the perfume, and the intensity of these rays, on the surface of a thermo-electric pile, was measured by the amount of electricity generated, a method which we will explain in a future article.

If watery vapor is then a powerful absorber of obscure caloric rays, the amount of this absorption can be used as a measure for the amount of the absorber in the atmosphere, that is, for the amount of watery vapor; and this is exactly what is accomplished by means of the aethrioscope; a total absence of radiation from the bulb, or perhaps rather the perfect compensation of its loss by radiation, by the downward radiation or reflection of the heat absorbed by the watery vapor, is of course indicated by an absence of motion in the liquid column, *c*, of the instrument. This takes place as soon as the sky is commencing to be covered with a thin film of cloudy mist; but before this point of the beginning of the condensation is reached, the sky is clear, notwithstanding it is charged with a great deal of vapor; and there is an infinite graduation in the amount of this vapor, from the point of visible condensation mentioned to that of drying, which will all show itself by the amount of radiation toward the celestial space, and the consequent greater or less motion, of the column in the aethrioscope, taking place as soon as the surface of its reflector is uncovered, the same being directed towards that part of the upper atmosphere of which we wish to determine the amount of invisible moisture.

We need not say that, between the point of condensation when the vapor commences to be visible and that of actual rain, there is also a gradual increase of the amount of floating water particles and consequent density of the clouds, which finally will discharge their excess of liquefied vapor in the form of rain.

MEN are often capable of greater things than they perform. They are sent into the world with bills of credit, and seldom draw to their full extent.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Steam Propulsion on the Canals.

To the Editor of the Scientific American:

Although more than a year has passed since the award was offered for a new motive power for the propulsion of boats upon the canals, no plan has as yet been submitted which is capable of superseding the old system in point of economy, a point which seems to have been generally overlooked, in consequence of the prevailing erroneous impression that the principal difficulty, to be overcome in the application of steam power for canal propulsion, is to prevent the washing of the banks by the commotion, created in the water by the propelling instrument, in connection with the increased rate of speed of the boat. It is a noticeable fact that the merits, of nearly all the new plans produced, are based upon the prevention or neutralization of the swells, which are claimed to work so much damage to the banks of the canals.

The report of the commission appointed by the act, also the report of the engineer of the commission, have just been published, and will no doubt place the matter in a clearer light, so that the object aimed at by the authorities can no longer be misunderstood.

Section third of the act requires a speed of not less than three miles per hour, as an average, "without injury to the canals or their structures." It was soon discovered that this phraseology was calculated to lead many inventors into serious errors, by which their time and money would be wasted. The commission, therefore, in August last, unanimously adopted a resolution whereby the subject was thoroughly explained. The principles involved in the ordinary systems of propulsion are also thoroughly explained in the engineer's report referred to. The writer of this article has made numerous experiments in steam propulsion, for the purpose of ascertaining the causes of the evident waste of power resulting from the use of even the most approved propelling instruments acting upon the water. The inferences drawn from these experiments are fully sustained by the engineer, so far as the points considered are identical.

One point in the report, with reference to those systems in which the water displaced at the bow is forced through a channel or flume under the boat, furnishes, in my opinion, the key to the whole mystery of the enormous waste of power in the use of paddle wheels or screws acting against the water. It is shown that the water driven back, by contact with the sides of the channel, produces the effect of serious ly retarding the progress of the boat, and explains the very slow rate of speed attained by boats propelled in this manner. A similar action, although somewhat modified, undoubtedly exists with the wheel at any other part of the boat than the bow. When the wheel is at the stern, the water acted upon must recede at a rapid rate of speed and must also be replaced by that adjacent and ahead of the wheel, for the latter acts in two directions, namely, backward and centrifugally, and creates a suction ahead of the screw. The proof of this lies in the fact that when an ordinary tug boat drawing, say, six feet of water is placed upon the canal, having a depth of seven feet, upon the screw being set in motion a settling of the boat takes place, by reason of the water drawn out from under the hull—first, that adjoining the screw, followed by the whole volume under and at the sides some distance above the keel; and this forced receding of the water in contact with the boat also materially retards its progress. This is more noticeable upon canals and narrow streams than in the open sea; in fact, by reason of the great expanse of water, it is in the latter case additionally modified. The facility for comparison, between the work of a given number of horses in towing and steam of equivalent horse power as applied for propulsion, when applied to act against the water, is the chief cause of rendering the waste of power more noticeable, and of course it cannot be made available at sea. It would seem, therefore, that in order to apply steam power profitably for propulsion, an entire departure from all systems of acting against the water is required, and the latter should be employed for flotation only.

PRO BONO.

Schoharie Court House--Hub and Spoke Factory. Schoharie Valley--Geological Features and Reminiscences.

To the Editor of the Scientific American:

Though not strictly a manufacturing village, Schoharie contains one establishment, at least, the special and peculiar character of which makes it interesting. I refer to the American Hub and Spoke Factory, which the proprietor, Mr. Treat Durand, kindly gave me an opportunity to inspect.

Into the hub department, are brought the logs of elm, white oak, and birch, which are first cut with circular saws into pieces of the proper length, which is determined by the diameter of the stick. These pieces are then bored by machinery, after which they are turned on self regulating power lathes, which are the characteristic features of the establishment. They were the invention of Mr. A. Richard of this place, and have been in use since 1859. The turning is done by means of knives which resemble plane irons, being somewhat shorter and stronger, the edge being shaped to correspond with the edge of a vertical section of a hub. These knives, four in number for each machine are fastened with bolts to the sides of a strong shaft about four inches square. Two straight edged knives cut the straight portion of the convex surface at the ends; two others of proper shape cut the curved and grooved central portion. This knife bearing shaft is made to revolve with great rapidity; while the block to be turned, after being fixed in a sliding frame or carriage (a strong bar driven through the hole in the center serving as a mandril), is drawn up to the cutting knives at the same time that it is made to revolve slowly by means of two spirally threaded shafts and corresponding cog wheels at one side which gear the cutting shaft with the carriage. The diameter of the hub is regulated by putting a pin into a hole in the frame on which the carriage moves. The lathes are of different sizes, each machine being adjustable to several sizes of hub. The smallest hubs made are six inches long and three in diameter, the largest, eighteen by twenty inches. Of the smaller sizes, one machine will turn four hundred hubs in a day; of the larger, from one hundred to one hundred and fifty. A few lathes were sold by the American Hub Company, the former owners of this establishment; but this is believed to be the only factory in the country where hubs are extensively manufactured by power lathes. On the order book, nearly all the States are represented, large shipments being made to the extreme West and South. After passing through the lathe, the hubs are painted and then laid away to season. Previous to shipment, they are mortised by machinery, according to directions given by purchasers. Spokes also are turned by automatic lathes, not peculiar to this establishment, the cutting gouges being fastened to the periphery of a wheel about ten inches diameter, which revolves rapidly while it moves slowly in the direction of the length of the spoke, which also revolves slowly, the frame which holds the spoke in the meantime moving back and forth so as to give the spoke an oval form. The spokes are smoothed on sand belts, and tenons are cut by machinery. The timber used for spokes is hickory and white oak.

In the vicinity of this factory are several localities and objects of scientific and historic interest. The beautiful valley of the Schoharie, with its rich alluvial soil to which General Washington looked for wheat for his armies, and which has ever since teemed with abundant harvests, is bordered with hills several feet high, which Nature has laid up in gigantic terraces, and of which the exposed rocky faces with their wealth of minerals and organic remains are a standing invitation to geologists and palæontologists to gather stores of trilobites, encrinites, minerals, and fossil shells, "butterflies," as they are frequently called. Mr. Albert Lintner, curator of the New York State geological rooms, and his predecessor, Mr. John Gebhard, acquired a large share of the scientific information, by which they were fitted for the office, by the exploration of these rocks and the careful study of their contents.

A short distance above the hub factory, there issues from a cave at the base of a limestone ledge, a clear cold fountain of sufficient capacity to supply the village with water. Near the spring stood the old Lutheran church, and Lawyer's tavern, the resort of the friends of freedom during the Revolution. A mile below is the "Old Stone Church," which was built in 1772, and served as a fort during the war; and which is now owned by the State and used as an arsenal.

C. H. DANN.

Schoharie, C. H., N. Y.

Amalgamation of Gold Ores.

To the Editor of the Scientific American:

Within the past few months there have appeared, in your valuable journal, various articles upon the amalgamation of gold ores. Being engaged in gold mining in South Carolina, I have read these articles with great care; but I must confess that none of them have pointed out a satisfactory process whereby the gold, that is now lost by imperfect amalgamation, can be saved. The great want is something, or some way, that is rapid, simple, cheap, and efficient. At present, blankets, copper plates, either quicksilvered or silver plated, and the use of "quick" in the battery are the methods, mostly relied upon by miners, for saving the gold. But they know that from forty to sixty per cent of the gold is lost by the use of these means. They are, however, the best, cheapest, and most rapid of any means yet discovered for saving the gold in the ordinary class of ores.

In your issue of March 9th, there is an article calling attention to the process of Mr. Percival Stockman, and it is stated that "practical men" recommend it "to the mining world." The process, however, so far as the amalgamation of "free gold" is concerned, is simply a modification of Wyckoff's chloride of silver process, and I doubt if it is any great improvement upon it. The difficulties with both processes are slowness and expense.

A great majority of mines yielding free gold produce ores that will not work more than ten dollars per ton; and, of course, a large quantity must be worked to make it pay. Hence any process that is not rapid and cheap will not answer.

As to the working of sulphuretted or "rebellious" ores: Of the hundreds of patented and other processes, hardly one is worth a moment's consideration. It may be said, however, that many of the so called improved and newly discovered methods work well enough in the laboratory, but, when put to a practical test, are found to be worthless.

After many experiments, I have found the following process to be the best: I first roast the ore (though it is free gold ore) in large piles, thus rendering it very friable, and thoroughly drying all the dirt and clay. In every ton of the ore, there is about 300 pounds of fine rock and dirt, which I have screened out through wire sieves of about one quarter inch meshes, and this fine stuff I run through a common drag mill, and then through a "Georgia rocker," thus saving nearly all the gold. In fact, by this simple process I obtain nearly fifty dollars of gold per ton of dirt; whereas, when run through the stamp mill and over copper plates, I obtain only about ten dollars per ton. The rock I crush in one of the Wilson patent stamp mills, using quicksilver in the bat-