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AMERICAN INDUSTRIES.—No. 70.

FLOUR MILLING.—THE ELECTRIC MIDDLINGS PURIFIER.

However simple in outward appearance, a grain of wheat exhibits, when looked into, a curious complexity of structure, organically as well as chemically; and the processes now employed in converting grain into flour are scarcely less complex and curious. Indeed, unless one has made a special study of modern milling he can have no idea of the many processes of reduction and purification a grain of wheat now undergoes between the bin and the flour barrel.

It is doubtful whether any other great industry has during the past ten years experienced so complete a revolution as flour making. For the previous half century or more, from the day when Oliver Evans set up the first automatic milling machinery in his mill on the Brandywine, the industry grew in volume and importance, but underwent no signal or radical improvement in machinery or processes. The non-progressive period came to an end about 1870; and since then change, and rapid radical change, has been the order of the day, at least in the great merchant mills, which turn out by far the larger and better portion of American flour.

The causes which led to the era of change were several, chief among them the conditions and exigencies of wheat growing in the new Northwest, the development of cheap railway communication with the seaboard, and the resulting possibility of competing with Austria and Hungary in supplying the flour markets of Western Europe. The problem was to make good white flour out of the spring wheat of Minnesota, and the processes of milling were revolutionized for its solution. To describe in detail even the more characteristic changes in the means and methods of milling thus brought about does not fall within the scope of this paper. It is necessary, however, to indicate roughly the more important of them to enable those of our readers who are not millers to appreciate the improvement in milling processes to be described and illustrated below.

Structurally the wheat kernel is composed of the following parts: (1) The light, straw like, valueless hull, comprising the three parts called *epidermis*, *epicarp*, and *endocarp*, together making about 3 per cent of the weight of the grain. (2.) The testa or episperm, which forms, with an underlying membrane, the inner skin of the berry. This part carries the coloring matter, and constitutes about 2 per cent of the weight. (3.) The germ and its membranous expansion, say 5 per cent; nutritious but not desirable in the flour, since it carries an oil likely to become rancid and injure the sweetness of the flour. (4.) The central or floury portion, 90 per cent, composed of starch and gluten variously combined. The heart is the softest, and contains the least gluten. In the successive layers around the center the proportion of gluten increases outward, the entire amount varying with the kind of grain, the quality of the crop, etc., etc.

The old process of milling involved but two distinct operations after the wheat had been cleaned—the grinding and the bolting, or separation of flour from bran. Three products were obtained: fine flour, more or less discolored by particles of 1 and 2; a coarser and more granular part, rich in gluten and dark in color, called middlings; and bran, more or less mixed with the other two.

To obtain the largest possible yield of flour the stones were set close together, or the upper stone "low." With soft, starchy, winter wheat, having a tough husk, low grinding gave excellent flour. With the hard and brittle hulled spring wheat the flour was mixed with so much fine bran, which could not be bolted out, that it was unpopular and unprofitable.

The new process was designed to remove these objections to the flour made from Minnesota wheat. The aim now became, not to make the most fine flour and the least middlings at a grinding, but the reverse; it being found that, when properly purified or freed from branny particles, the middlings

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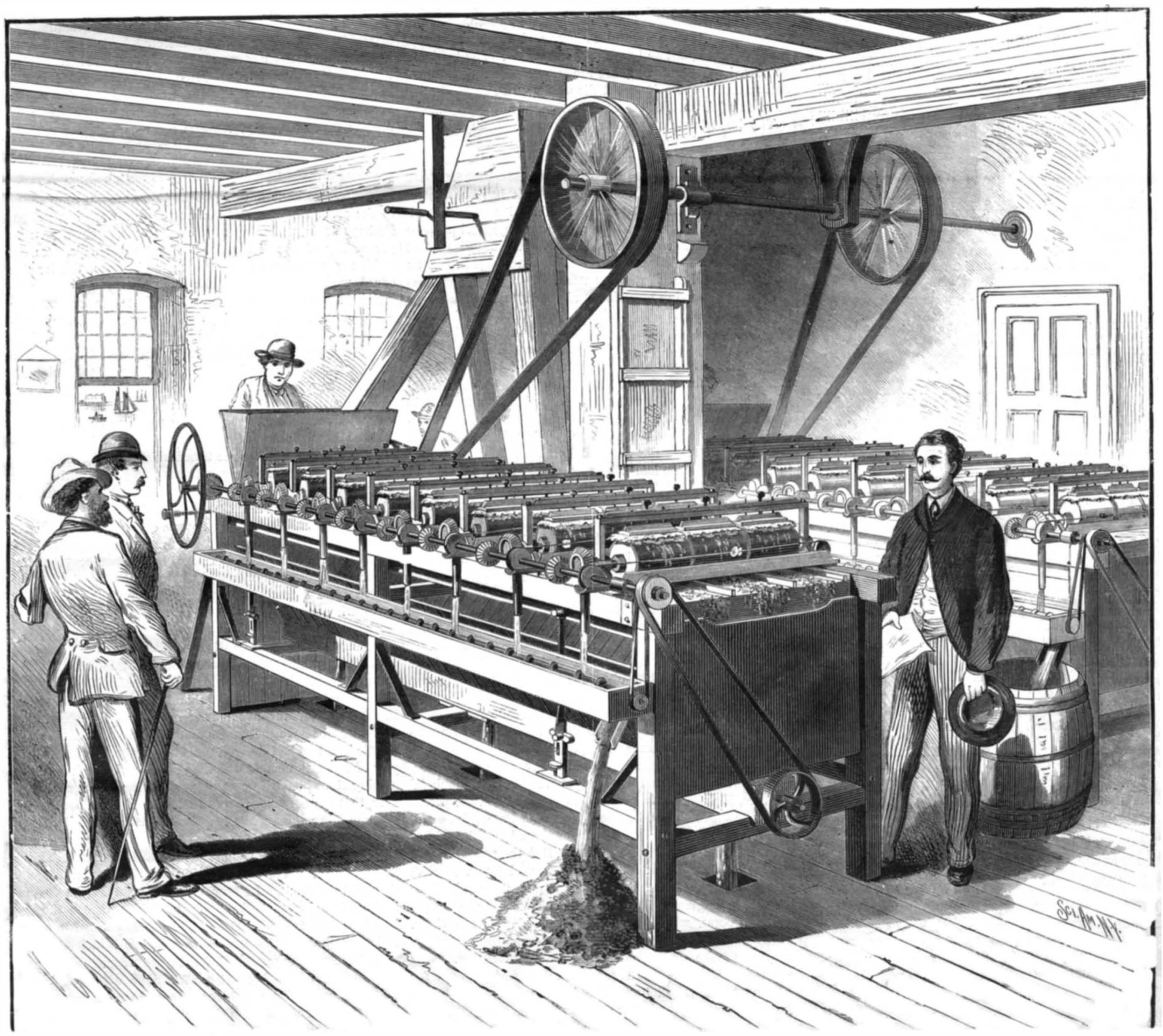

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NEW YORK, SATURDAY, APRIL 9, 1881.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 275,

For the Week ending April 9, 1881.

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RECENT INFRINGEMENT DECISIONS.

Attention was called some months ago by the SCIENTIFIC AMERICAN to the important question involved in the noted suit against Postmaster James—What remedy has an inventor when a government officer uses his invention and refuses to pay royalty? The decisions than narrated were to the effect that the postmaster was personally accountable for the profits realized in the city post office by the use he had made of the plaintiff's canceling stamp. Since then two further decisions have been rendered in the same litigation. Postmaster James applied to the court for a certificate that there was "probable cause" for his using the patented stamp. The courts are authorized to grant such a certificate when an officer of the revenue is sued for damages for an official act; and the effect is that the judgment for damages is paid out of the Treasury, and the officer goes free. The court said that such a certificate cannot be granted to a postmaster, because he is not an officer of the revenue. Mr. James will need a special act of Congress to authorize the Treasury to pay the damages in his behalf. The other of the two decisions was in his favor. The owner of the patent, not being satisfied with the damages awarded—they were, we believe, upwards of $60,000—applied to the court to order judgment for "increased damages." The judges are allowed, when they see it to be just to do so, to increase the damages rendered against an infringer, not exceeding three times the amount of the verdict. But the court said that this can only be done in an action for damages, and is not allowable where the suit is for an account of profits. Moreover, in this instance it had been greatly to the advantage of the owner of the patent that his invention had been used and his right established to recover the profits, which were quite sufficient.

It is a familiar general rule that a patent for a combination is not infringed by use of distinct parts; the essence of the invention being in the combination, unless a person uses all the parts, he does not use the invention. A recent decision recognizes an exception to this rule, and says that if one part of a patented combination, considered by itself, is novel and useful, and is an invention for which the inventor might have taken out a separate patent, then using that part is an infringement, although the entire combination is not used. The patent was for a double-acting pump. Several contrivances were combined in it, one of which was a new mode of taking out and replacing the valves. The infringer contrived a rival pump, using the same method of removing and returning the valves, but dispensing with any imitation of some other parts of the combination. He was enjoined.

The importance and difficulty of rendering the high explosives needed in modern engineering unexplosive while in transportation or in storage is well known. "Dynamite" or "safety powder" is the name of one article which has been patented and used as a safe explosive. It has been introduced and patented in England; and there it met with competition from a French article of the same general purpose named "lithofracteur." In a lawsuit in the English Court of Chancery, the lithofracteur has been adjudged to be an infringement of the dynamite patent.

Persons exporting manufactured goods to England may be interested in another decision. The inventor of an improved process for making salicylic acid—a useful but formerly very expensive medicine—took out letters patent in England for his process, and by means of it was able to manufacture the drug at about half former cost. A subsequent inventor of a rival process formed a firm and established a factory in Germany, and brought the acid manufactured there into England for sale. When he was sued his lawyers argued that the patent only forbade manufacturing in England; that he had a perfect right to manufacture in Germany; and that if his goods were lawfully manufactured, the patent did not forbid him from importing and selling them.

"A justice asked whether the sale in England of a product made abroad could be restrained because it was made according to a process which was the subject of an English patent, the patent being only for a new method of making a product previously well known.

"Counsel for the patentee cited two former decisions that it might be.

"Counsel for the infringer said that such a principle if carried out would lead to absurd consequences. Suppose a process to be patented for making flour by crushing wheat instead of grinding it, and suppose all the millers in France were to make flour according to that process, is the importation of flour from France to be prohibited?"

But the Court of Appeals decided in favor of the patentee. The opinion states that the judges were at first doubtful whether, if a process is patented in England and the patent is for the process only, and that process is imitated abroad, the importation of the product from abroad and the sale of it in England is an infringement. But they reached the conclusion that the exclusive right granted by an English patent, although for a process only, includes a monopoly of the sale in England of products made according to the patented process, whether made in the realm or elsewhere. These patents expressly forbid any person directly or *indirectly* to make, use, or put in practice the invention. Now a person who procures the product to be made abroad for sale in England, and imports and sells it there, is, surely, indirectly putting in practice the invention. Any other rule would render a patent for any really valuable process worthless. America it is familiar that if the patent is upon the article it forbids sales of it here, wherever made; but the same has not been generally understood as to a patent upon a process.

A singular controversy arose between two rival manufacturers of steam engines. Each had a patent for the kind of engine he made, and there was not, in truth, any infringement or legal interference between them. But one of them, rather inappropriately named Brotherhood, made it a practice to publish notices charging that the other engine was an infringement of his patent, and, whenever he could gain the names of persons who thought of purchasing the rival engines, he would make threats to them that if they bought them he would sue them for infringement. This course he continued for three or four years, with the effect, of course, to injure his competitor's business, yet he never in any instance brought such a suit as he threatened, and had no real ground for maintaining one. At last the competitor—Halsey by name—brought suit to enjoin him from giving any more such notices and threats. The Chancery judge decided that the suit would hold. An owner of a patent has a right, acting in good faith, to give notice of his claims as he believes them to exist, and to threaten an injunction suit against infringers. And if it should so happen that he overstates his rights, or that the infringers desist of their own accord, and so the suit threatened is never brought, he is not liable to any lawsuit. But the case stands very differently when he knows that he is, in his notices, exaggerating his rights, and has no real intention of bringing suits as threatened, but only hopes to break down his competitor's business by alarming the latter's customers. Such practices —or any unfounded or malicious assertions that a machine on sale is an infringement of a patent—are in the nature of a libel on the manufacturer of the rival machine aspersed.

SEA SICKNESS.

Much has been written about this troublesome malady and many remedies suggested, yet *mal de mer* remains the same bugbear it ever was. Thousands of people inhabiting the Old World are deterred from visiting our shores by thoughts of this, and among them many of the ablest scientists and literati. Our energetic race are less inclined to yield obedience to their fears, so that the annual tide of tourists abroad is scarcely affected by it. To many, however, the sufferings are a source of dread and leave behind unpleasant reminiscences. Each, however, seeks comfort in the assurance that it involves no risk of life, for no one ever died of sea sickness, on the contrary the after effects are usually favorable. Sea voyages are recommended to those in poor health, those exhausted by mental or physical labor, for the enforced rest brings relief unattainable on land. There is no daily mail, no newspaper, no market reports. The busy world is nothing to us there; it is comparable to the seclusion of a cloister, or the durance of a prison. Perhaps it is well that nature's claims absorb the entire personality of the victim for the first three days, else the sudden change from life to death, as it were, the terrible ennui, would drive reason from its seat.

Sea-sickness has been charged to first one organ, then another: the liver, the brain, the nervous system, the imagination, all have been attacked, but the poor stomach alone seems to be capable of expressing its dissatisfaction. Numerous remedies have been suggested by persons who discovered them just as they were about ready to recover, and hence attribute their recovery to the remedy instead of the remedy resulting from recovery. Others who have tried them at the beginning of the voyage fail to derive any benefit. One writer says that he timed his breathing to the motion of the vessel, inspiring as it went up and expiring as it went down. One tells you to keep a full stomach, another advises a fast, and we have been benefited, we think, by one on one voyage, by the opposite course on the next. One advises you to drink freely of brandy, another to be temperate; one attributes his sickness to a glass of beer, another to champagne. A cabin boy once told us that he had derived great benefit from a towel tightly bound around the waist, and that during several of his earlier voyages he could do no work except when tightly bandaged. This remedy has been more fully elaborated recently, and one writer, Dr. Jobart, of Brussels, states that the belt should be made with gores so as to accurately fit the body and stiffened with whalebone like a corset, and worn as tightly as it can be borne. Ladies, he says, find less inconvenience from its use than gentlemen. Not long since we met a gentleman who said that he felt satisfied that he had derived benefit from the use of a straight pair of ordinary corsets which he purchased at a ladies' furnishing store just before sailing. The inconvenience, however, that a man experiences in lacing his own corsets and of concealing them while on, caused him to abandon their use. Ladies, on the other hand, who are accustomed to lace tightly on shore, usually lay aside their corsets at the first feeling of sea sickness, saying that they feel worse with them than without. If, however, they would resist the first impulse to unloosen their dress, it might prove in the end as advantageous for females as Jobart says it is for males. It is well known that sailors wear a belt which is drawn much tighter than most ladies' belts are worn.

Sailors who have been at sea for years will often sicken when an unusually rough sea is encountered. Men who have just returned from a four years' whaling voyage are terribly sick on a Sound steamer.

lime water, equal parts. Hydrate of chloral is also advised, but must be administered by a physician. Nitrite of amyl is looked upon by Clapham as curative in 90 per cent of all cases treated. Three drops are inhaled from a hand kerchief held close to the nose, the patient being in bed. This is, however, too powerful a remedy to be placed in the hands of the laity.

There remains one point to be considered, to which the attention of the faculty and laity should be directed, as much ignorance prevails in this respect, namely, the effect of sea sickness upon pregnant women. The nausea attending this condition is as difficult to control as that which belongs to sea sickness. When the one is superimposed upon the other, continuous vomiting may set in with such violence that utter prostration results, retching continues, and the strength of the patient is exhausted and a typhoid condition sets in which results in death, not from sea sickness but from exhaustion. The testimony of the stewards of ocean vessels confirm this theory. and a recent case that came to the knowledge of the writer came near resulting fatally, and the patient had to be kept under the influence of morphia, hypodermically injected. A severe illness of two or three weeks resulted after coming ashore. Through all these vicissitudes the fœtus suffered no ill effects, and at the expiration of the usual time was delivered without accident. The danger of a sea voyage to a lady during the latter stages of pregnancy cannot be overestimated, not from the dangers of miscarriage, which has never been known to result, even during the ninth month, but from a return of the nausea and vomiting, which quickly exhausts the strength when no nourishment can be retained and even stimulants are rejected by the outraged stomach.

REPORT OF THE EXPERT.

We have received from Mr. John W. Hill a copy of his report as the expert appointed to superintend the test trials of automatic cut-off steam engines at the Millers' Exhibition, Cincinnati, O., June, 1880. It contains 90 pages, and for excellence of arrangement and clearness with which it exhibits the mathematical values of the performances of the tested engines, the report is a model. Five engines were entered for trial, but two of these were withdrawn, and the test was therefore confined to three, namely, a Harris-Corliss engine, built by William A. Harris, Providence, R. I.; a Reynolds-Corliss, built by E. P. Allis & Co., Milwaukee, Wis.; and a Wheelock engine, built by Jerome Wheelock, of Worcester, Mass. The following are some of the particulars of the several engines and their performances, as given in the report:

	Reynolds-Corliss.	Harris-Corliss.	Jerome Wheelock.
Cylinder	18·02″	18·03″	18·26″
Stroke	48″	48″	48″
Flywheel	16′	16′	16′
Weight of engine, exclusive of flywheel., lb	22,180	18,000	9,000
Weight of flywheel, lb. ..	14,694	11,950	12,000
Revolutions per minute...	75·383	75·830	74·472
Factor of horse power....	4·6039	4·6416	4·6666
Boiler pressure.....	95·83	96·09	96·25
Indicated horse power...	162·9952	165·5781	158·3846
Friction of engine.....	10·2624	9 5734	7·8141
Net effective horse power.	143·1953	145·0766	143·9463
Coefficient of usefuleffect.	87·8516	87·6183	90·8845
Coal per ind. h. p. p. h., evaporation 10 to 1.....	1·9489	1·9364	1·9265
Steam per ind. h. p. p. h ..	14·886	13·755	13 915
Lb. of water expended per lb. of steam.	30 881	32·532	24·743
Relative economy.....	0·98848	0·99487	1·00000

The engines were all fitted with liberating valve gear. The "Harris" and "Reynolds" using the original "Corliss" valves and gear, with special improvements of their own; and the "Wheelock" using a system of taper plug valves, placed below the base of the cylinder. The "Corliss" wrist-plates and valve rods are used by both Mr. Harris and Mr. Reynolds, but the latter has added a very ingenious liberating hook, which imposes a constant load upon the regulator, independent of the point of cut-off. In the "Wheelock" engine the eccentric hook engages with a stud on a small starting bar attached to the stem, and forming the lever or the forward exhaust valve. A link, with a gab at its forward end, extends back from the lever of the forward valve to the lever of the back exhaust valve. The motions of the exhaust valves are simultaneous in time and quantity. A short crab claw or liberating hook, pivoted to the lever of each of the exhaust valves, furnishes the opening movement of the corresponding steam valve.

The steam valves of the "Reynolds" and "Harris" engines were fitted with vacuum dash pots. The "Wheelock" engine was furnished with weight dash pots. The cut-off movement of the "Harris" and "Reynolds" engines was very prompt, but with the "Wheelock" engine the closure of the steam port was rather tardy.

The "Reynolds" engine was fitted with a combined fly ball and mercurial regulator, which was so nicely adjusted that changes of load or steam pressure produced no material change in the motion of the engine.

The "Harris" engine was fitted with a "Porter" governor, the performance of which was only fair.

The "Wheelock" engine was furnished with a fly ball and spring governor, which, while inferior to the "Reynolds" regulator, controlled the motion of the engine, during the regulator test, much better than did the "Porter" governor on the "Harris" engine.

The "Reynolds" engine was fitted with an independent, single-acting air pump and jet condenser. During the condensing trial the air pump was driven by a belt from the engine shaft; but the machine is provided with a steam cylinder, slide valve, and piston, to work independently of the engine under ordinary circumstances. The arrangement of the air pump and condenser is very compact and convenient, and as demonstrated during the friction trial requires much less power to work it than the form heretofore in use with this type of engine.

The "Harris" engine used a double acting air pump and jet condenser. The air pump was driven from the crank pin by a light shackle bar and rocker arm.

The "Wheelock" engine was furnished with a "Bulkley" condenser; as is well known this form of condenser requires no air pump, the air present in the exhaust being carried down the descending leg of the condenser by induction.

According to Mr. Wheelock, his condenser was calculated for a larger delivery of exhaust steam, and as no means existed for the contraction of the steam and water apertures in the condenser head, to the weight of steam actually exhausted, the condenser would not show as good results as a smaller machine.

So far as the vacuum is conducted, it did not equal the jet condensers of the "Harris" and "Reynolds" engines, but in economy of circulating water, it does not appear that the excess in size of the condenser worked any injury.

The general construction of the "Reynolds" engine was excellent, all parts were heavy and well fitted, and the design strikes the observer as being well calculated to successfully meet the natural working strains. Being entirely devoid of burnish or nickel plate, the engine had every indication of being built for service and not for display.

The "Harris" engine was in all respects similar to the engines furnished by this well known builder to his customers. The design appears lighter than the "Reynolds," with more polish and fewer details. The weights of the engines, exclusive of flywheels, do not vary greatly, with the excess in favor of the "Reynolds."

The "Harris" engine more nearly resembles the original "Corliss" than the "Reynolds," the form of the girder, and the valves, valve chambers, and valve gear, together with the regulating mechanism, being alike in the "Harris" engine and its celebrated predecessor; while Mr. Reynolds, in his design, retains only the four steam and exhaust valves and the wrist-plate motion, with the latter materially modified.

Although the "Harris" engine departs less from the original "Corliss" engine than the "Reynolds," Mr. Harris has added several valuable improvements of his own, chief of which are the cone bonnets, self-packing valve stems, and the Babbitt & Harris piston packing.

The "Wheelock" engine is a type of its own, with all the valves located below the cylinder in a common plane. This engine is a marvel of compactness and simplicity, and I might say oddity, as many of the peculiarities of the builder are reproduced in his engine.

Engineers of a fastidious turn have not been disposed to recognize Mr. Wheelock as in the front rank of automatic steam engine builders. But the record made by his engine in these trials may procure for him a more respectful consideration in the future. The whole engine is extremely light; the weight, exclusive of flywheel, being but one-half that of the "Harris," and less than half of the "Reynolds" weight. But the weights of the two latter engines include the air pump and condenser.

It did not appear, however, during the trials that the reduced weight of the "Wheelock" engine rendered it less capable of resisting the load strains than either of its more celebrated competitors.

All of the engines were new, and leaked slightly through the valves, and possibly in one instance past the piston, during the trials. Mr. Ellis, of the "Harris" engine, attempted to hasten the seating of the steam valves of his engine by filing, previous to the trials, with good results, as shown by the diagrams. No effort was made with either the "Reynolds" or "Wheelock" engines to seat the valves except by wear.

The foundations of the "Reynolds" and "Wheelock" engines were excellent in every respect, but the foundation of the "Harris" was very inferior to those of its two competitors. During the operation of the engine, previous to the trials, the foundation cracked under the pedestal, and required special bracing before the condensing load was put on.

Each engine was belted back from a sixteen foot pulley on the main shaft to a five foot pulley on a short counter or jack shaft, mounted in suspension hangers overhead. From a pair of four foot pulleys on the jack shaft, two twelve inch, double leather belts conveyed the motion to a pair of four foot pulleys on the test trial line shaft. At the remote end of the test trial line shaft motion was taken to a pair of No. 5 Gould's rotary power pumps, mounted upon a heavy timber foundation, under the line shaft, by four four-ply rubber belts, with forty two-inch pulleys on the line shaft, and thirty four-inch pulleys on the pump shafts.

The main belts were double, of select stock, twenty-four inches wide, and were made for the trials by the house of E. F. Bradford & Co., of Cincinnati.

All belts were drawn tight, and worked without binders.

The "Harris" engine occupied the position nearest the boilers, with the "Reynolds" next, and the "Wheelock" at the remote end of the main steam pipe.

The report closes with a discussion of the subject of the award which ought to be given for the first degree of merit. I believed, says the expert, and not without precedent, that the engine which upon trial would develop the highest economy condensing, would also develop the highest economy non-condensing, and that no material differences would occur in the relative regulation of the engines, nor in the consumption of condensing water, to effect a given vacuum under given conditions. But upon the record, which I believe was as accurate as skill and vigilance could possibly make it, it appears that while one engine develops the highest economy condensing, another engine develops the highest economy non-condensing, and still a third produces a regulation under varying load trial, hitherto unheard of.

The engine which produces the best record condensing, also exhibits the best economy in the use of condensing water; but the condenser used upon this engine was a machine of independent manufacture, and not in common use by the builder of the engine.

The positions, twelve in number, of the respective engines for the various economies are summarized, and they show seven points in favor of the Wheelock engine, four for the Harris-Corliss, and one for the Reynolds-Corliss. But the actual difference in the performances of the engines, in either of the positions, is extremely small, and the report is submitted without comment or award.

As a whole the report forms a most valuable contribution to engineering knowledge, and the author is entitled to the highest credit for the thoroughly scientific manner in which the labors pertaining to the tests were conducted and recorded.

A GIGANTIC ARTIFICIAL MOON.

The colossal representation of the moon, which has been on exhibition at Steinway Hall, in this city, during the past week, does not appear to have attracted anything like the attention it deserves. On a half globe, sixteen feet in diameter, the mountains, plains, and other characteristics of the lunar surface visible from the earth are shown in relief, with shadings and colorings faithfully representing the moon as seen through a powerful telescope. It is by far the largest, most elaborate, and expensive portrait of the moon ever made; and seeing that it was constructed for and under the immediate direction of one of the most eminent of living selenographers, Dr. Schmidt, now Director of the Observatory at Athens, Greece, we may safely accept it as a faithful portrait. It certainly gives at a glance a clearer and more comprehensive idea of the physiography of the moon than could be got by much study with any other means short of a telescope of great power. When gradually lighted from one side by a powerful lime light, the varying phases of the moon, from new to full, are shown with impressive vividness.

The shadows of the mountain ranges, the black depths of the crater pits, the changing light upon the broad plains, and other lunar phenomena pass rapidly before the eye, enabling one to obtain in a few hours, indeed in a few moments, a more comprehensive knowledge of the lunar surface than can ever be had of the earth's surface until some enthusiastic geographer constructs in relief a terrestrial globe on a scale of corresponding magnitude.

The "moon" has been purchased and brought to this country for exhibition by Mr. E. Riverston, and it is to be hoped that it will ultimately find a permanent abiding place in some one of our public institutions. Meanwhile students of astronomy and all persons taking an interest in science will find the exhibition well worthy of attention.

A Bureau of Labor Statistics Wanted.

A meeting of delegates from trades unions and provident societies was held in this city recently to receive the report of a special committee charged with draughting a bill to be presented in the State Legislature to establish a bureau of labor statistics, in the interests of labor organizations and provident societies. The draught as submitted by the committee was adopted. It provides for the establishment of a separate department to be known as the Bureau of Labor Statistics, with the objects of collecting, assorting, systematizing, and presenting in annual reports to the Legislature statistical details about all branches of labor. It further requires the Governor to appoint two persons as commissioners, one of whom shall be selected by and from the labor unions and the other by and from the provident societies. The salaries of the commissioners are to be $2,000 each per annum, and an additional $10,000 a year is to be appropriated for the current expenses of the department. The commissioners are to have the power of visiting all public institutions, factories, workshops, and mines, and to summon witnesses.

With wisely chosen commissioners, and a bureau properly organized and administered, not a little public good might result from the collection and publication of statistics of the sort described. Organized as proposed, on a narrow trades union and provident society basis, the wished-for bureau would, we fear, be of very little use to the community as a whole, and still less to the laboring portion of it. The proper function of a government bureau is to serve the people, not any special class, however deserving.

EXPORTERS of petroleum to Germany should not forget that the established test is 110° Fah., and that hereafter the oil will be examined by government experts and none allowed to enter Germany which is below this standard.

FLOUR MILLING.—THE ELECTRIC MIDDLINGS PURIFIER.

[*Continued from first page.*]

yielded a flour as white as that from winter wheat and much stronger, owing to its larger percentage of gluten. The new method was characterized as high grinding, the stones being set so far apart at first as to granulate rather than crush the kernel. The stages of this process were four: (1) the granulation of the berry; (2) the separation of the product ("chop" or meal) by bolting into fine flour from the starchy center of the grain, the middlings or hard glutinous portions, and the coarser bran; (3) the purification of the middlings by an air blast, which winnowed away the bran mixed with them; (4) the regrinding and rebolting of the middlings, thus getting a strong, white, "fancy," or "patent" flour.

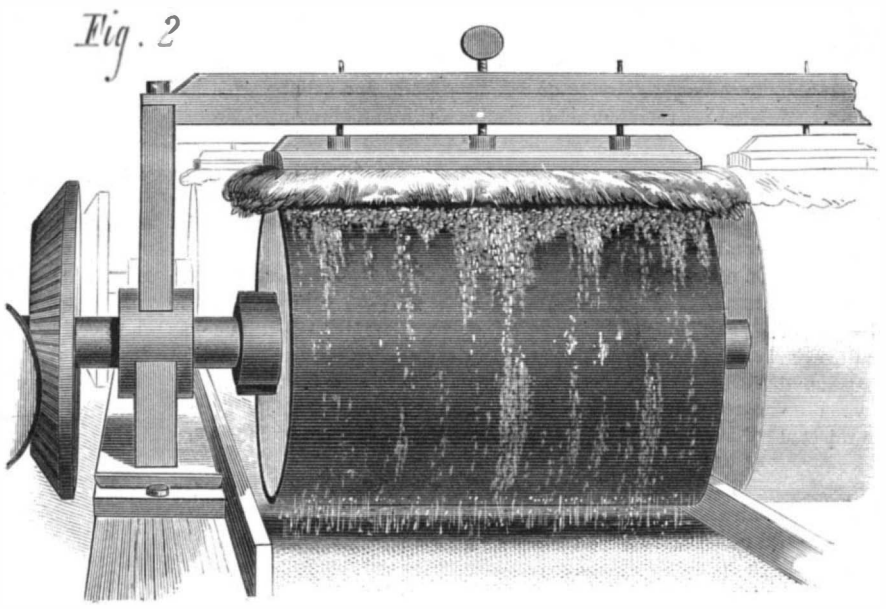
Under the stress of competition and the necessity of obtaining larger and larger yields of high quality flour, through the increase of middlings and the more perfect separation of discoloring elements, the still more complicated processes of gradual reduction were developed. By this method the aim is to remove the hull as completely as possible with the least breaking, to separate the weak flour of the heart of the grain from the rest, and to convert the more glutinous parts of the berry into high grades of flour by slow and gradual reductions, each time subjecting the several grades of middlings to successive purifications and subsequent reductions by means of high grinding, or by crushing between rollers. It thus came to pass that the work of purifying middlings became the most important part of the milling operation, and the purifiers and their appurtenances the most conspicuous and characteristic portion of the machinery of the flour mill.

The higher quality of the flour produced justified the greater cost and trouble, but the system was not all gain. The fine flour-dust blown about the mill, particularly through the systems of purifiers and into the settling rooms or dust houses, was soon found to be as explosive as gunpowder; and several mills were wrecked by the careless handling of lights or by chance sparks from the rolls or stones firing the dust in the atmosphere of the mill or in the purifiers. The inapplicability of the purifying system to the smaller custom mills, which constitute numerically the larger part of the milling interest, was another though minor objection, the chief objections being the extra life and fire risk involved; the cost and cumbersomeness of the purifying systems; the power required to operate them; the space required for dust houses; the wastefulness of the system, some of the finer flour being blown away with the bran; and the largely increased complication of the work of flour making.

Impressed by the prevailing discontent of millers, both at home and abroad, with respect to the means of purifying middlings in general use, a young American miller, Mr. Kingsland Smith, naturally gave much thought to the problems involved. While making a practical study of the European systems of milling in 1876 and 1877, Mr. Smith conceived the idea of using frictional electricity to remove the bran, and experimented enough with an electrically excited hard rubber roller to convince himself that the matter was worthy of investigation. On his return home, he referred the problem to his friend and former classmate, Mr. Thomas B. Osborne, of New Haven, whose inventive talent he had a high respect for. Young Osborne, then a student at Yale College, undertook the task, and in a short time devised the plan of the desired machine. It consisted of a series of hard rubber rolls (electrified by the friction of hair, silk, wool, or other suitable material), under which rolls the middlings were to pass slowly along a shallow receiver, the latter being rapidly shaken so as to bring the bran to the top. The expectation was that the particles of light bran would be attracted to the revolving rolls, where they would cling until carried over a bran receiver into which they could be brushed.

His principal doubts were whether the electrified rolls would not also attract the floury particles, and whether the material attracted might not be repelled so quickly as to defeat the desired object. Both these doubts were dissipated by the action of the first working model of the machine. The principle of his device being happily established, Mr. Osborne added the necessary attachments, and had made a working machine with twelve rolls. This machine was tested in New Haven about a year ago, and from its successful working attracted much attention. It remained to be proved, however, whether the machine would be equally efficient in practical use in all sorts of weather. To settle this question a machine was placed in the Atlantic Mills, Brooklyn, N. Y., where, since May, 1880, it has been run almost continuously as a part of the mill machinery. The construction and appearance of the electric purifier will be made clear by the engraving on our front page. The material to be purified—middlings, bran, and flour dust in whatever combination—is received at the further end, and passes slowly under the rolls about two inches below. The agitation of the sieves causes the bran to rise to the surface, whence the light particles leap to the rolls and cling thereto until brushed into a shallow gutter placed in front of each roll. Meantime the heavy and electrically rejected middlings descend by gravity and pass through the bolts in the order of their fineness. Traveling brushes constantly sweep

Fig. 2



Action of Electrified Roll on Bran.

ELECTRIC MIDDLINGS PURIFIER.

the bran from the gutters into the bran receiver on the left side of the purifier, in which is seen the spiral conveyor. By the time the last line of rolls is reached the material has been successively diminished by the abstraction of the bran and the screening out of the several grades of middlings, until only a trifling quantity of heavy refuse (if there be any) is left to pass over the tail of the purifier into the spout provided for it.

The power required to operate the purifier and generate the electricity employed is so slight that a man can work the entire machine with one hand. The trial machine in the Atlantic Mills purifies over fifty barrels of middlings a day, and its efficiency appears to be entirely unaffected by lapse of time or atmospheric changes. The machine occupies a space nine feet long, five and a half feet high, and three feet wide. The proprietors of the mill say that it works equally well on spring and winter wheat, and on all grades of middlings, and absolutely without dust. Dust-house material, when passed through the electric purifier, yields fully half its weight of fine flour and middlings suitable for flour.

This alone would effect great economy in the working of large mills employing air purifiers. Compared with the best air purifiers in use, by weighing materials and products, the difference in favor of electric purifying is found to be from six to eight per cent. The saving of space and power is even more remarkable, the extra room required for air purifying and the power needed to drive the machinery and supply the blast being equivalent to one-tenth the capacity of a mill; in other words, without any addition to the power employed, the output of a mill may be increased ten per cent by the introduction of electric purifiers. For example, the Atlantic Mills have a maximum capacity of 700 barrels a day, and average 600 barrels. The space saved by displacing the air purifiers is 2,500 square feet. At the same time the engine is relieved of work requiring 22 horse power, now employed in driving the fans and other purifying apparatus. The power saved by electric purifying will easily grind 60 barrels a day, and the space saved will amply accommodate the stones and other machinery required to increase the average output to 660 barrels a day.

In dispensing with the use of air blasts, there is no possibility of filling the air of the mill or any part of it with explosive starch dust, and the serious problem of insurance is thus materially simplified. With the source of hazard removed the excessive rates charged for insuring flour mills would be unnecessary.

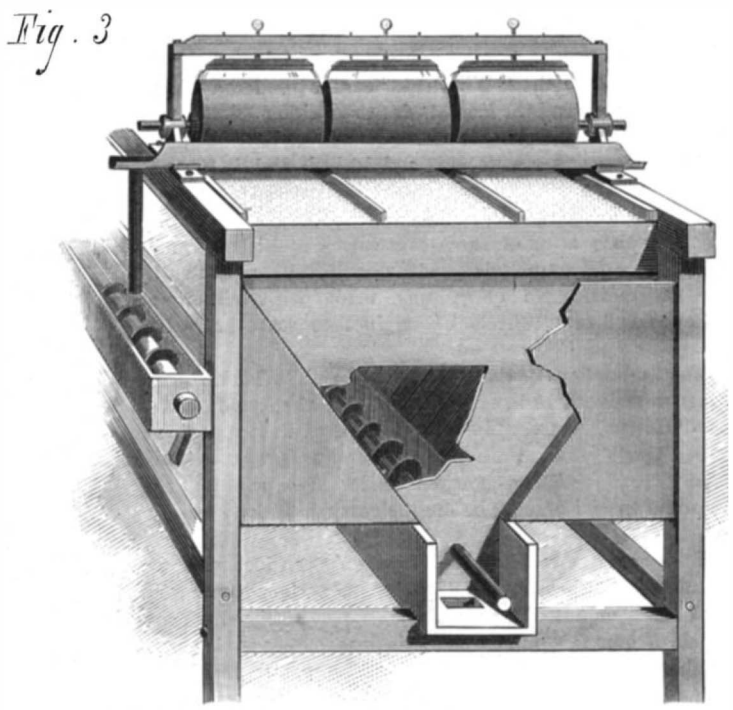
Taking into account, therefore, the great saving in cost of machinery, in power required, and in space; the more rapid action of the bolts since the material meets with no resistance in passing through the meshes; the more perfect separation of the bran from the flour products; the diminished waste; the fewer processes required to achieve a given result; the diminished fire risk from the absence of dust; the great simplification of the work of milling promised by electric purification and the possible increase in the capacity of mills, the new system can scarcely fail to meet with immediate attention if not favor at the hands of progressive millers. To those operating custom mills, it seems to offer especial advantages, since it makes possible the conversion of grain in small distinct lots into new process flour, giving each customer his own.

The ultimate importance of the new system, if wider application sustains the promise of its performance hitherto, must be enormous. Our annual wheat crop is equivalent to something like 100,000,000 barrels of flour. The proprietors of the Atlantic Mills say that, "after making all allowances and reductions, we estimate the saving in material alone effected by the electric purifier to be at least 10 cents on a barrel of flour, wheat being at present $1.20 per bushel." By this estimate, the saving of material in milling a year's crop of wheat would be $10,000,000, and this is but one of several savings made possible by electric purifying over purification by air blasts and the machinery now in use.

Little needs to be said in explanation of the detail illustrations, which tell their own story. Fig. 2 shows very clearly the appearance of the bran as it leaps from the sieves and clings to the rolls. The adhering bran is brushed off when it reaches the sheepskin cushion, which lightly touches the top of the roll to electrify the hard rubber. The bran trough in front of the roll has been omitted, to show the behavior of the bran more clearly. Fig. 3 shows the tail of the purifier broken, to expose the shoot for the tailings and the spiral conveyor further in, by which the several grades of middlings are conveyed to their respective delivery spouts.

The Smith-Osborne patents for this process of purifying middlings are owned by The Electric Purifier Company, of New Haven, Mr. John Rice, General Manager. New York office, 17 Moore Street.

Fig. 3



End of Purifier broken away to show Middlings Conveyor and Tailings Spout.

ELECTRIC MIDDLINGS PURIFIER.

MECHANICAL INVENTIONS.

Mr. Evan T. Davies, of Manistee, Mich., has patented a sorter for separating lumber as it comes from a sawmill into different grades, and depositing each grade separately or upon its own wagon, thus avoiding handling the lumber.

Mr. Simeon Nichols, of Lisbon, Me., has patented a simple and convenient device for adjusting the elevation of the coupling link and for coupling and uncoupling cars without going between the cars for that purpose.

An improved combination wrench has been patented by Messrs. Edward M. Butler and William H. Campbell, of Cleburne, Texas. The object of this invention is to provide a wrench whose movable jaw is adjustable without a screw, and with whose handle are combined several useful tools or instruments.

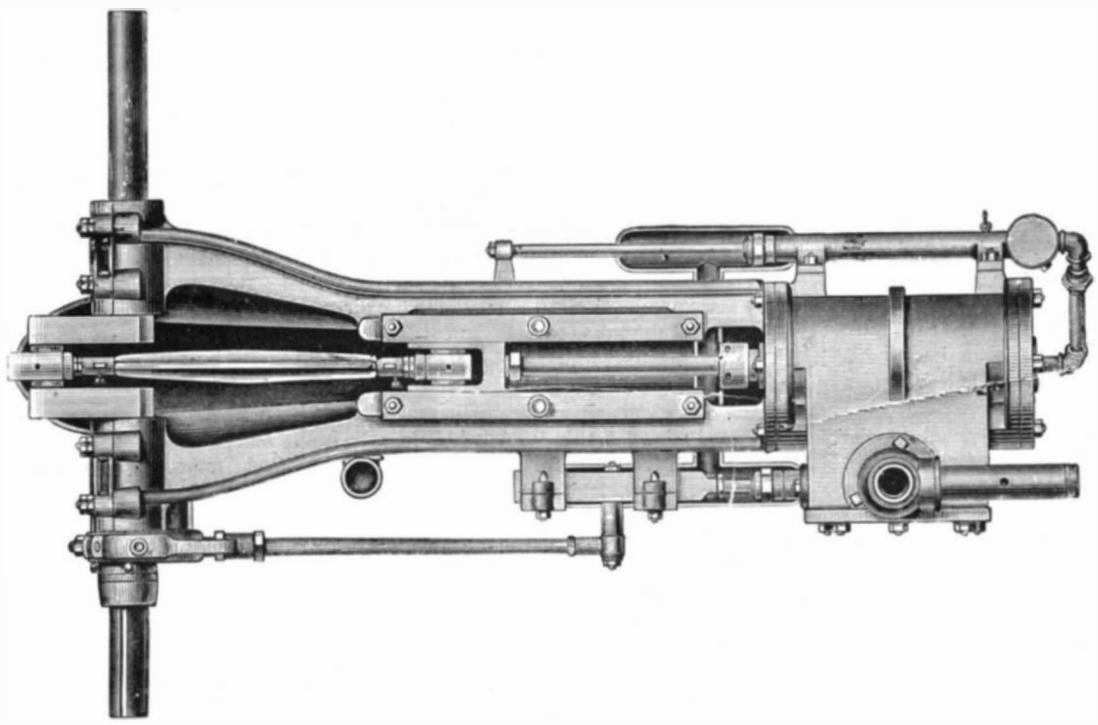
An improved car truck has been patented by Mr. Franklin Beaumont, Jr., of San Antonio, Texas. The improvement consists in providing the lateral guide wheels with long axles which are inclined at an angle of about 45 degrees to the axles of the ordinary truck wheels, and in providing the bolsters of the truck with a central opening, and otherwise constructing it with a view to attachment of such inclined axles.

An improved mill for reducing grain has been patented by Mr. Edward L. Baker, of Red Wing, Minn. This invention is designed to accomplish the disintegrating of grain in milling as is now usually done on grooved iron rolls by a mill or machine applicable to all old style mills without

change in their construction, adapting them with little expense from low grinding to high grinding, or Hungarian mills, thereby increasing their capacity and usefulness. It is designed, also, to make the best quality of flour while making the greatest possible amount of middlings in disintegrating grain, and to be applied in and take the place of the ordinary French burr stone now in use.

STATIONARY AND PORTABLE ENGINES.

The requisites of a good engine are that it shall be self-contained, simple in its design and construction, direct in its action, having its bearing surfaces ample and all of its parts accessible, beside being so proportioned and constructed as to yield the best results from the steam furnished to it. These important features are possessed by the engine which we illustrate herewith.



SKINNER & WOOD'S STATIONARY ENGINE.

The frame of this engine is cast in one piece with the front cylinder head and main shaft boxes, and the center line of the bed lies in the same plane with the line of centers of the engine, thus insuring direct action and avoiding the evil of getting out of line so common to engines having their different pieces bolted to the bed. The bearings are of unusual size, and all of the moving parts are made adjustable, so that any wear may be readily taken up without throwing any of the parts out of line. The guides and crosshead are particularly well arranged in this respect. Every engineer or owner of an engine likes to have his engine and boiler clean and bright. In this engine particular attention is given to the arrangement of the different parts so as to render this convenient. Drip pans are provided which receive any oil and water which may drip from the pump or other parts, and conveys it away through a single pipe.

The pump is driven by the crosshead, and has interchangeable brass valve seats. It is arranged so that all parts may be examined without disturbing the rest of the engine. The stop valve placed between the pump and boiler is contrived so that should the pump be started with this valve shut no damage can be done to either pump or valves, as communication between the pump and atmosphere is established when the stop valve is closed. This is a very simple and effective arrangement.

The engines are provided with safety stop governors, which prevent the engine from "running away" should the governor belt be broken by any accident, or slip off. These and many other good points are found in this engine.

The portable engine is in all respects like the stationary, and its boiler is of the best design for safety and durability. They are complete, self-contained, manageable, and safe.

These engines are made in various sizes, from 5 to 20 horse power, by Messrs. Skinner & Wood, of Erie, Pa.

The Chicago Breakwater.

On January 12, 1881, the Board of United States Engineers decided upon the location for the proposed exterior breakwater of Chicago. The construction of the new, exterior, or detached breakwater, will be commenced this spring. It will be about 5,400 feet in length and 30 feet wide, having a direction of about E. S. E. Its westerly end will be at a point 4,850 feet due north of the east (or outer) end of the present "North Pier," and its easterly extremity at a point 2,200 feet north, by 4,700 feet east from the above mentioned point on the north point, or 4,200 feet south by 1,100 feet west of the water works crib. This work will be done by hired labor, and materials furnished by contracts, with Major G. J. Lydecker, Corps of Engineers, U. S. A., as the U. S. Engineer in charge. It will be formed of cribs 100 feet in length and sunk directly upon the bottom, no piling being considered necessary, as examinations give a clay bottom covered with a shallow stratum of sand and stones. —*Amer. Engineer.*

New Geysers in Montana.

According to the *North Montana River Press*, two new geysers have appeared in a strip of that Territory known as "Sag." The first was seen about a month ago, but has only lately assumed remarkable proportions. It is situated in a small cañon running out from the wall of rocks on the east of Alkali Lake, and throws up a jet of hot water and steam over a hundred feet high. The height of the other geyser is only fifty feet, but the diameter of the spout is larger. The geysers are, of course, intermittent, and seem specially active in the morning. The formation of the country is a sandstone and gneiss, and has all the appearance of being an ancient river bed.

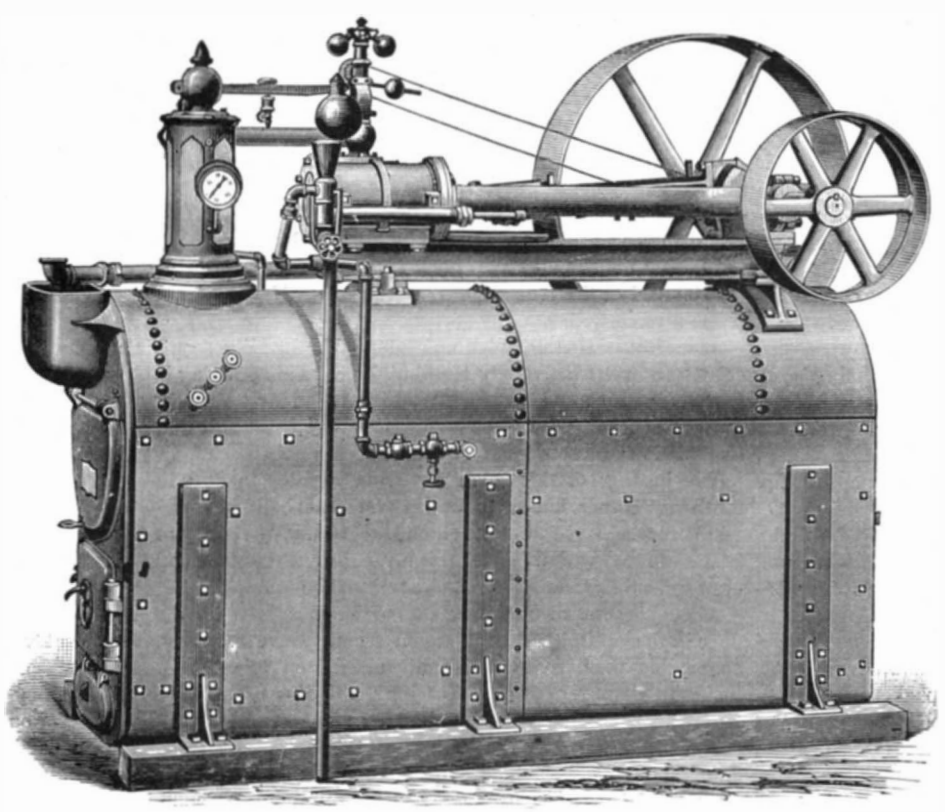
MISCELLANEOUS INVENTIONS.

An improved cabinet has been patented by Mr. John Sorenson, of Leavenworth, Kan. The object of this invention is to construct cabinets and other articles of furniture without nails, screws, or glue, so that they can be knocked down and packed in small compass and easily set up again for use.

An improved millstone-dress has been patented by Mr. Burrell C. Lambeth, of Thomasville, N. C. The object of this invention is to dress a millstone so that it will run with less friction at the skirt, will be less liable to heat or choke, and will grind faster and more evenly, and keep in face longer than stones dressed in the ordinary way.

Mr. Sidney Crowley, of Manchester, County of Lancaster, England, has patented a heel plate provided with a central screw perforation and projecting studs upon the upper surface.

Mr. Isaac Heine, of Leipsic, Saxony, Germany, has patented an atomizing tube that can be bent into any desired shape, which it will retain. The invention consists in constructing an atomizing tube of such materials as may allow it to be flexible, to remain in any desired position, and at the same time prevent the vapor from coming in contact with the metallic constituent of the tube.



SKINNER & WOOD'S PORTABLE ENGINE.

An improved sunshade-fan, which is simple and can be folded very compactly, and may be used as a fan or as a sunshade, as may be desired, has been patented by Mr. James H. Dennis, of Newark, N. J.

Mr. Samuel May, of Toronto, Ontario, Canada, has patented a billiard-table cloth covered on one side with a coating of India-rubber, to prevent the dust from passing through the cloth and gathering upon the table.

A simple and effective device, designed especially for use in sprinkling cotton plants with poisonous solutions, to protect them against the ravages of injurious insects and worms, has been patented by Mr. Alois J. Polansky, of Fayetteville, Texas. The invention consists of a portable force pump provided with a capacious air chamber, and having on the end of its discharge pipe a sprinkler of novel form, which causes the liquid to be ejected in fine spray.

An improved grain meter has been patented by Messrs. Reuben R. James and Mirabeat N. Lynn, of Rising Sun, Ind. This invention relates to apparatus for weighing and measuring and registering the amount of grain that passes through it by means of apparatus actuated solely by the weights of the grain, and thereby be automatic in its operation; and the improvement consists in employing double-balanced measuring buckets suspended from a balance beam that is supported upon a vibrating lever operated upon alternately by the weight of the grain in one of the buckets, and the weight of a scale beam connected with the free end of the vibrating lever, to hold the receiving bucket in its raised position until the proper weight or quantity of grain shall have been delivered to it, when it will be allowed to drop of its weight at once in a peculiar manner, and in so doing close the receiving valve and open the discharge valve connected to the full bucket, to allow the grain to discharge therefrom, while the other measuring bucket is by the same movement raised and acts upon its receiving and delivery valves—to respectively open the one and close the other, and become, in turn, the receiving bucket—the operation above described to continue so that one bucket will operate upon the other so long as grain is allowed to pass the receiving valves.

Artificial Indigo.

The following is Bäyer's synthetical process, described by himself: I take orthonitrophenylpropiolic acid, and in the cold I mix the said acid with sulphuric acid, as, for instance, with from about ten to twenty parts, by weight, of sulphuric acid, of about 1·84 specific gravity to every one part, by weight, of orthonitrophenylpropiolic acid employed. In effecting the said mixture care is to be taken to avoid a considerable rise of temperature, say, 20° Cent. The mixture thus obtained quickly assumes a bright yellow or orange color, and the reaction is allowed to proceed in the cold until a sample of the mixture, upon being tested for the presence of orthonitrophenylpropiolic acid by means of glucose and alkalies, no longer contains any appreciable quantity of the said acid. The sulphuric acid mixture thus produced is then submitted to the action of suitable reducing or deoxidizing agents in order to effect the conversion into artificial indigo. In practice I have found a great number of substances belonging to various classes of chemical compounds which act as deoxidizing agents upon the above-mentioned new product, and I may especially mention ferrous sulphate (green vitriol, copperas). As an example of the manner in which I prefer to conduct the aforesaid operation, I take the orange colored mixture resulting from the treatment of one part, by weight, of orthonitrophenylpropiolic acid with about from ten to twenty parts sulphuric acid, as above described, and I mix the same with a solution containing about five parts, by weight, of ferrous sulphate. The mixture is then allowed to stand at the ordinary temperature until the blue color, which it quickly assumes, is fully developed, and the dyestuff or coloring matter thus produced may be separated out of the mass by diluting the result of the operation with water, by which the new dyestuff is precipitated, and may be filtered and washed. The dyestuff is then ready for use. The characteristics of my new dyestuff or coloring matter, prepared according to the above process, are the following: The dyestuff or coloring matter resembles in appearance vegetable indigo, and it can be used in dyeing in a manner similar to it; but it is in a great part soluble in aniline at an ordinary temperature, and also in an aqueous solution of sulphurous acid.

How Rubber Tubes are Made.

The "good old times" when 3-16 inch tubing brought sixteen cents per foot have passed into history. The present sharp competitions make the manufacturers look closely into small leakages as well as large ones. Work must be rapidly done with little waste of material and no porous or blistered results.

Different manufactories have different methods of making tubing, as regards the minutiæ of the work, but on the whole they are practically the same in them all.

A common and easy way is to have the mixed sheet spread quite thin on cotton sheeting in rolls of some fifty yards in length. This is wound as fast as spread upon a wooden core. The table upon which the tubing is to be made is zinc covered and should be very smooth. If the tubes are to be twelve feet long three operatives are needed; if fifteen feet, four.

The roll of sheet rubber is hung in a "rack" consisting of two simple uprights with bearings for a horizontal bar which runs through the core. The "cutter," or boss of the gang, takes a clean squared stick, a trifle longer than the sheet is wide, and, slipping it under the edge, acquires a firm hold. One of his assistants winds the cotton sheeting off upon a second core, while the boss, still holding the rubber, backs slowly the length of the table, careful not to stretch the long sheet which follows him. Letting it drop upon the zinc, after wetting his knife in a convenient water cup (sometimes in his mouth), he cuts the sheet away from the roll, leaving it a little more than fifteen feet in length.

The tube makers now gather in their places, all on the same side of the table, the "cutter" standing farthest from the roll. The further edge of the rubber sheet is secured to prevent slipping. This may be done by running a small brush wet with naphtha under the edge of the sheet, or by striking with the palm of the hand the whole length of the edge, or better still, by having a long strip of board hinged to the table, on the under side of which is a corrugated strip of vulcanized rubber and on the upper side a few short weights of lead.

The mandrels, or wires, which are to form the core of the tubes, are laid upon a table at the back of the workers. The wires have previously been treated to either a thorough coating of grease or of soft soap, and thoroughly dried, after which a light coating of cement made of mixed sheet and some convenient solvent—naphtha is the most common—is brushed over the length of the wire. (Some use no cement at all, folding the rubber over upon itself.) In a few moments this is dry. A wire is then taken and laid upon the edge of the sheet, which has previously been "trimmed" by the cutter. The four tube makers strike it gently to "set" the cement, and then turning up the wire slightly, the edge is struck wherever not previously caught by the "setting." The wire is then raised free from the table, the sheet straightened out, and the core rolled over upon itself three or four times, gauges in the hands of the workers determining its size. The cutter, then wetting his blade anew, goes to the further end of the table, and walking backwards, by a single long skillful stroke, cuts the tube free from the sheet. After being rolled forward and back several times, and possible blisters being pricked, the tube is taken by the "end men," swung over the heads of the "middle men," and deposited upon the rear table, which is upholstered with a mattress of cotton cloth to prevent the waxy vulcanized tube from "breaking down" or becoming jammed. The same process is repeated until the entire sheet has been used.

This kind of tubing has an advantage over that made of one thickness of stock, inasmuch as it is very strong, and having no seam is not liable to break open longitudinally.

When a "heat" of tubes has been made and laid upon the mattress, then comes the process of wrapping them in cloth moulds. These moulds, or "formers," are simply long strips of cambric muslin or other fine cloth, which are thoroughly wet and laid upon the rear table. The end men, taking the top one, lift it over and stretch it upon the zinc table, and the tube is then lifted over, and having been laid upon the cloth, the edge is lapped over it, brushed down with the fingers, drawn tight, and with a quick roll wrapped as securely as a mummy in its shroud. In this, care should be taken that the cloth is not too wet, as they are apt to slip and cause damaged places.

It is further tightened, however, by a process of rolling either with four short boards or with one long fifteen foot board. The latter is preferable. Boards are sometimes covered with heavy frictioned canvas, which increases their rolling power and prevents warping. An iron pan, upon which is laid a thin mattress of coarse cloth, receives the tubes for the vulcanizer. They may be packed in layers, three, sometimes four deep, depending upon the size of the tube and the weight of the mandrel. Some of the heavier ones will need supports at both ends and a deeper bedding in the middle.

Sometimes the tube after being wrapped in cloth is heated until the rubber is thoroughly softened and has taken the necessary form, when it is plunged into water, the cloth stripped off, and the tube then buried in French chalk and vulcanized. This manner saves the cloth, which otherwise would soon be burned so as to be useless, but it is not profitable on account of the time it consumes.

After the tubes are "cured" the cloths should be stripped at once, or if they grow dry and cold should be wet before stripping. This simple precaution alone will save twenty per cent of the cloth, while the skill of a careful yet rapid "old hand," as compared with the clumsiness of a "green hand," will surprise one unaccustomed to such comparisons.

In removing the tubes from the wires it is necessary to heat them slightly, after which with the end of the wire gripped by a vise, they can invariably be slipped off without trouble.

Another way of making tubing is by having the mixed sheet spread as thick as the tube is to be, which after being folded over upon itself is cut off obliquely; the two edges, of course, fit together and form a tube. Into this a wire is thrust, and it is either wrapped in cloth and cured as previously described, or is packed in chalk without any cloth wrapping.

Tubing made by hand is all lengths, from one foot to fifteen feet. That of which we have been speaking is essentially rubber tubing, that is, it has no canvas or wire gauze in its composition. Of the different styles of tubes that are made by hand there is almost no end.

Tube machines are in use in many manufactories, and in some cases do very fine work. One of the most simple of these consists of a cylinder which is fitted with strainers and a tight piston. In the lower end are a number of holes through which run ingeniously constructed mandrels. The cylinder is filled with rubber softened by a solvent, the piston is pressed down, and the tubes are slowly forced out around the mandrel. A short exposure to the air evaporates the solvent, and the tube acquires the hardness of unvulcanized caoutchouc and is ready for the "chalk pan."

In tube making half of the time will be saved by having the cutter, one who is especially quick, and who can keep a knife in good trim. A thin "Tuck" blade is the best. The clothes in which the tubes are wrapped, after being stripped, should be sprinkled, laid together, and folded smoothly, ready for the next heat. If the sheet rubber sticks to the zinc after a heat has been rolled on the table, a little oil rubbed into the zinc and then carefully wiped off, or a slight dusting with French chalk will prevent it.

It is a good plan to put the talkative man of the party in the place of "middle man," as there he is liable to receive "accidental" blows from the swinging tubes and wet cloths which the end men manipulate, and then he will be under control, and may, if desired, be kept in a chronic state of misery.

An everlasting mattress for the tube pan may be made from asbestos covered with a thin sheet of coarse cloth, the latter to be renewed from time to time as it is burned up.

An ingenious "blister pin" is frequently made by cutters of a sharp piece of wire which is driven into the handle of the knife a little above the blade and bent away from it. In this shape it is always at hand and cannot be lost in the scrap.

Pure "gum tubes" should be dusted with chalk before being wrapped in cloth, as otherwise it will be impossible to remove the cloths whole.—*Rubber Era.*

Correspondence.

To the Editor of the Scientific American:

I have succeeded in showing by actual demonstration that a ventilating flue or duct, running up through a building either as a chimney or ventilating flue built in the wall, will not in extreme cold weather convey the heated or foul air out of a room. The chimney or the flue must be warmed by artificial means or current produced by fan blower to produce the desired result. It not only does not carry off the heated or foul air, but cold air will come in through registers in such flue, whether they are near the ceiling or at the floor line, until the air in the room gets to be overheated. And also if indirect radiation is used in heating by passing air over steam coils in air boxes there must be flues for conducting the cold or the foul air out of the room, if you would warm a room with rapidity and success.

As an illustration, the plan now adopted in the Microscopical Room in the University Hall building. This building is four stories high and basement; the room on first story in southeast corner, with three large windows on east side and two windows on south side of room.

The heating of this room was from register in floor in southwest corner, hot air coming in over steam coil; in northeast corner a large radiator, which had become necessary to keep the room warm. With this arrangement the room had been so cold as to be a source of continual complaint.

About the first of February I placed two registers in the floor in the central part of the room, about twelve feet apart, connecting these registers by galvanized iron tubes, eight inches in diameter, twelve feet long, and thence by tubes twelve inches in diameter to chimney or flue running out of roof of building. In the bottom of this chimney a small steam coil is placed, which gives the flue and the connecting tubes to register a good draught, making a complete revolution in the heating and ventilation of this room.

So great is the change that doors and windows may be opened and thermometer run down to thirty, and in an hour, by closing doors and windows, go back to sixty, and yet have the air pure. ANDREW CLIMIE.

University of Michigan, Ann Arbor,
March 16, 1881.

Serpents' Eggs a Cure for Hay Fever and Catarrh.

To the Editor of the Scientific American:

There is one feature connected with sulphocyanide of mercury (Pharaoh's serpents' egg material), as produced from the pernitrate) which deserves attention at the hands of medical gentlemen. It is its power to arrest coryza, hay fever, cold in the head, and all similar affections. The slightest "whiff" of the *thoroughly dried* precipitate (mercuric sulpho-cyanide) will, in from seven to ten minutes, or less, produce *a first-class specimen* of coryza (when *thoroughly* dried it is an impalpable powder); and, acting on the homeopathic principle of *similia similibus curantur*, I have, in myself and others, arrested violent attacks of like nature—through taking cold—by *slightly* snuffing it in the nostrils. I have it in a small pasteboard box, wrapped in paper, *i. e.*, the box (it is difficult to confine the dry powder), with a rubber band around it. I simply "snap" this band, without opening box or removing paper, and inhale the dust. It is *infallible.* J. DE W. CHURCHILL.

Richmond, Va., March 16, 1881.

An Honest Letter of Thanks.

The following is from a prominent and successful clergyman in Ohio, but who requests that his name may be omitted.

To the Editor of the Scientific American:

I am a Presbyterian clergyman, thirty-four years of age, and have been a subscriber to your two weekly publications for several years. This letter is to tell you in some degree how your papers are of use to a clergyman.

You noticed recently "A Rich Man's Workroom," that of Mr. Robert Coleman, of the great Cornwall estate; it was an item of decided interest, but your paper comes into many more humble workrooms. My own adjoins my study; in it are a lathe and five-inch aperture telescope, all of my own construction, save the grinding of the telescope lenses. Also a battery, tools for wood and iron, various bundles of wire, and bottles of chemicals. The room is fitted for work and for experiment; and during these seven years of my work as a minister, not a week has passed without my presence in the workroom, at something there. You may remember receiving from me two years ago a sample of my work. Now, then, into this workroom your two papers come regularly, and I assure you they are very welcome. When I have read my two papers I carry them to a mechanic, he reads them; I carry them to our physician, and he reads them. A good paper is worth carrying to others.

My parish is very large; my work in it considerable and burdensome, but the workroom affords my best recreation; for it I have chosen the best room in the house. While other clegymen find delight, and very properly, with their gun, oar, or fishing tackle, give me a tool, a crucible to watch, or an idea to work out in material form. I want no better delight, and with the delight comes successful endeavor, something to use. The correspondence of my workroom—for it stationery is provided and a desk—is considerable and increases.

But further. You may think my sermons not orthodox, and my habits of study quite unusual. I tell you that I have often quoted from your publications facts pertaining to scientific research, and used them for illustration and information in my sermons before an audience of three hundred. I read no other paper as thoroughly as yours, though I have many. I believe it is rare that a new advertisement appears in the SCIENTIFIC AMERICAN that I do not discover. So I thank you from my study for your papers. They afford a profitable relief for a tired brain; and then at the second reading, real material for the study of any mind. A young man has just called to invite me to scientific experiment at his house when I have time. I shall be glad to go. The next man will want some laboratory work done, and I am always ready for that. If I could do more of this investigating it would be most welcome work. Mr. G. M. Hopkins, Mr. Robt. Coleman, and Mr. T. A. Edison enjoy their investigating labor, I very well know, and I do not wonder at all that any such man forgets to eat and to sleep in the prosecution of work. Questions to ask you occur constantly. Once a year I venture to send you such as are not answered by that time, so what you receive from me are sifted questions. Go on Messrs. Editors, you are giving us a good thing in your papers.

AGRICULTURAL INVENTIONS.

Mr. Jonathan C. Deuel, of Reynale's Basin, N. Y., has patented an improved apparatus for bleaching fruit. The object of this invention is to set the original color of the fruit and vegetables, such as apples, pears, peaches, potatoes, etc., or bleach them immediately after they are sliced, so that they will not afterwards, in the drying process or manipulation, become discolored by exposure to the air and light. The invention consists of an improved fumigator designed especially for the convenient reception, exposure to the sulphur fumes, and removal of the fruit or vegetables, and for a continuous automatic supply of sulphur, and to prevent the escape of the fumes to annoy the operators.

An improved seed sower has been patented by Mr. Mason Gibbs, of Homer, Mich. The object of this invention is to furnish seed sowers for sowing clover seed, timothy seed, and other fine seeds. It is so constructed as to sow the seed uniformly, and it can be readily adjusted to sow any desired quantity of seed to the acre.

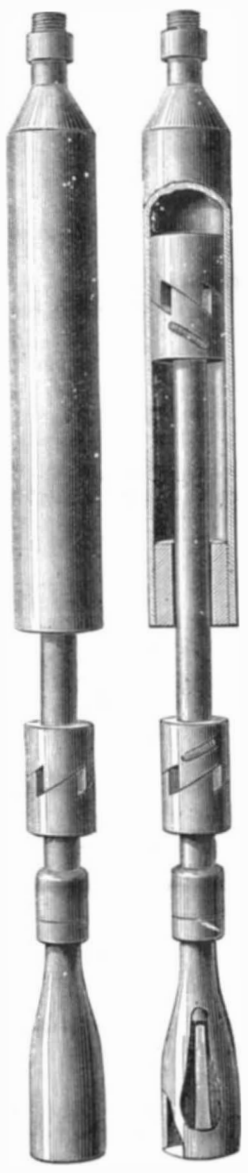
Martha J. Dorsett, of Prince George's County, Md., has patented a fruit drier, so constructed that it can be readily moved from place to place, will protect the fruit from insects, and may be compactly folded for storage and transportation.

NEW GRAPPLING TOOL FOR OIL WELLS.

A simple and effective tool for recovering drilling tools from oil and other drilled wells, is represented in the annexed engraving. The tool consists of two solid ratchets rigidly secured, at some distance apart, with their teeth toward each other, on the long shank of the grappling tool, and of two corresponding movable ratchets encircling the tool shank and held by springs with their teeth nearly in contact with those of the fixed ratchets. A cylindrical hammer encircles the top of the tool shank and the upper ratchets, by means of which the loose ratchets are alternately driven against the fixed ratchets to make the grappling tool rotate downward in one direction.

Fig. 1 shows the exterior of the tool, and Fig. 2 is a sectional view showing internal parts.

In operating this device, it is lowered into the well until the lower end of the tool is engaged upon the drilling tool that is to be recovered. The hammer is then drawn quickly up, so that the upper surface of its block is brought in contact with the loose ratchet, forcing it against the fixed ratchet, and making its teeth slide on the corresponding diagonal surfaces of the teeth of the loose ratchet, so that by friction and impact the ratchet is made to rotate and impart its motion through the shank to the tool. Then the hammer is permitted to fall upon the lower ratchet, rotating the ratchet, and consequently the tool, in the same direction, and the hammer is thus operated until it has produced the desired effect by driving down and rotating the tool, causing it to securely grapple with and unscrew the drilling tool that is to be removed from the well; and when the drilling tool is thus grappled and unscrewed by the application of repeated torsional blows of the hammer it is raised, together with the drilling tool, by means of an ordinary drilling stem or cable attached to the hammer, and by the engagement of the block against the lower face of the upper ratchet.



Fairchild's Grappling Tool for Oil Wells.

To those familiar with the difficulty of removing tools from drilled wells the advantages of this simple tool will be at once apparent.

This device was recently patented by Mr. O. J. Fairchild, of Buttsville, Pa.

The Largest Farm.

The wheat ranch of Dr. H. J. Glenn, about twenty miles above the town of Colusa, Colusa county, California, is perhaps the largest and best known in the State. The Chicago *Tribune* says that on being asked recently why he raised nothing but wheat, Dr. Glenn replied: "It is the only crop that will bear transportation; it is the only crop not perishable. I must not raise on my land what ruins me, but what is profitable." Dr. Glenn's ranch comprises about 60,000 acres of land, and the number of acres in wheat each year ranges between 40,000 and 50,000 Reckoning an average of from 20 to 25 bushels to the acre. the aggregate crop each year amounts to something more than 1,000,000 bushels. This enormous amount of grain requires vast appliances for planting and bringing it to market; and the capital invested in machinery alone sums up a considerable fortune.

During the harvest time there are employed on the entire ranch some 500 men. Dr. Glenn is general-in-chief of his force, and the ranch is divided, for convenience of operations, into nine smaller ranches—each with dwelling house, barns, blacksmith shop, and other necessary buildings. In charge of these are seven foremen, under whom are sixteen blacksmiths, fourteen carpenters, six engineers, six machinists, five commissaries, and numerous cooks and servants. The common workmen are divided into gangs, and detailed where they are needed. There are 130 gang plows; 60 herders, to which belong 180 wagons; 6 cleaners, 100 harrows, 18 seeders, 6 thrashers, 6 engines. Besides, there are many smaller instruments and vehicles, which cannot be classified. Co-operating with their human brethren in the great labor are 1,000 work horses and mules, with a kinship of 1,000 brood mares and younger stock which has not yet achieved the dignity of labor. There are 32 dwelling houses, 27 barns, 14 blacksmith shops, and other structures sufficient to swell the aggregate to 100. The machinery could not be replaced for $125,000; the work horses and mules are worth $110,000; the brood mares and young stock $75,000, and the buildings on the place $100,000.

Treatment of Pain by Mechanical Vibrations.

For some years past Dr. Mortimer Granville has been occupied with important researches upon the possibility of combating neuralgia by mechanical means. Proceeding largely upon theoretical considerations, he came to the conclusion that a series of interrupted mechanical shocks to a nerve would diminish its sensibility, and for that purpose invented a small instrument whereby a succession of rapid blows could be kept up upon the skin. Many physicians in London and Paris have seen and employed the apparatus, and spoken of it with approval; but Dr. Granville forbore to bring it under general notice until it had been thoroughly tested. He has paid the penalty of his patience, and the old story is repeated of the publication of an idea by another person by whom it was conceived long after the one who first thought of it, but who did not proclaim it to the world. In justice to himself Dr. Granville should forthwith point out how he arrived at the idea, and state his experience of its practical enforcement. Meanwhile it may be interesting to summarize the statements of M. Boudet de Paris, who writes on the subject in the current number of *Le Progrès Médical.*

After alluding to Dr. Brown-Sequard's observation that chloroform applied over the skin of an animal produces general anæsthesia by its irritant action on the peripheral nerves, he points out that all irritants or revulsives may be placed in one category—such as actual cautery, hypodermic injections of water, application of metals, magnets, tuning-forks, electricity, vesicatories, sinapisms, compresses steeped in ether or chloroform, a motley group, but each intended for the same end—the relief of pain; they all operate by irritating the terminal twigs of sensory nerves. Vulpian long ago showed the good effect of the local application of chloroform; and Landouzy has recently pointed out the remarkable influence in controlling the cough of phthisis of hypodermic injections of water; while the cautery, acupuncture, and each of the forms of electricity are commonly applied to relieve pain. The action of metallic applications—metallotherapy—of which we have heard so much in the last few years, was best explained on the theory of vibrations by Vigouroux, who proceeded to experiment upon the effect of sonorous vibrations, which he thought might have a direct mechanical effect upon the sensory nerves. By the aid of a large tuning-fork and sounding board he caused hemianæsthesia to disappear, and provoked contractions in hysterical subjects at La Salpétrière, as rapidly as with the magnet or electricity. The pains of an ataxic were subdued when his legs were brought under the influence of these sound waves.

M. Boudet de Paris then thought this might be applied locally over a nerve—the sonorous being changed to mechanical vibrations by means of a small button attached to the resonator, and applied over the nerve. He therefore contrived a small apparatus consisting of an electrically mounted tuning-fork, the vibrations of which were transmitted to a rod which could be easily applied over a nerve. In a healthy man this mechanical excitation produced rapid local analgesia, often anæsthesia, the maximum effect being by application over a nerve which could be compressed on a bony surface. When placed against its skull its walls vibrate in harmony with the tuning-fork, and a sensation of approaching vertigo, frequently followed by a desire for sleep, is produced. An attack of migraine can be cut short by the application. Neuralgia—especially of the fifth, where the nerves issue from bony canals—disappears after a few minutes' application of the instrument to the nerve at such points, but in the case of deeper-seated nerves, much protected by soft parts, it is more difficult to get good results. The writer suggests this treatment for the pains of ataxics and syphilitics; he thinks there is no limit to its applications, and suggests that perhaps cranial vibrations may induce cerebral and thus general anæsthesia. Its mechanical action is comprehensible, when we see how simple friction of the skin may soothe very acute pain. He does not regard the number of vibrations as important. This, however, is, we believe, a point on which Dr. Mortimer Granville lays the greatest stress.—*Lancet.*

A Magnetic Thermometer.

It is well known that the "permanent" magnetism of steel magnets is not constant, but changes slightly with changes of temperature, the magnet becoming weaker when warmed, and recovering its strength as it is cooled. The magnetic thermoscope described by Sir W. Thomson ("Proceedings Royal Society") is intended to indicate differences of temperature by showing differences between the magnetic moments of steel magnets. Two thin wires of hard steel, each one centimeter long, are arranged so as to form a *nearly* astatic couple, being magnetized to equal strength and set in opposite directions, but not quite parallel, so that they set at right angles to the magnetic meridian. Two other magnets, about twice the size of the former pair, are placed one on each side of this astatic couple as "deflectors," being laid in one line nearly along the magnetic meridian, with their similar poles facing one another at about two centimeters apart. When properly adjusted the little astatic pair suspended between them will be found to be excessively sensitive to the least change in the strength of either of the deflectors, and if they are at different temperatures will turn through an angle which, if small, may be regarded as a measure of the temperature difference. A small mirror suspended from the lower needle of the pair serves to reflect a spot of light on to a scale in the usual way.

IMPROVED ASH SIFTER.

The sifter shown in Fig. 1 in perspective, with a portion broken away, and in Fig. 2 in vertical section, is believed to be superior to other devices for the same purpose, as very little effort is required to operate it, and the motion being rotary, the whole body of ashes is simply turned over, and not moved by main force, as in sliding sifters. It is free from dust, and delivers the ashes to the barrel, while the cinders pass out of the spout and drop into a hod or other receptacle.

The sieve consists of a cylinder having wooden ends and

Fig. 1.

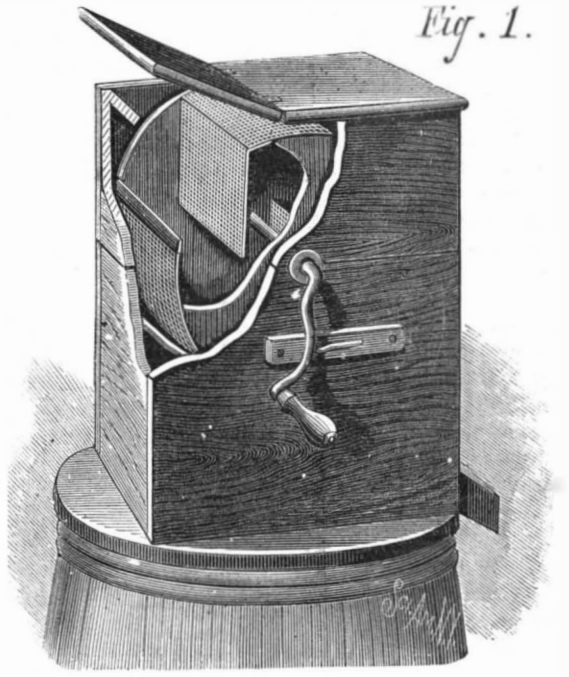
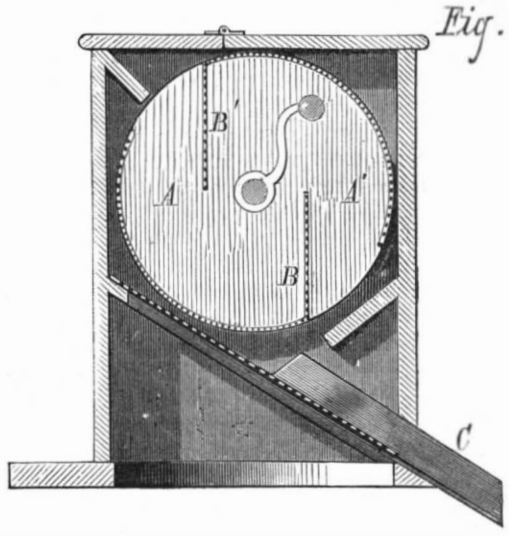


Fig. 2.



KELLY'S ASH SIFTER.

wire cloth sides, B B', which are opened on diametrically opposite sides and extended inward. The ashes are poured into cylinder through one of the openings, A A', the inclosing box is shut, and the cylinder is turned, so that the cinders are delivered from one of the curved sieves to the other, while the ashes drop through the inclined sieve into the barrel. When the ashes have been all removed from the cinders the cylinder is turned in the reverse direction, when the cinders pass out through the openings, A A', and are delivered to the hod or other receptacle through the spout, C. It will be seen that this sifting apparatus is entirely inclosed, and that in consequence no dust is allowed to escape. The sifter is simple, compact, and inexpensive.

For further information in regard to this useful invention, address Mr. Geo. B. Kelly, 162 Broadway, Cambridgeport, Mass. We call attention to an advertisement in the Business and Personal column relating to this invention.

A Buried City in Algiers.

French newspapers report the discovery in Algiers, by the archæologist M. Tarry, of a city which had been entombed in the sand. M. Tarry's attention had been awakened by the mound like appearance of the sandy soil, and some digging brought to light the minarets and upper portion of a mosque. Further excavations laid bare a terrace, a tower, and about a dozen houses, all in excellent preservation. He reported his discovery to the Government of Algiers, which has undertaken to have the site thoroughly explored. The place is in the southern part of the province, not far from the town of Ouargla, and exposed to the full blast of the sandy winds from the desert. Probably a succession of siroccos bearing clouds of sand completely filled up the streets and houses, making the town uninhabitable, and so drove out the population. At present there is no ground for conjecture as to the date of the occurrence.

IMPROVED DRYING KILN.

A cheap and economical apparatus for drying lumber, staves, and other material, has been long needed, and a great deal of time and money has been expended in experiments in this direction without corresponding results. Messrs. E. & B. Holmes have perfected a dry kiln which seems to combine all the necessary requisites for a successful drying apparatus.

This dry kiln, which is represented in the accompanying engraving, is composed of several sections, more or less as desired. In the bottom of each of these sections are placed two sets of steam coils of novel construction, one above the other, for radiating the heat, and on the side of each section is a thin apartment containing condensing pipes filled with cold water, supplied by a pump or otherwise.

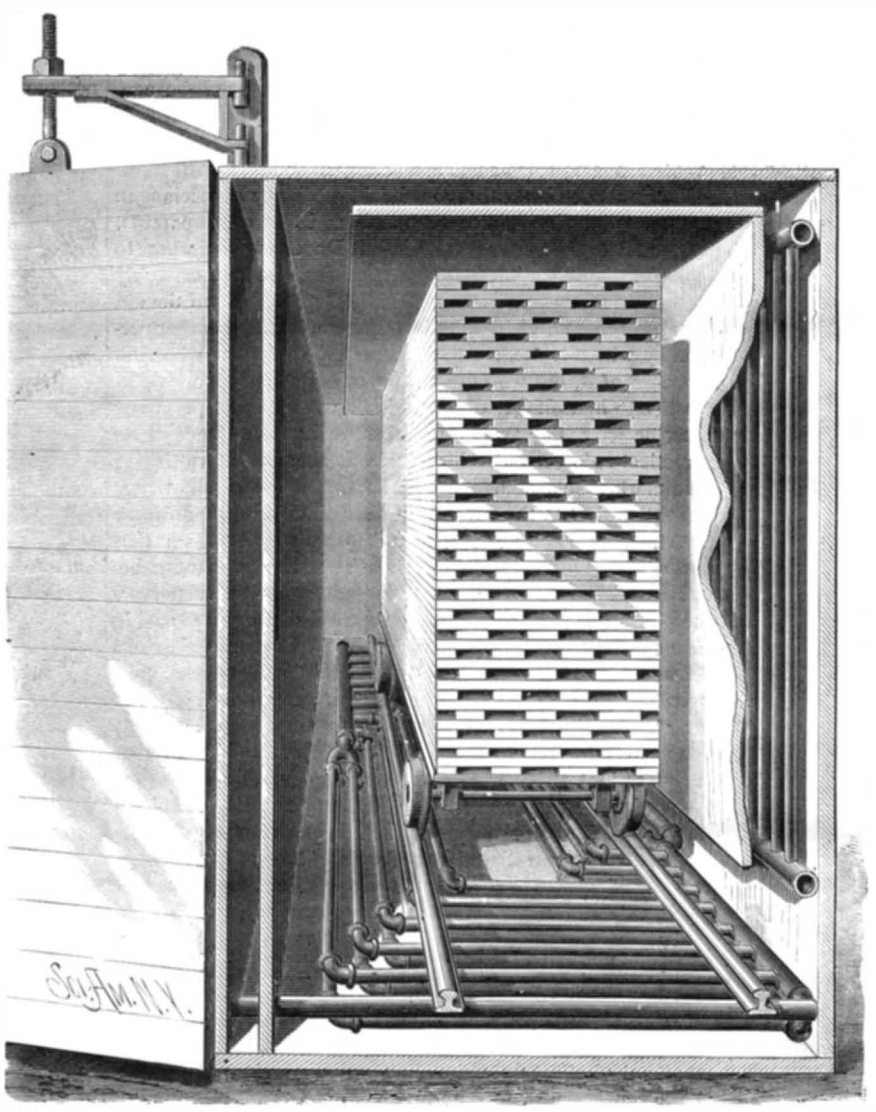
The air in the bottom of the kiln, being heated by the steam coils, passes up through the material to be dried, to the top of the kiln, carrying the moisture with it. Here it enters the thin condensing apartment and passes down, leaving the moisture upon the condensing pipes, and, being cooled, again passes downward under and through the steam coils, where it is reheated, when it again rises up through the material, and so on. In this manner a very rapid circulation is secured, which carries the moisture from the material to be dried and deposits it upon the condensing pipes, from which it runs into a conductor and passes out of the kiln, the same air being used over and over.

Car tracks pass through the kiln, and extend far enough in each direction outside of the kiln to allow of loading, drying, and unloading at the same time. In this way the kiln is kept open only long enough to pass one car out and another in, and as only one section is opened, the others are not affected or cooled by it.

The doors of the kilns are made double thickness with an air space between, and are swung on cranes, so that one person can handle them with ease.

Messrs. E. & B. Holmes, who are the inventors and patentees of this kiln, claim for it better results than can be obtained by anything else in use, having tried others and abandoned them, and they have now kilns of this kind that hold about 200 000 staves which they are using in connection with their barrel factory, the latter being filled with the Holmes barrel and stave machinery. This firm has an auxiliary apparatus invented by them for taking the condensed water from the dry kilns and returning it to the boiler without the aid of pumps.

Any further information respecting either dry kilns or stave and barrel machinery may be obtained by addressing Messrs. E. & B. Holmes, Buffalo, N. Y.



HOLMES' DRYING KILN.

IMPROVED INCUBATOR.

An improved incubator, which regulates its temperature and shifts the eggs automatically at regular intervals, is shown in the annexed engraving. It is provided with a series of longitudinal cloth hammocks or egg receivers, attached to end pieces pivoted to rigid supports and to movable bars, which are automatically moved so as to shift the eggs at regular intervals by suitable levers controlled by clock-work. The gas or oil cock of the flame of the boiler for heating the incubator is controlled by means of a pair of electro-magnets, connected with a battery, and with a metal thermometer provided with an adjustable scale so that the temperature of the incubator is regulated automatically.

In the engraving, Fig. 1 is a perspective view, and Fig. 2 is a vertical section. The box is constructed with rabbeted corner posts and a double casing, the space between being filled in with non-conducting material The box is also provided with a shelf, upon which the boiler and automatic regulating devices rest. The boiler, C, is provided with the pipes for conducting steam to and from the heating tubes circulating in the box, and arranged in such a manner as to gradually pitch back to the boiler. The boiler has a tube, F, for filling it, also a water gauge and a safety valve, and is heated by means of a flame of gas or of an oil lamp provided with an Argand burner. When oil is used, an oil tank, D, connected with the burner by a tube is placed on the shelf.

It is of the greatest importance to maintain a uniform heat in the incubator, and mechanism is provided which automatically regulates the temperature. A spiral metal thermometer, G, of well known construction, is attached at one end to a binding screw, fastened to the ceiling of the box, and connected with the battery by a wire, and the other end of the thermometer is attached to an index pivoted in the center of a curved scale at the side of the incubator, which can be adjusted by means of a journaled endless screw.

The index is provided with rectangular arms, which are hinged in such a manner that they can only bend upward, and can never form less than a right angle with the hand, so that if the thermometer continues to rotate the needle or hand, after the ends of the arms rest on the end pieces of the scale, the arms will not break, but will incline at the joint or hinge.

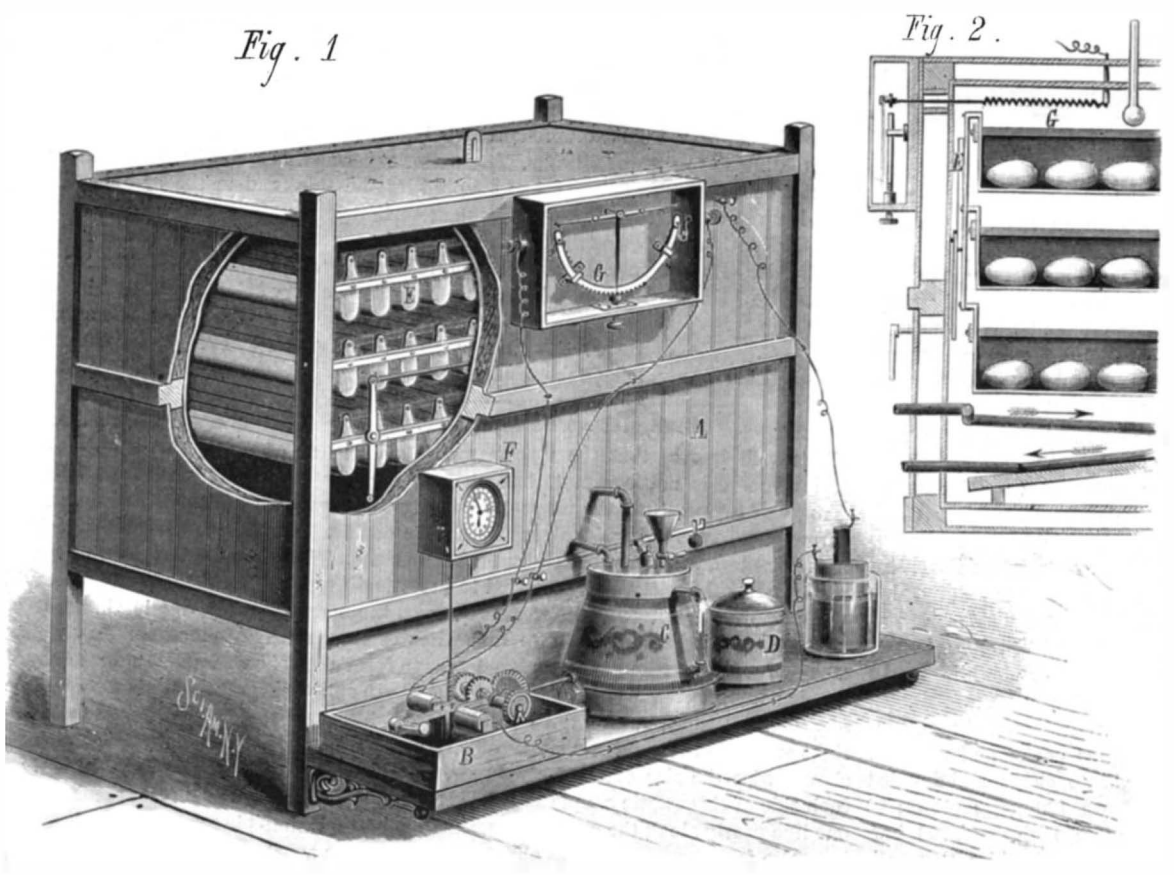
By means of the endless screw the scale, and consequently the thermometer, can be made to correspond with the mercury thermometer at the top of the incubator. The end pieces of the circular scale are connected with the electro-magnets by the wires, and the magnets are in turn connected with the battery.

The armature of the magnets is attached to a spring which holds it in a central position in relation to the two magnets. This mechanism controls the gearing, which operates a horizontal shaft driven by clockwork and acting upon the burner. The eggs are placed in longitudinal hammocks or receivers, made of canvas, attached to bars which are fastened to end pieces, which are pivoted to fixed bars and to movable bars. The movable bars are acted upon by the works of the clock, which are constructed similar to the striking mechanism of an ordinary clock, so that the receivers are moved at regular intervals.

The eggs having been placed into the hammocks, the metal thermometer, G, is regulated and adjusted according to the liquid thermometer. If the flame of the burner under the boiler is too large, too much steam will be generated and the air in the box will become overheated. The thermometer, G, expands, and, moving the index, the electric circuit is closed, operating the mechanism which turns down the flame of the burner. If the air in the box is too cold the above operation is repeated, but all parts move in the inverse direction, and in this manner the temperature can be controlled automatically. If desired, alarm bells may be arranged to ring when the temperature rises too high or falls too low.

Shallow vessels containing water will be placed above the steam tubes for the purpose of supplying the air in the incubator with necessary quantity of moisture.

This invention was lately patented by Messrs. Chas. L. and Henry S. La Barge, 22 Nicholson Place, St. Louis, Mo.



LA BARGE'S INCUBATOR.

NEW INVENTIONS.

Mr. John Menahan, of New York city, has patented an elastic band-fastening for pocketbooks. It consists of an elastic band and plates provided with a hook and slot to allow interlocking.

Mr. David W. Frazee, of Skaneateles, N. Y, has patented an embalming table, consisting of the two equal perforated hinged sections with side and end pieces, folding legs, braces, with fastenings. It is provided with adjustable head and foot rests.

Mr. Pearly N. Dixon, of Cahoka, Mo., has patented a stock for hand and other drills, so constructed that the drills can be easily, conveniently, and rapidly worked.

Mr. Ambrose Mathews, of Kewanee, Ill., has patented a force pump. A stem valve and spring-actuated hollow plunger, or piston, working in a close-bottomed cylinder, is so arranged that on the up stroke the valve lifts above the piston, and admits water to enter the top of the cylinder and flow into and below the piston, while on the down stroke the valves close down in the top of the piston, so that they act together as a solid piston in forcing water.

Mr. Andrew J. Curtis, of Monroe, Me., has patented an improved spring bed, having rows of upright spiral springs whose enlarged tops are connected with each other and the inclosing bed frame by rings and braces in such a manner that they can move only in a perpendicular line, so that when compressed the spirals of the springs will not come in contact with each other, said springs having their upper ends firmly and unyieldingly secured to their bodies to prevent their lateral contraction and expansion.

An improved car door latch has been patented by Messrs. W. McCombie and T. J. Morgan, of Chicago, Ill. The object of this invention is to construct a lock, especially designed for cars, that is easy of repair, of superior durability, and that can be attached to a car door in less time than other locks in use.

BRANCHIOPOD CRUSTACEANS.

Unquestionably the most interesting group of all crustaceans (crabs, lobsters, shrimps, etc.) are the branchiopods or branchipeds. They occur in salt and fresh water, and usually in great numbers. When taken out of the pool with a common dipper and dropped into a glass jar with some water, their most graceful motions can be observed at leisure. They swim slowly backward, incessantly paddling with their branchial feet, of which there are usually eleven pairs on either side of the upper body. Each of the leaf-like feet has a sort of a gill attached for breathing, in the shape of an oval fleshy lobe. The head is rounded, and has two large stalked eyes at the sides. A little above the eyes there is on either side a thin delicate antenna, or organ for feeling. The tips of the feelers are beset with microscopically small touch-globules and bristles. A little below the eye stalks there are a pair of claspers, often with hooks, large in the male, and small and simple in the female. The male claspers are sometimes flat and curiously branched, as in the genus *Streptocephalus*, Fig. 6.

Between the male claspers there are often two fleshy lobe-like tongues, which are usually found coiled spirally beneath the head. These fleshy processes are curiously branched in the genus *Chirocephalus*, Figs. 5 and 7. The mouth is closed by a pair of minute jaws, which, when viewed under the microscope, look like two currycombs. Below these there are two more pairs of very minute jaws.

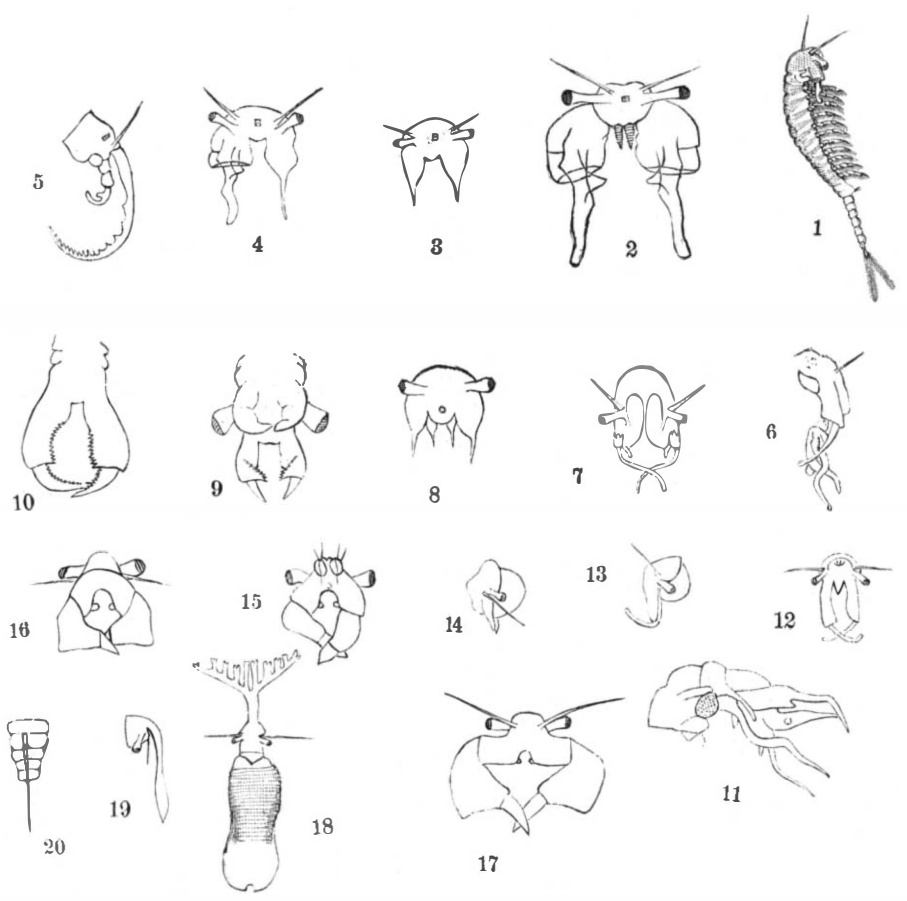
All members pertaining to this family take their food from the soil of the ponds or pools in which they occur. They occasionally strike against the mud, whirling it up, thus getting a quantity into the external channel between their feet. The motion of the latter is such as to gradually drive the mud toward the head, and microscopic organic matter (algæ, etc.) contained therein enters the mouth and stomach. F. Spangenberg, Ph.D., first mentioned this fact in 1875, and I have frequently observed the same in *Eubranchipus, Streptocephalus watsonii P.*, etc. Under no circumstances will they ever partake of chopped meat or bread placed in the aquarium; for as soon as the decomposition of the meat begins, all the individuals will die.

Just below the last pair of branchial feet the external sexual organs may be seen, contained in two united segments. Below the sexual organs is a cylindrical prolongation of the body, the so-called post-abdomen, to which the two united sexual segments also belong. The post-abdomen ends usually with a furca or terminal fork. The latter consists of two more or less long, flat, and stiff bristles fringed with finer bristles (setæ).

The furca undergoes great changes in salt water species according to the density of the water; the furca is therefore of but little value in the determination of species. In *Thamnocephalus*, Fig. 20, we find a rudder-like, flat, broad appendage instead of a terminal fork, the latter being but faintly indicated by a median notch. Some branchiopods occur in the hot season only; others, like *Eubranchipus vernalis*, Verrill, Fig. 1, only in winter. In midwinter, when mild weather sets in, and the thin coat of ice gradually melts away, *Eubranchipus* can be seen by the thousands near Maspeth, L. I., in ponds along the railroad track. They are of various hues of red, more or less transparent, and measure about one inch in length when full grown. The female drops her eggs every few days; the latter are dark brown, spherical, and finely granulated. The eggs of other genera form perfect mathematical figures, and are very peculiar. The smaller pools nearly all dry up in the hot season, being occasionally filled by rains. *Eubranchipus* are supposed to be a relic of the ice age, and are never seen in summer.

The eggs of branchiopod crustaceans show the singular phenomenon of hatching only after having once been dried up. Perfectly dry mud from the pools in which they occur will develop the eggs contained therein, after adding water, in a tumbler or jar, within two or three days. The young at first look entirely different from the adult, and swim about very actively. They shed their skin a number of times, and every time reappear with an additional growth of feet and increased body, until mature.

CARL F. GISSLER, Ph.D.
Brooklyn, N. Y.



1. *Eubranchipus vernalis*, Verrill. Male, about twice natural size. Author's drawing.—2. Head of *Eubranchipus*. Male, much enlarged. front view. After Verrill.—3. Head of *Eubranchipus*. Female, slighily enlarged. Author's drawing.—4. Head of a hermaphrodite of *Eubranchipus*. Male and female claspers on one and the same animal. Sexual organs accordingly. Author's drawing.—5. Head of *Chirocephalus*, Holmani. After Ryder. Lateral view of male. From Woodbury, N. J.—6. Head of *Streptocephalus sealii*. After Ryder. Side view of male. From same locality.—7. Same as Fig. 5. Front view.—8. Same as 5. Female, front view.—9. Head of *Branchinecta arctica*, Verrill. Male. From Labrador. 10. Head of *Branchinecta grœnlandica*, Verrill. Male. From Greenland.—11. Head of *Streptocephalus texanus*, Packard. Male. From Texas.—12. Head of *Branchinecta coloradensis*, Packard. Male. From Colorado.—13. Head of 12. Side view.—14. Head of female of 12. Side view.—15. Head of *Artemia gracilis*, Verrill. Male. Connecticut and Massachusetts. In salt water. 16. Head of *Artemia monica*, Verrill. Male. Mono Lake, Cal.—17. Head of *Artemia fertilis*, Verrill. Male. Great Salt Lake, Utah.—18. *Thamnocephalus platyurus*, Packard. Entire male. Half of natural size. Seen from above. Kansas.—19. Head of female of the same. Side view.—20. Side view of the last few segments of abdomen with telson of 18.

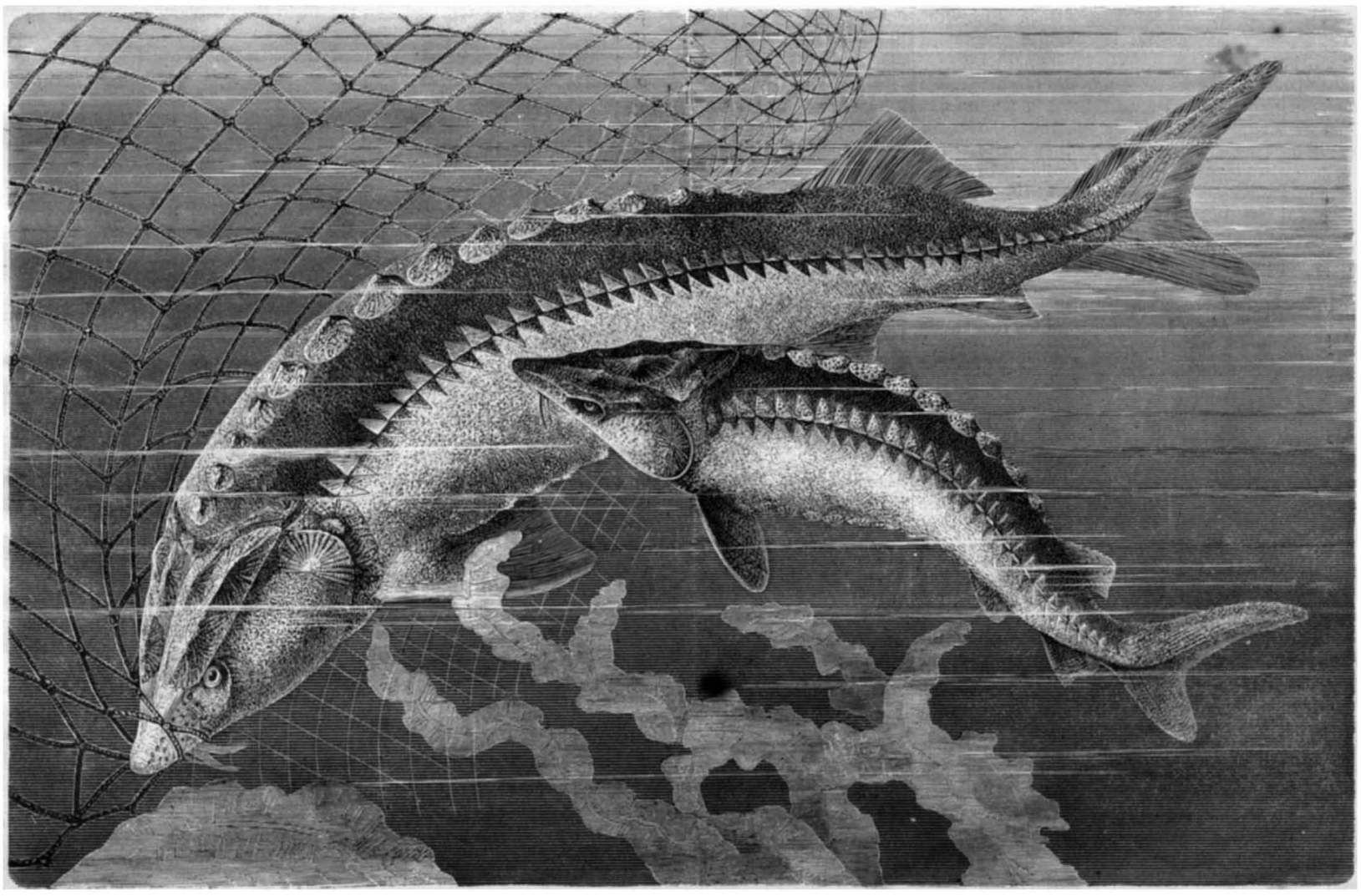
THE STURGEON FAMILY.

This family of fish have no bones like the cod, salmon, herring, etc., but, instead, have soft flexible gristle. The sturgeon is for some countries as important as the salmon, and is most common in Eastern Europe, living both in the sea and the large lakes, and at certain seasons of the year ascends the rivers in large schools.

In Russia a large proportion of the population is supported by the sturgeon fisheries, where it is salted, smoked, sundried. From it is obtained the Russian isinglass and caviare. All attempts to hatch sturgeon eggs and raise the fish artificially have so far been failures.

The finest kind of sturgeon (of Europe), whose flesh is almost as high-priced as that of the salmon, is the sterlet (*Acipenser ruthenus*), which seldom measures more than two feet, and averages eight and a half pounds, is found in the Danube, Salzach, the Drau, and Dniester. From its air bladder the finest isinglass is made, and from its roe the finest caviare.

The Prussian Ministry of Agriculture, in 1872, accepted an offer from De Koch, of St. Petersburgh, to plant 100,000 young sterlets from the Volga in the rivers of Germany, especially in the piscicultural establishments. With our American sturgeon great confusion has resulted in determining the different species, from basing them on cha-



THE STURGEON FAMILY—(*Acipenserini.*)

racters of insufficient value, and from the fact of the differences in appearance existing between the old and young. In the young the snout is long and slender, which, by being absorbed or failing to grow as fast as the rest of the body, with the larger sturgeons presents a blunt form. In some the shields or plates in the young are well developed, which, as they become more mature, disappear. Santher speaks of the same tendency occurring with the European sturgeon. In numbers the sturgeon will compare favorably with any of our staple food fishes. As an article of food in the fresh state they are not generally popular, as few people understand the various methods of cooking. The Canadian-French prepare a soup from the flesh which has much the flavor of chicken soup, but being very rich requires a strong stomach to retain it. A very good pickle is made by first boiling the flesh and afterwards pickling it in vinegar. But undoubtedly the best method of preparing the flesh is by smoking. The sturgeon are first skinned and the viscera taken out, after which the thick parts are cut into strips and placed in strong brine, and for a short time smoked over a close fire. The demand for smoked sturgeon is very constant and on the increase. It is best to smoke only small quantities at a time, as it is apt to become rancid. The thin portions and offal are boiled down for oil. From the roe is manufactured the American caviare, of which imme seiquantities are shipped to Europe. The caviar is prepared in the following manner: After tearing away the enveloping membrane the eggs are placed on a horse-hair sieve, the mesh of which is sufficiently large to allow the eggs to drop through after being stirred around in one direction with the palm of the hand; this is continued till all the roe has passed through and are entirely free of all membrane and fatty material, after which they are placed in a salt pickle (made from the best of salt) for a length of time, which is regulated according to temperature and season of the year. After coming out of the pickle it is placed on trays or cloths to drain off previous to being packed in barrels.

The Kauri Gum of New Zealand.

Consul Griffin, of Auckland, makes an interesting report to the State Department, from which we make the following extracts, on the product of the kauri gum, which is so extensively used in the United States for the manufacture of varnish. It consists of the dried and solidified sap of the kauri tree, a species of pine known to botanists as the *Demerara australis*. It does not exist in any other part of the world. It is found only in the province of Auckland, in that part of the colony lying to the northward of the thirty-ninth degree of south latitude.

It was the opinion of many for a long time that kauri gum is a fossil article, like amber, and is no longer being produced. This, of course, is a mistake, but it is nevertheless true that the best and by far the largest quantity of merchantable kauri gum is dug out of the ground. It is found at various depths, from just above the surface of the soil to many feet below the surface. It is found on bare hillsides, on flat clay lands, in swamps, and even in some places that are covered with a more or less thick coating of volcanic *débris*.

Sometimes the gum is found in small detached lumps, and at other times large deposits will be found in one hole. On cultivated land it is not unfrequently turned up by the plow, and in many places cutting large drains in swamps has revealed large deposits of this vegetable product.

In the forks of the large branches deposits varying from a few pounds to nearly a hundredweight are sometimes met with. When a kauri tree is cut in the bark, even the largest and oldest of them, varying in diameter from six to ten or twelve feet, it will bleed like a young sapling. In a few weeks, if the weather be dry, a large mass of half-dried gum will have oozed from the wound, not unfrequently appearing in the form of a great, thick band, reaching from the wound to the surface of the soil around the tree. When a tree is felled the stump bleeds in a like manner until large masses of gum can be broken off from the stump. This "young" gum is white in color, and has not the rich amber color which age imparts to it when stored beneath the surface of the soil away from the action of sun and weather.

The gum is not soluble in water. It ignites freely and burns with a lively sooty flame. It froths and bubbles, and produces a pleasant aromatic odor. The perfume it exhales when burning in the open air is not unlike that of frankincense and myrrh.

Some of the finer specimens of kauri gum are used in the manufacture of jewelry, but, while it is very clear and beautiful, it is not so desirable for this purpose as amber. It is nothing like as hard as the latter, and is much more brittle, and insects and plants are not so frequently found embedded in it.

Kauri gum was known to the native race long before the islands were settled by Europeans. They used it for the purpose of kindling their fires, and it is also said to have been employed by them in their religious rites, but there does not appear to be any ground for the statement.

Kauri gum became an article of commerce immediately after New Zealand became a British colony. At first the exports were small, amounting to about 100 tons per annum. The price of gum at that time ranged from $24 to $28 per ton. The natives then were the only persons engaged in searching for it and bringing it to market.

The implements used in digging for the gum consist of a spade and a spear. The spear is a long steel rod about half an inch in diameter, with a wooden handle with a cross on the top like that of a spade or a shovel. The rod is brought to a point, and the gum digger pierces it into the ground. Practice and experience enable him to tell whether he is touching a stone or a piece of gum. When he touches the gum he digs around it until it is extricated, and then renews the search as before.

The number of persons regularly engaged in digging gum varies from 1,800 to 3,000, the greater part of whom are Maories, but even they do not show any special fondness for the work. They resort to it when they become pressed for food and clothing on account of the failure of their crops or other causes. Many Europeans have resorted to this kind of work, but they belong generally to a class who are unruly and impatient of the restraints which a civilized life imposes upon them, and who prefer to camp out after the fashion of gypsies, and live in tents and ranpo huts rather than in houses fitted for civilized beings.

It is generally supposed that a European who resorts to gum digging is unfitted for any other occupation. He leads a reckless dare-devil sort of life, away from friends and kindred, and from the restraints of civilization. All the finer feelings of his nature become blunted, and he falls to a lower depth than the savages with whom he makes his home. Among this nomadic class are a number of the degenerated sons of the aristocracy of Great Britain.

When the gum is taken out of the ground it is covered with earth, and its surface is found to be in a partial state of decay. When the digger is tired of work he puts his gum into a bag and carries it to his tent or hut, and in the evening or upon rainy days he, with the assistance of his wife and children, scrapes off the decayed surface until the clear solid gum beneath is reached. When a sufficient quantity of it has been scraped, it is put into a box or bag and taken to the nearest store or public house, where it is sold for what it will bring. Sometimes the purchaser will assort it, but it is not generally sorted till it reaches the city buyer, who employs a large number of skilled hands for that purpose. The gum, after it is scraped and assorted, is packed carefully in boxes, so as to prevent the lumps from breaking. It is then ready for export. The dust and scrapings are also exported.

Some of the gum is used in New Zealand for the manufacture of varnish, but in no great quantity.

The export of kauri gum for the year 1880 will be larger than that of any other year. The total export for 1878 was 3,410 tons, and 3,247 tons was the total export for 1879. The invoices thus far received indicate that the total shipment for the year 1880 will be 5,500 tons.

The price of gum varies, of course, according to quality and the condition of the market. It ranges from $144 to $720 per ton. The greater part of it, however, is bought at the former price. The average price may be safely set down at $216 per ton. At this rate the total value of the estimated shipment for the year 1880, viz., 5,500 tons, would be $1,188,000. More than two-thirds of the gum goes to the United States. It is either shipped to New York and Boston in sailing vessels, or to London for transshipment to the American cities.

It is a matter of regret, adds Mr. Griffin, that the kauri forests are disappearing. The trees are being so rapidly cut down that they will soon cease to exist. The government has not taken any steps to protect them, either by conserving those that remain or by planting new ones. At the present rate of consumption, fifty or eighty years will see the great bulk of the kauri trees cut down. Of course, when the trees are destroyed there can be no deposits, and kauri gum will become a thing of the past.

The amount of gum taken out of the soil up to the present time has been so great, Mr. Griffin concludes, that it would probably require a forest growth of ten thousand years to replace it.

The Depths of the Sea.

Mr. Henry Du Villard recently lectured before the Franklin Society in Providence, R. I., on the "Depths of the Sea," illustrating the same by some fine drawings and specimens of apparatus which had been in use in the deep sea soundings. These were loaned by Captain Bartlett of the United States Coast Survey steamer Blake. The lecture was further illustrated by specimens of the marine life taken in the soundings and dredging.

The speaker began by referring to the circumstances which gave him the opportunity of being aboard the Blake, commanded by Captain John R. Bartlett, Jr., for a time last summer, relieving, while there, an officer who was ill. He was enabled, while on board, to collect many interesting facts. The sea covers three-fourths of the surface of the globe. Its saltness is attributable to rivers and springs which are constantly washing into it chloride of sodium and other soluble salts. As evaporation carries more of these salts back, they naturally accumulate. The sea water in arctic regions is less than in the tropics, owing to the melting of icebergs. The color of the sea water when free from all mixtures is a pure deep blue. The color is due to the fact that the blue rays of the spectrum are less liable to be absorbed by masses of transparent substances than the others, thus predominating in the reflected pencil. The red, white, and brown patches in the Pacific and Indian Oceans are owing to the presence of swarms of animalcules, and the colors of the red and the yellow seas to materials of vegetable origin. The phosphorescence of the sea, best seen on a dark night, is due to the presence of innumerable forms of life contained in the water.

The common method of "throwing the lead," by which depths near the shore are approximately ascertained, was here explained. The depth of the ocean was for many years a matter of uncertainty, in consequence of the great difficulties with which investigators had to contend in using a weight and rope for sounding its depths. This line would run out long after the shot had reached the bottom. A sinker of sufficient size to remedy this difficulty could not be hauled back against the pressure of water.

Owing to the imperfections in the methods of sounding, as explained by the speaker, fabulous depths of six or eight miles were reported and no bottom reached. Methods of ascertaining depths by exploding charges of powder in the deep water, and by a record of the compression of air in tubes, were explained and the reasons of their failure given.

It was not until about the year 1854 that Passed Midshipman T. M. Brooke, a clever young officer in the United States Navy, invented an ingenious device for detaching the shot when it reached the bottom. This apparatus was shown both by drawings and by an actual piece ready for use. The simplicity and beauty of this machine greatly pleased the audience. Soundings of two and one-half miles were made by Lieutenant Brooke in the Pacific Ocean, and this corresponds nearly with Professor Bache's estimate of the average depth of the ocean calculated from the movement of the great tidal wave of December 23, 1854. The deepest sounding ever accurately made was by the Challenger, Captain Nares, in the Indian Ocean, where they found 5,000 fathoms, more than five miles. The soundings made for the laying of the first Atlantic cable were explained.

Scientific men had long believed that life at the bottom of the sea was confined to a narrow limit near the land, six hundred feet being about the limit, and that those animals and plants had almost disappeared, these representing only those of the simplest organization, and at the depth of 300 fathoms (1,800 feet), nothing could possibly exist, and that the sea bed was a desert waste. They knew that at a depth of 1,000 fathoms animals must bear a pressure of a ton on a square inch; moreover, that at a depth of 50 fathoms, the sun's light is almost entirely cut off. Further deep soundings brought up shells of dead animals living near the surface, but no living ones.

The progress of explorers by which evidences of life in great depths were found was here given. The first absolute proof that animal life could be sustained at such great depths was from fishing up a cable that would not work, lying between Sardinia and Bona. It was corroded, broken, and covered with marine animals, cemented to it. In 1868, 1869, 1870, H. M. ships Porcupine and Lightning made many hauls of the dredge in the Atlantic, the deepest being twenty-seven miles off the Bay of Biscay, where animal life, including bony fishes, was found in abundance.

The question of what the myriads of animals at these great depths feed upon was considered. Explanations given by scientific men, notably Sir W. Thomson, were quoted, the amount being that these animals take in organic matter, which analyses prove is in sea water everywhere, by absorption, they belonging to the lower orders, which are nourished in that way. It is also probable that they make their shells in a similar way.

In regard to the enormous pressure at great depths, Sir Wyville Thomson estimates the pressure upon a man at a depth of 12,000 feet to be equal to a weight of twenty locomotives, each with a good train loaded with pig iron. But a body supported within and without, through all its tissues, by a comparatively incompressible fluid as water is, would would not be necessarily incommoded. We sometimes find, when we get up in the morning, by a rise of an inch in the barometer, half a ton has been piled upon us during the night, but we experience no inconvenience. If, however, we were to go up a high mountain we would move with great difficulty.

The speaker noticed the same effect upon the animals brought to the surface aboard the Blake. Their eyes were blown nearly out by air expanded, and their swimming bladders were forced nearly out of their mouths. The greater part were dead except eels. The work of the Blake in its soundings and dredgings was explained by the speaker, and a book of the records shown. It included the depth of the water and its density at different depths, the bottom and surface temperature, and at two fathoms deep, and in all cases the meteorological and other conditions are carefully noted.

At this point the speaker gave an idea of the most approved sounding machine now in use by the aid of a model taken from the Blake. It is the Sigsbee sounding machine now in use upon the Blake, embodying the original design by Sir Wyville Thomson, with improvements by Lieutenant Commander Sigsbee, United States Navy.

The lecture was listened to with the greatest attention and interest, and after complimentary remarks by the President and Dr. W. O. Brown, upon motion of the latter a vote of thanks was tendered to the lecturer by the Society. After the adjournment the audience gathered around the table to examine the apparatus and specimens.

A New Product from Birch Bark.

A French inventor has patented a method of improving India-rubber and gutta percha by the addition of a distillate of birch bark. By distilling the outer layers of the bark he obtains a dense black gummy matter which possesses the properties of ordinary gutta percha with the additional

quality of resisting both the action of air and the strongest corrosive acids. He claims also that by adding a small proportion of the birch bark gum to gutta percha or to India-rubber (one-twentieth part will suffice), the durability of the rubber or the gutta-percha will be greatly increased, the new mixture not being acted upon by the air or by acids.

The Destruction of Trichinæ.

It is commonly believed that ordinary cooking will destroy trichinæ and render infested meat innocuous. Without doubt, as has been stated in the daily press, "the encapsuled parasites cannot survive a certain elevation of temperature, and death renders them harmless." Is it, however, correct to say that a "complete means of protection is furnished by the heat incidental to cookery?" Considerable doubt is thrown on this statement by M. Vacher, of Paris, whose authority is of considerable weight. He affirms that the protection given by cooking is quite illusory, and that in the thorough cooking of an ordinary joint of meat the temperature in the center is not sufficient to insure the destruction of the parasite. He took a leg of pork of moderate size and boiled it thoroughly. A thermometer placed within it at a depth of two inches and a half registered, after half an hour's boiling, 86° Fah., after boiling for an hour 118°, after an hour and a half 149°, and after two hours and a half, when the joint was thoroughly cooked, 165°. This temperature M. Vacher maintains is insufficient, and we must remember that at the center, which is still further from the surface than the bulb of the thermometer was placed, the temperature would not be so high. "Trichinæ would escape almost entirely the action of boiling water" in cooking. M. Vacher's note was communicated to the Chamber of Deputies, and, no doubt, has influenced the decision of the French Government to prohibit entirely the importation of American pork.—*Lancet.*

Raw Oysters.

Dr. William Roberts, in an interesting series of lectures on digestive ferments, published in the *Lancet*, says: The practice of cooking is not equally necessary in regard to all articles of food. There are important differences in this respect, and it is interesting to note how correctly the experience of mankind has guided them in this matter. The articles of food which we still use in the uncooked state are comparatively few, and it is not difficult in each case to indicate the reason of the exemption. Fruits, which we consume largely in the raw state, owe their dietetic value chiefly to the sugar which they contain; but sugar is not altered by cooking. Milk is consumed by us both cooked and uncooked, indifferently, and experiment justifies this indifference; for I have found on trial that the digestion of milk by pancreatic extract was not appreciably hastened by previously boiling the milk. Our practice in regard to the oyster is quite exceptional, and furnishes a striking example of the general correctness of the popular judgment on dietetic questions. The oyster is almost the only animal substance which we eat habitually, and by preference, in the raw or uncooked state, and it is interesting to know that there is a sound physiological reason at the bottom of this preference. The fawn-colored mass which constitutes the dainty part of the oyster is its liver, and this is little else than a heap of glycogen. Associated with the glycogen, but withheld from actual contact with it during life, is its appropriative digestive ferment—the hepatic disastase. The mere crushing of the dainty between the teeth brings these two bodies together, and the glycogen is at once digested, without other help, by its own diastase. The oyster in the uncooked state, or merely warmed, is, in fact, self-digestive. But the advantage of this provision is wholly lost by cooking, for the heat employed immediately destroys the associated ferment, and a cooked oyster has to be digested, like any other food, by the eater's own digestive powers.

Medical Uses of Figs.

Prof. Bouchut mentions some experiments he has made, going to show that the milky juice of the fig tree possesses a digestive power. He also observed that when some of this preparation was mixed with animal tissue, it preserved it from decay for a long time. The *Medical Press* refers to this fact, in connection with Prof. Billroth's case of cancer of the breast, which was so excessively foul smelling that all his deodorizers failed, but on applying a poultice made of dried figs cooked in milk, the previously unbearable odor was entirely done away with. Certainly the remedy is worth trying.

Foot-and-Mouth Disease.

A serious invasion of eczema epizootica, or foot-and-mouth disease, has taken place, after the country had been free from it for several months. The infection is supposed to have been conveyed by diseased cattle from the North of France, which arrived at Deptford Market some time ago. Thence it was carried in every direction, the fairs and markets being the chief sources of dissemination. It now prevails pretty generally over England, notwithstanding the efforts made to check its progress. It is to be feared that inspection of the cattle markets is often at fault. For the chief metropolitan market there is only one inspector, and as the number of animals crowded together is frequently more than two thousand, it is evident that they cannot be submitted to that careful examination which is so necessary for the detection of the disorder, particularly at its commencement, or in its milder form. The infection can be conveyed by all kinds of media independent of the living animal, and this certainly renders the extension of the disorder far more easy, and its suppression much more difficult, than some other transmissible diseases of animals. It must not be forgotten that the infection can be transmitted to other than the bovine species, and man himself is not proof against it. The milk is the chief vehicle of infection.—*Lancet.*

NOVEL FISH BASKET.

One of the most ingenious and useful inventions for the comfort and convenience of fishermen that we have seen for a long while is a canvas basket or creel, made by Messrs. Abbey & Imbrie, of this city. They are made of waterproof canvas, with the sides and bottom perforated for the purpose of draining the basket and for ventilation. As they roll up in a small package when not in use, or to fit in a valise when traveling, their great superiority over the old-fashioned fish basket can readily be seen.

FISH BASKET.

The accompanying illustrations show the basket ready for use and folded for traveling, and are sufficiently plain to be understood without further description.

FISH BASKET FOLDED.

Good Work by Boys.

The good example set in Maine last year and year before, of offering prizes for farm work by boys, has been wisely followed in Vermont. The prizes won last year have just been awarded. The first prize of $25 and a scholarship in the Vermont University and State Agricultural College (worth $50 a year for four years) for corn, was taken by Frank J. Hubbard, of Whiting, and the first prize, of the same amount, for potatoes, by Lewis S. Breed, of Goshen. The second prize, of $20, for corn, was taken by Edgar J. Tuthill, of Newfane, and for potatoes by Frank J. Hubbard. The third prize, of $15, for corn, was taken by J. T. Goodenow, of Montpelier, and for potatoes by Burt Royce, of Williamstown. The fourth and fifth prizes for corn were taken by Edward N. Casey, of Whiting, and H. E. Thayer, of Guilford; and for potatoes by Eugene Plastridge, of Northfield, and George R. Powers, of Lunenburg. No less than 305 boys competed from 146 different towns. The best yield reached was at the rate of 192 bushels of dry shelled corn to the acre and 422 bushels of potatoes to the acre. As the average production of Vermont farms is estimated to be 39 bushels of corn and 140 of potatoes to the acre, it will be seen that the results secured by the boys are quite encouraging.

Opening of a New Railway to the Pacific.

A new route to the Pacific is opened by the completion of the Atchison, Topeka and Santa Fe Railroad to a connection with the Southern Pacific at Deming. From Kansas City to Deming the distance (over the Atchison, Topeka and Santa Fe) is 1,154 miles; from Deming to San Francisco (over the Southern Pacific and Central Pacific), 1,208 miles, making the distance from Kansas City to San Francisco 2,362 miles, against 1,916 from Omaha to San Francisco. From Chicago the distance is about the same to Kansas City (or Atchison) as to Omaha; but from New York the distance to Kansas City by the shortest route is 1,342 miles, and to Omaha 1,402 miles. Thus the new route is considerably the longest in distance; but as trains run quite slowly by the northern route, it will not be difficult (though somewhat costly) to make as good time by the new route as is made now by the Union Pacific. At the rate trains run on the Union Pacific the additional length of the Southern route will require nearly twenty-four hours' time, but as the average speed on the old line is but 19 miles per hour, this can be made up by running trains on the new line about 23½ miles an hour. The new line is likely to get a fair share of the through traffic, from this direction at least; in the other it will depend chiefly upon the disposition of the Central Pacific, which works both roads and may prefer to send traffic by the route which will give it the largest profits. Passengers, especially those who expect to make the trip but once, are very likely to take one route in one direction and the other in returning, thus seeing as much as possible. A good deal has been claimed for the new route on account of its freedom from snow blockades; but we doubt if the possibility of a snow blockade on the Union Pacific will drive from it in winter as many passengers as the certainty of the infernal heat on the Southern Pacific in Arizona and the California desert will deter from attempting that route in the summer. But no doubt the new route will get a good share of the through passengers, and the loss of them will be quite seriously felt on the old line, the rates being high and yielding a good profit. The competition of the new route, however, will not be nearly so serious a matter as it would have been a few years ago, when the local traffic was comparatively trifling.

The country that is likely to profit most by the new line is the mining region of Arizona, which heretofore has had to get its supplies from the Atlantic coast by shipping them 3,300 miles west to San Francisco, and then 1,000 or 1,100 miles southeast. However, rates on this traffic are not likely to be low now. These scattered mines are about all there is to give local traffic on some 700 miles of road.

Rates, it is understood, will be the same by the new route as they have been by the old one. The Central Pacific, working both lines on the west, is in position to control this, and it is not likely to consent to anything which will reduce its profits.—*Railroad Gazette.*

A Luminous Liquid.

It is well known that certain metallic salts, especially if previously heated, when exposed to direct sunlight, to the electric or the magnesium light, and then brought into a dark place, give off a yellow or a bluish-white light. Especially the sulphurets of magnesium, strontium, and calcium possess this property in a greater or less degree. Balmein has recently patented a mixture which possesses this property in a remarkable extent. Thus, if the dial plates of watches are coated with this composition and then with a colorless varnish, the figures may be seen in the dark at some distance, if they have been previously exposed to diffused daylight. According to my experiments the organic compounds of these metals possess the same property, especially rosin oil lime soaps. If 100 parts of rosin oil are boiled in a suitable pan with 30 parts of freshly slaked lime, raising the heat by degrees, the mass which is at first lumpy becomes tougher, and finally passes into a thin liquid. As soon as this stage is reached, say at 320° Fah., the entire surface of the liquid becomes luminous in the dark, which is still more intense at a greater heat. At 380° Fah. the bluish-white light is very strong in the dark. Objects dipped in the liquid remain luminous for some time.—*B. Hoffmann, in Chemiker Zeitung.*

Laundry Machinery in China.

Our esteemed antipodal contemporary, the Foochow *Herald*, under date of January 27, 1881, says that plans and specifications for a model laundry have arrived there from England—a complete steam laundry, such as in England purify the shirts of the nobility, and, mayhap, royalty itself. The *Herald* is immensely tickled over it, and sets the details of the machine before its readers with great relish, and indorses the scheme with unction—heedless of the advertisement involved. It says that the "plant" to be adopted will have the capacity of turning out 12,000 articles per week, and be worked by a four horse power engine with all the appurtenances. The *Herald* hopes and believes that the new laundry will be the forerunner of other steam laundries which will soon "eclipse that continual pest, the washman, and all his tribe." It is a curious fact, suggests the *Daily Graphic*, that just as we are beginning to welcome Chinese washmen in this country as ideals of care and skill in their line, and desirable substitutes for the ripping and reckless washerwomen, China itself should be hailing steam laundries as a deliverance from what we are learning to regard as one of the mercies of Providence. But so it is. The world revolves as of old, and light ever comes from the East.

Intestinal Bacteria.

Nothnagel, of Jena, has been investigating the organisms found in fæces, and has examined the microscopical characters of five hundred stools in health and disease. He found many microscopic organisms constantly present, but that which was found in greatest abundance was the *Clostridium butyricum* of Prazmowski (the *butyric vibrio* of Pasteur, the *Bacillus amylobacter* of Van Tieghem). It occurred in the fæces in which no starch could be demonstrated. It is probably this which has given rise to the statement that the yeast fungus is often present in the fæces; in point of fact it is very rarely found in the fæces. Riesenfeld and Brieger discovered butyric acid in both the intestinal contents and in stools, and the product is doubtless the result of the growth of these bacteria.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. C. asks: 1. Does iron, when subjected to intense cold, become more brittle? A. See answer to C. P., page 106 (3), current volume. 2. Can a perfectly round ball be made to travel in a horizontal curved line? A. Yes. 3. What is the simplest way of making a fire assay of metal specimens? A. It depends upon the character of ore and the metals to be determined. It is probable an article on the subject will shortly appear in this paper. 4. Where can I obtain double sulphate of nickel, also pure nickel? A. Almost any druggist can procure it for you. See our advertisment columns for addresses of dealers in electroplating supplies. 5. What is the best manner of connecting the battery with a silver plat bath? A. See article on page 81, current volume. 6. Can cast iron be welded in a common forge fire without the aid of anything except the hammer? A. Not satisfactorily. 7. Can iron wire (small) be welded to any extent in any manner? A. They may be welded at a bright red heat by cleaning with a little borax glass powder and hammering together.

(2) T. F asks (1) for test for pure cream tartar and soda. A. Dissolve a sample of the tartar in hot water and note whether any impurities remain behind. Acidify with a little nitric acid, and add solution of barium sulphate. A precipitate indicates the presence of sulphuric acid—probably as sulphate or soda or potassa. Weigh out 188 grains of the dry sample, dissolve in hot water, filter, and add a filtered solution of lead acetate. Filter, dry the precipitate at 212° Fah., and weigh it; it should weigh 355 grains, corresponding to about 80 per cent tartaric acid. 20 grains commercial bicarbonate of soda should just neutralize 18 grains pure tartaric acid. It should dissolve completely in 40 parts of water, and the solution should remain unaltered on adding solution of pure corrosive sublimate, platinum chloride or sulphate of magnesia. 2. How is powder bluing made for washing? A. *a*. Use aniline blue in powder. *b*. Triturate thoroughly fine prussian blue with about one-twelfth its weight of ferro-cyanide of potassium and a little water; mould and dry. *c*. Nearly neutralize indigo sulphate paste with soda, and dry. *d*. Purify finest blue ultramarine by elutriation. 3. What are the pictures called oilgraphs, and how made? A. The picture or design is made translucent by saturating it with castor oil, then fastened between two glass plates.

(3) H. H. F. asks for full practical information on enameling on wood in black, like parlor organ stops and knobs. A. Seed lac and pale resin, each 2 oz.; alcohol, 1 pint. Warm the wood in an oven, apply the varnish quickly and evenly; let dry, give another coat, and when dry rub down with pumice stone. For a black body, dissolve 4 oz. shellac in 1 pint of alcohol, and mix up to color with ivory black in impalpable powder; give the work one or more flowing coats of this, and heat in an oven (gradually) to about 400° Fah., for half an hour. After cooling somewhat give a flowing coat of pale spirit-copal varnish, harden again in the oven, and polish with felt and tripoli, finishing with a trace of oil. For white ground mix washed flake white with one-sixth its weight of starch, grind very finely, and temper with mastic varnish. Harden by heat, and lay on 5 coats of the following: Seed lac, 2; gum anime, 3; coarsely powder, dissolve in 1 quart of alcohol, and strain. Harden and polish as before, using putty powder.

(4) R. S. T. asks: What will give ink a fine gloss? A. Add a little nitric acid to any good gall iron ink and increase the amount of gum arabic and sugar sufficiently. Or add gum arabic to a strong hot aqueous solution of soluble nigrosine.

(5) E. V. writes: I have a large quantity of frosted silver to keep clean. Could you recommend something in the way of a bath to keep it in good order? A. Try a solution of 1 oz. cyanide of potassium in 1 pint water (cyanide is very poisonous, and must be handled accordingly). Rinse thoroughly in running water and then in hot water. The heat imparted by the latter will cause to dry at once when taken out.

(6) C. M. K. asks: What effect would tartaric acid have on the system when used as a beverage? A. In small quantities it is a comparatively harmless refrigerative. In large quantities, or in a concentrated form, it is, in common with other acids, a corrosive poison.

(7) J. H. C. asks (1) how to make the cable insulating material used in making electrical condensers. A. The following composition is used for the purpose: Linseed oil, 2 parts; cotton seed oil, 1; heavy petroleum, 2; light coal tar, 2; Venice turpentine, ½; spirits of turpentine, 1; gutta-percha, ½; sulphur, 2; heat the oils separately to about 300° Fah.; cool to 240°, and mix in the other materials, the sulphur last. Heat to 300° Fah., for about an hour or until the mixture becomes pasty, and on cooling is soft and elastic. 2. How many feet of No. 35 copper wire is used in a Brush or Edison electric machine to produce a light of eight candles? A. No. 35 wire is too fine for a Brush or Edison machine. The size of the wire will depend on the size of the machine and upon the manner in which it is to be used.

(8) J. S. asks: What is put in the starch to make collars and cuffs stiff and also to give them a gloss? A. Moisten the surface of the starched articles with a rag dipped in a mixture of raw starch (unboiled starch mixed with a little warm water) to which has been added a small quantity of gum arabic and well beaten white of egg. Use a polishing iron.

(9) M. C. M. asks: 1. Is there a cure for hydrophobia? If so, what is it and where can it be had? A. See articles on this subject, pp. 299 (No. 19), 797 (No. 50), 957 (No. 60), and 1006 (No. 63), SCIENTIFIC AMERICAN SUPPLEMENT, and pp. 120 and 320, vol. xxxix., 129, vol. xxxv., 274, vol. xxxvi., and 326, vol. xxxvii., SCIENTIFIC AMERICAN. 2. What will make a good black japan for small castings and how used? A. Asphaltum, ½ lb.; melt and add hot balsam of capivi, 1 lb., mix well and thin with oil of turpentine. Give three coats, and dry in an oven at between 250° to 300° Fah.

(10) R. A. & J. S. ask: What is the best way to repair a rent in a rubber gas bag? A. Use a benzole solution of caoutchouc or marine glue. See receipts in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(11) F. J. H. asks: With a ten foot pulley as driver on to a six foot pulley as driven what distance between centers will produce the best result in belting in transmitting power? A. There is no definite rule, but the shafts should be so far apart as that the belt would have a decided "sag" on both parts. We think from six to eight times the diameter of the smallest pulley would operate very well.

(12) E. S. W. asks: Is there any rule for sparring and putting a center board well in a three-mast schooner, also what is the rule for stationing the masts in a narrow flat two mast schooner? Is there any architectural work in use in which I could find these things? A. We know of no published work which will give you the information. Your masts for schooner should be so placed that the center of effort of the sails shall be a little forward of the center of length on water line.

(13) H. & W. ask: Would the heating of carriage tires in boiling water expand sufficiently to be placed on the wheel? If so, it would be a great benefit, as the heat would be equal all round, and no burning of the rim, also the contraction equal. A. The slight expansion caused by the heat of boiling water would be of no use. The iron requires to be heated above the temperature of melted lead to grip the tire properly on chilling. The best method of heating tires that we know of is the gas heating apparatus illustrated on p. 66, vol. xlii., SCIENTIFIC AMERICAN.

(14) A. W. W. writes: 1. I want to find a composition or substance which has the property of being pliable and of taking and retaining a clear impression, but which can be again worked over and used. A. Gutta percha alone, or tempered with a little pitch, will probably answer your requirements. It is easily softened by gently heating in water or otherwise. Gelatine-glycerine moulds may also prove serviceable. See answer to A. T. G. (14), p. 106, current volume. 2. What kind of ink is used for inking ribbons of hand stamps? It seems to not dry while upon the ribbon. A. Dissolve a sufficient quantity of good aniline violet, blue or red, in warm glycerine by digestion and trituration.

(15) S. H. writes: In calculating the horse power of an engine we are directed to multiply the square, diameter, etc., by the speed of piston in feet per minute, etc. A light engine runs at a higher speed than one carrying a load. How am I to allow for this? It is self evident that as the load varies so will the speed of the piston. Though the engine may be working up to the same pressure, yet the result of the calculations, owing to the varying load, would greatly differ. A. The pressure on the piston is determined by the work the engine is doing, not by the pressure in the boiler. Then, of course, the less work or load the less pressure on the piston and the engine working at less horse power.

(16) A. E. F. asks: 1. Can you give me a good receipt for a baking powder? A. Bicarbonate of soda, 20 oz.; bitartrate of potassa (cream of tartar), 45 oz.; fine starch, 35 oz. Dry each separately and mix thoroughly. It must be kept from moisture. 2. What change takes place when it is mixed, in bread making? A. The reaction may be expressed as follows:

Bitartrate of potassa + Bicarbonate of soda, = Tartrate of potash and soda, + Carbonic acid, + Water

$$C_4H_5KO_6 + HNaCO_3 = C_4H_4KNaO_6 + CO_2 + H_2O$$

(17) D. H. D. asks: 1. What is the composition of an amalgam for the rubber of an electrical machine? A. Mercury, 4 parts; zinc, 8 parts; tin, 2 parts. Melt the zinc, add the tin, stir it well and pour it, not too hot, into a wooden box coated internally with chalk and into which the mercury (heated) has first been poured. The cover is put on and the box violently shaken until the amalgam becomes cool. It is then finely pulverized in a mortar, and is mixed with a little lard and applied to the cushions. Care should be taken not to inhale the fumes of the mercury. Amalgam that will answer nearly if not quite as well as the above may be made by mixing fine zinc and tin filings with mercury in the proportions given, and allowing the mixture to stand for a day or so befor rubbing it up in a mortar. 2. Should the rubber of the exciting plate of a two plate Holz machine be coated with the same amalgam as an ordinary friction machine? A. No.

(18) W. A. P. asks: 1. How long a line will a telephone made as described in SUPPLEMENT, No. 142, work over? A. Five miles or more. 2. In making the magneto-telephone call, as per SUPPLEMENT, No. 162, how much wire and what size should be wound on the bobbins? A. six to eight layers of No. 36.

(19) L. M. writes: 1. I am making a dynamo-electric machine, as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161. Now, what I want to know is whether the wire (No. 14) with which the connections under the base are made must be cotton covered or whether naked wire would do? A. This is immaterial, so long as there are no crosses; but for safety it is better to insulate with rubber tube. 2. I have turned the armature three-thirty-seconds of an inch smaller than the cylindrical cavity in the electro-magnet is bored out. Is that too small? should the armature fit closer? A. Your armature is too small. It should fit as closely as possible without touching. 3. Would a piece of hard wood (maple), well coated with shellac, answer for the commutator? A. Yes.

(20) I. B. C. asks: Cannot a platinum wire of the same length be substituted for the smaller carbon of George M. Hopkins' transmitter, illustrated in SCIENTIFIC AMERICAN, of March 19, 1881, with an improved result? A. We believe this has been tried, and preference given to the carbon.

(21) C. R. writes: We heat the liquors in our tannery by passing the exhaust from our engine, through a copper pipe, which lies in the bottom of a long dall, through which we run the liquor. Occasionally there occur, as it were, explosions which burst the copper pipe with a tremendous force. Would you tell me how this could be avoided? A. We think your trouble must be from a bad arrangement of the pipes, allowing water to accumulate; or it may possibly occur from a leak in the pipes.

(22) C. W. S. writes: I have been much pleased with and instructed by the article upon "Amateur Mechanics" in your issue of March 5, 1881, and I should feel greatly obliged if your correspondent "M" would further explain some of the details of the attachments therein described and illustrated: 1 The size or sizes best adapted for the cutter heads, Nos. 3 and 4. A. This will depend on the size of the lathe and the speed at which it may be driven. If the lathe is capable of being driven fast enough to turn small wooden articles a head 1½ inches square will be right. 2. The length and size of the bar No. 5 for fluting, and the material of which it should be made? A The size and length of the twisted bar will depend entirely on the kind of work to be done. For small work the bar may be of iron a quarter of an inch thick and three quarters of an inch wide. 3. How can the taper hole be bored for the mandrel from the underside of the top end of the frame No. 7, for moulding? The lower end or arm being directly in the way, I can see no other way but to make one of the arms separate, and then secure it to the frame after the hole is drilled and reamed. A. The holes in the top and bottom of the frame are first bored straight through, then a tapered reamer having a shank small enough to pass down through the screw holes at the bottom of the frame is inserted, and a bushing filling the screw hole and forming a bearing for the

reamer shank is put into place. The hole is then reamed, the reamer being driven by inserting the projecting end in a drill chuck. 4. Will the edge of the cutter head, G, No. 7, cut in wood? The edge being a right angle, instead of an angle of 60° or less, I should suppose it would scrape and tear instead of cutting. A. The cutter will cut without difficulty. 5. If M., or some one of your correspondents, would write a chapter upon a milling or planing attachment for the lathe, I am confident it would afford great satisfaction to many of your subscribers besides myself. A. You will find a chapter on milling attachments by "M," on page 340, vol. xl., SCIENTIFIC AMERICAN.

(23) F. L. W. asks: Can you give me any suggestions through your Hints to Correspondents, as to the best means of conducting water from my spring to my house, being situated about ten rods apart, the spring being about three feet lower than the house? My present mode of bringing it is by means of a pail suspended beneath a four wheeled iron car, which runs upon a track consisting of two wires. The track is built with sufficient grade as to cause the car to run to the spring and dip the pail. It is then drawn back by means of a cord attached to a wheel about two feet in diameter. By this means I am able at any time to obtain good fresh water, and can bring it right into the kitchen, but after building my new house my living rooms will be next to the spring and my kitchen on the back. Can I build my track on a curve so as to bring it to my kitchen? If not, what is the best means of conveying pure and fresh water from my spring to my house? A. You can work your car on a curve by proper arrangements. Would it not be better to sink a reservoir or cistern below the height of the spring and near or under your kitchen, lead the water from the spring to the reservoir by a pipe, and then pump the water for the uses of the house?

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

B. J. & Co.—1. Syenite. 2. Limestone. 3. Traprock. 4. Hematite—iron ore. 5. Calcareous clay. 6. Quartzose rock—contains gold and probably silver. 7. Limonite—iron ore.—E. M.—Arsenopyrite—arsenical sulphide of iron. It contains a trace of nickel.—E. P. St. J. —1 Crocidolite. 2. Amianthus—asbestos. 3. Talcose-schist. 4. Augite. 5. Alumite. 6. Talc.—F. M. D.—A fine variety of quartz sand.—J. J S.—Iron sulphide—contains a little copper, arsenic, antimony, and probably traces of silver. 2. Quartz, with a little erbusite. 3. Arsenical sulphide of iron and copper. 4. Powdered iron ore. 5. Powdered ferruginous and silicious limestone.—J. E. W.—Rich auriferous quartz—would probably assay about $2,000 a ton.—J. J.—Biotite—a variety of mica—and orthoclase.

COMMUNICATIONS RECEIVED.

On a Telephone Hook Switch. By J. H. S.
On a Petrified Human Skull. By T. G. H.
Ship Railroad Across the Isthmus. By J. A.
On a System of Weights and Measures. By D. B.

NEW BOOKS AND PUBLICATIONS.

UNITED STATES DEPARTMENT OF AGRICULTURE. SPECIAL REPORT (No. 28) ON THE CULTURE OF THE SUGAR BEET AND THE MANUFACTURE OF SUGAR THEREFROM IN FRANCE AND THE UNITED STATES. By William McMurtrie, E.M., Ph.D. Washington: Government Printing Office. 8vo, pp. 294.

A valuable study of the history, conditions, and success of the sugar beet industry in France, with suggestions applicable to the development of the industry in this country. Appendix A contains nearly half a hundred cuts of the more essential apparatus and machinery used abroad in the production of beet root sugar. The other appendices contain summaries of experiments made in this country and other related information.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION FOR 1879. Washington: Government Printing Office.

Contains, in addition to the annual report of the operations and condition of the institution, and related matters, a considerable number of important scientific papers much space being given to American anthropological researches.

REMINISCENCES OF DR. SPURZHEIM AND GEORGE COMBE. By Nahum Capen, LL.D. New York: Fowler & Wells.

The disciples of phrenology will welcome this sketch by one who was closely associated with Dr. Spurzheim during the closing months of his life, and who for nearly half a century has been prominent in that school of philosophy The larger part of the book is devoted to a review of the progress of phrenology from the days of Gall to those of Combe.

CHIPS FROM THE WHITE HOUSE, COMPILED BY JEREMIAH CHAPLIN. Boston: D. Lothrop & Co.

An unobjectionable book, whose reason for existence is not apparent. It is made up of selections from the speeches, conversations, diaries, letters, and other writings of the several Presidents of the United States.

THE LOCOMOTIVE. Published by the Hartford Steam Boiler Inspection and Insurance Company. New Series. Vol. I. Hartford, Conn.

The first twelve numbers of the *Locomotive* in its new form make a modest octavo book of some 200 pages, well packed with valuable information relative to boilers and boiler explosions. The publishers give little countenance to the "mysterious" in boiler accidents so-called, believing that boilers do not explode when properly made and managed. They recognize four causes of explosion: bad material; faults in type; bad work in construction; and inefficiency and carelessness in management. From this point of view boiler explosions are not so much accidents as crimes.

REPORT OF THE BOARD TO RECOMMEND A STANDARD GAUGE FOR BOLTS, NUTS, AND SCREW THREADS FOR THE UNITED STATES NAVY, May, 1868. Washington: Government Printing Office. 1880.

An examination of the systems of bolts and nuts in general use, with the reasons which led to the recommendations of the system of Mr. William Sellers, for use in the American navy.

CONCISE DESCRIPTION OF THE EAST RIVER BRIDGE. By E. F. Farrington, Master Mechanic. New York: C. D. Wynkoop. Paper, 50 cents.

In this pamphlet of 62 pages Mr. Farrington has given an interesting popular account of the manner in which the great work has been carried on, with details of construction and kindred matters. The accompanying engravings are in the best sense of the word illustrations.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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March 8, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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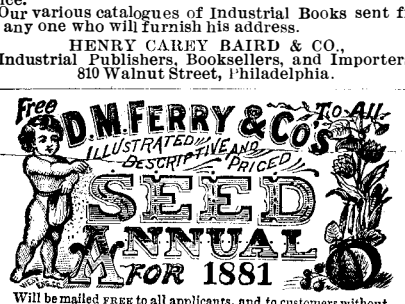

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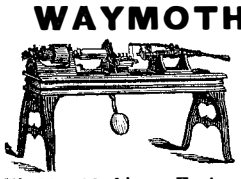

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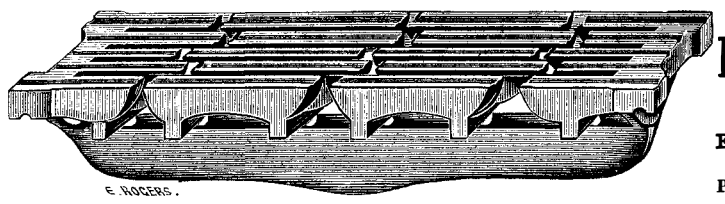

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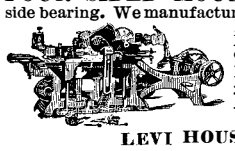

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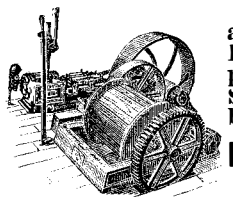

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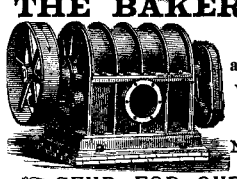

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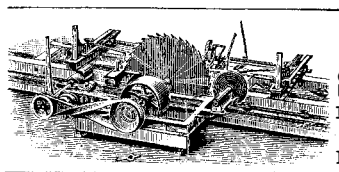

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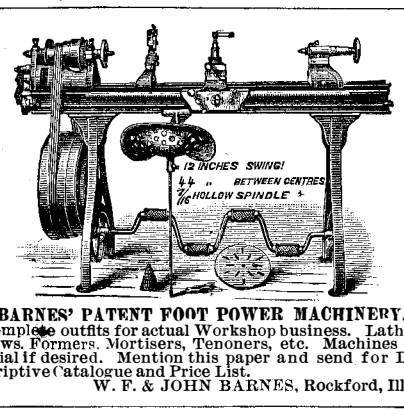

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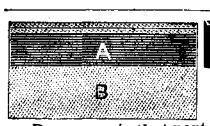

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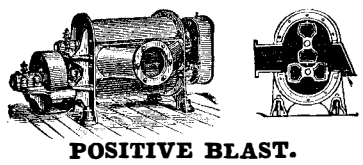

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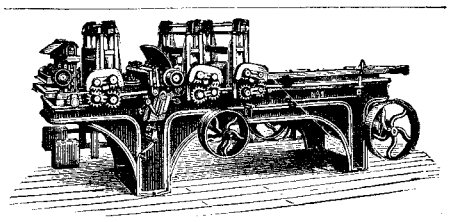

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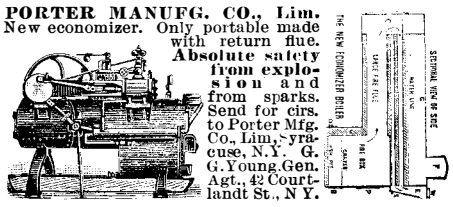

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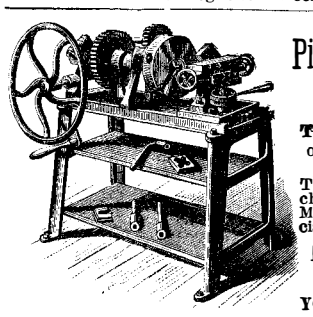

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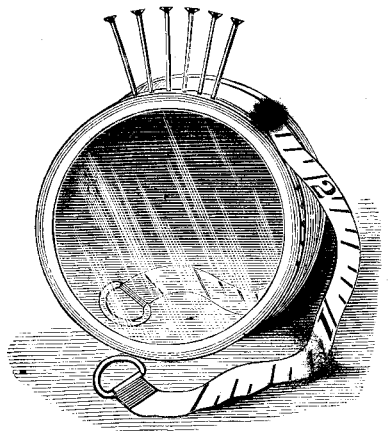
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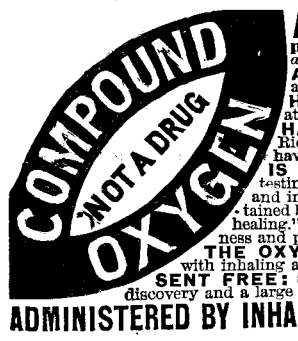

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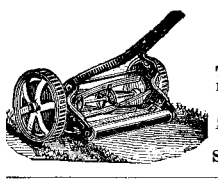
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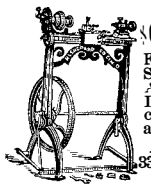
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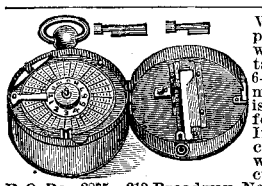
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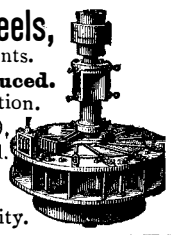

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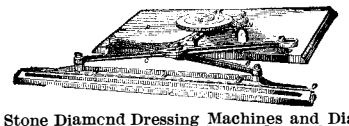
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