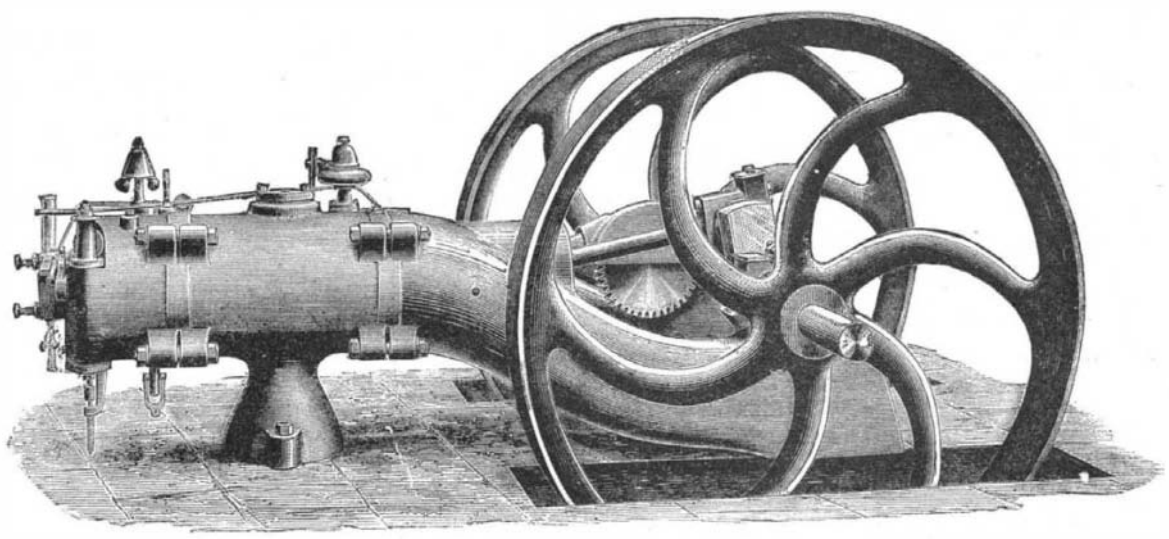
IMPROVED GAS ENGINE.

At the Electrical Exhibition, Crystal Palace, London, there areeight Crossley engines, namely, one 16-horse power nominal gas engine, indicating 40-horse power; three 12-horse power nominal gas engines, of 25-horse power each, indicating 75-horse power; one 8-horse power nominal gas engine, indicating about 15-horse power; one 3·5-horse power nominal gas engine, indicating 5·8-horse power; one 2-horse power nominal gas engine, indicating 3·9-horse power; one half-horse power nominal gas engine, indicating 2-horse power. The total indicated horse power is 141·7. The brake or effective horse power of these engines, when in good order, is stated to be about five-sixths of the indicated power. The 16-horse power engine is an entirely novel design, so far as the framing is concerned. We illustrate it herewith. The form is at once rigid, and most economical of material, while nothing can be easier to fix, nor depend less on the skill of the erector. This engine has also a new form of governor, in which, by changing the position of a link against the end of which a cam presses, the gas supply is varied by changing the period of admission. The air supply is nevertheless unaffected. This is a desideratum in Crossley engines. The principle of this new movement, which is simplicity itself, and yet is equal to varying the cut-off in steam engines, is also applicable to steam engines. If applied to them a separate small steam valve is put outside the slide casing, and on it the governor may operate in a manner analogous to that in which it operates on the gas valve. It is a form of governor arrangement which has the important advantage of offering no appreciable resistance to the governor itself, the work of moving the valve being done independently by the shaft of the engine.



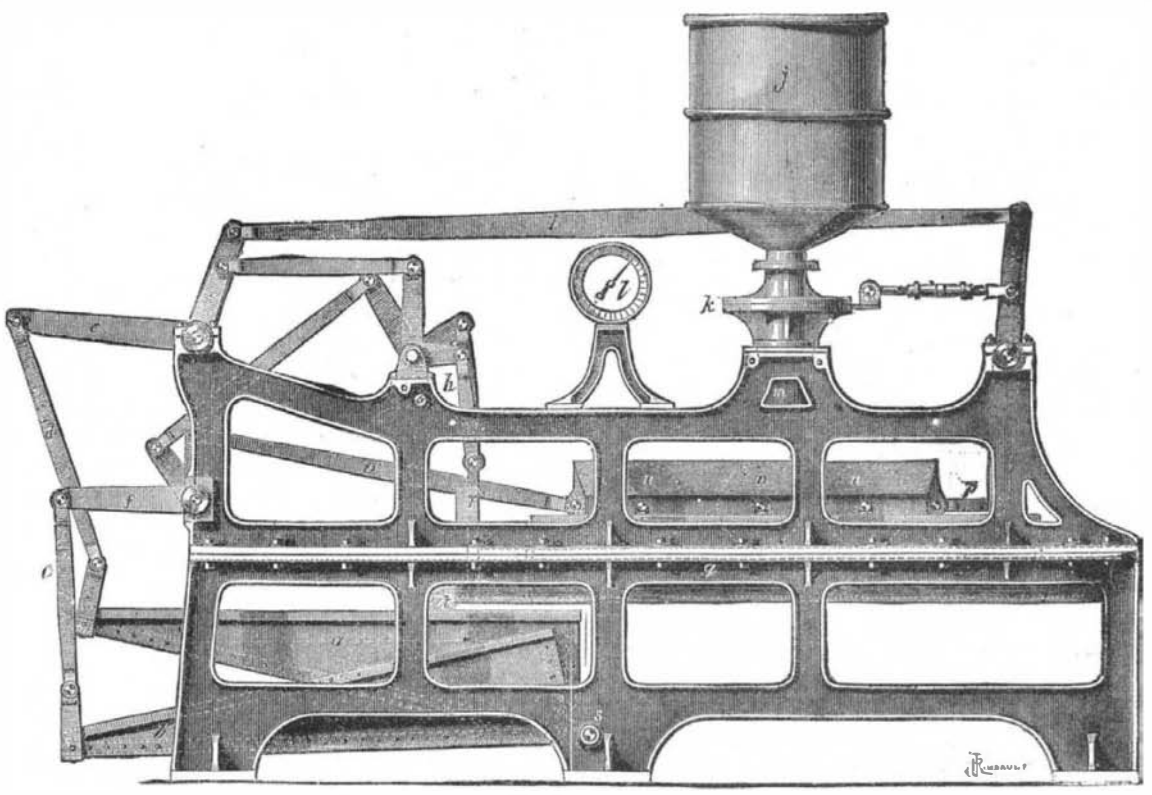
SIXTEEN HORSE POWER GAS ENGINE.

Everything about this engine is thoroughly substantial, durable, accessible, and, for the most part, even elegant in form. A small half-horse power nominal engine, which drives a number of Swan lamps, with a Siemens dynamo affixed to it on a suitable stand, forms a complete little electric plant, adapted for use in private houses, and is, we think, a very good little apparatus, and entirely novel, too, as a small installation.—*The Engineer.*

SEWAGE MACHINE.

The question of the purification and disposal of sewage has been tackled by a large number of enginecrs, chemists, and others, with a greater or less degree of success—more frequently less than greater. Mr. John Hanson's treatment consists in the use of lime and black ash waste as purifiers, and his system has been in use at Tong, near Bradford, England, for about four years with every success. It is also in use at other places, notably at Golcar, near Huddersfield, where the works were designed by Mr. Hanson and were started near the close of last year. The objection to lime alone, as stated by Mr. Hanson, is that lime alone does not remove the germs of infection, whereas with the addition of black ash waste the water is so effectually purified that, according to a report of the constable of the Tweed Commissioners, salmon fry and other delicate fish can live in the purified water. This black ash waste is a by-product from alkali works. According to Prof. Roscoe, for every ton of soda ash produced, from 1½ to 2 tons of waste are formed and accumulates in enormous quantities. This waste contains the whole of the sulphur burnt in the pyrites kiln, amounting to from 15 to 20 per cent of the weight of the waste. The purifying properties of black ash waste are as follows: Black ash waste as it comes out of the vat contains all the sulphur which was used in the making of the soda ash. It is then in the form of insoluble monosulphide of calcium. When the monosulphide of calcium is exposed to the action of the atmosphere it passes into a state of higher oxidation, then called disulphide of calcium. When this soluble disulphate of calcium is brought into contact with caustic lime, after both have been added to the sewage, then the disulphite of calcium contained in the black ash reacts upon the free caustic lime which is held in solution, and precipitates both in the form of monosulphide and sulphate, carrying down with them all the sewage impurities, thus discharging the effluent neutral and pure into the stream. By means of lime alone this is stated to be impossible. The two deodorizers are well stirred in the cistern by agitators, worked by a small gas engine. Into the lime cistern water is introduced to produce the necessary paste, and into the other the sewage runs by gravitation, and thus the effluent of each is a diluted fluid which is conducted into mixing and settling tanks. The tanks are emptied occasionally, the residuum being removed for use as a manure.

The chief feature of the machine, says *Iron,* is that it is worked by the sewage which is to be subjected to treatment, thereby avoiding the expense of skilled labor and fuel. Assuming the main sewer to be arrested, as it were, by this machine, its contents flow into a reservoir provided with a set of rollers which convert the lime and black ash to form the precipitate into a pulp. This is discharged into two trough levers beneath, which form the motive power for setting the whole machine in motion. A sufficient quantity of sewage having gone into one or the other of these troughs, it goes down, discharges its contents charged with the precipitating material, and in the action turns all the machinery that has ground the black ash and lime, and even registers the number of gallons of sewage that have passed. The invention is very simple. Every crank and lever is set in motion by one fall of the troughs, and it has not a wheel in it. Mr. Hanson calculates that for £500 such a machine could be erected which would clear the sewage of a town of 10,000 inhabitants. Of course, the great idea of treating sewage is to introduce the precipitating elements, to make it, in fact, innocuous; but this hitherto has only been effected at a great expense. Mr. Hanson's machine promises to make this a very simple matter.



MACHINE FOR PURIFYING SEWAGE.

Our engraving represents a side elevation of the apparatus. *a* and *b* are the water levers; when one is full of sewage water the lever drops and the empty lever rises, giving motive power to *c* and *d*, which are rods connected with levers *e* and *f*, and to the whole of the machine. The rods, *g* and *h*, are connected to sluices from which flow alternately the sewage water, Nos. 1 and 2, *a* and *b*. There is a lever bar, *i*, working the back part of the machine. The hopper, *j*, contains the black ash waste and lime or other chemicals for purifying purposes. A slide, *k*, is regulated to supply from *j* the given quantity of chemicals required to purify the quantity of sewage water contained in *a* or *b*. An indicator, *l*, is for registering the number of gallons of sewage water that pass through the machine. The chemicals fall through the tube, *m*, among the grinding rollers, *n*, by which they are crushed. The rollers are pulled forward by a lever, *o*, and backward by the lever, *p*. A sewage pipe, *q*, conducts the foul water to the sluice valves, *r*. The water levers, *a* and *b*, turn on a fulcrum rod, *s*. At *t* is seen the sewage water falling into the water levers.

It will, no doubt, occur to some that as the sewage is purer at night than during the day, the addition of the purifying material during the former period is so much waste. So thought Mr. Hanson, and he has devised an automatic arrangement whereby, as the sewage becomes purer, so the supply of purifying material is cut off until it ceases entirely. As the sewage becomes gradually foul in the morning the supply of the chemicals commences and continues. The mixture of sewage and chemicals will be led from the water levers into a series of settling tanks.

Lutorcine.

This compound is described in a sealed paper which the authors deposited in 1875, and which has now been opened at their request. Lutorcine is obtained on treating monobromated paracresylol with potassa. It crystallizes in very small colorless needles arranged in hemispheric masses. It melts at 104° to 105°, and dissolves easily in water, alcohol, and ether, but less readily in benzol and chloroform. It differs from orcine by its crystallization, its melting point, and its colored reactions. In presence of alkalies, lutorcine, on exposure to the air, takes a blood-red tint; acids turn this color to a yellow, but alkalies restore it. Chloride of lime gives a very intense and stable blood-red; potassium permanganate colors it also a bright red. With ferric chloride it takes a deep dirty green, and gives a reddish brown precipitate which does not contain iron. If treated with ammonia in presence of air it is converted into lutorceine, which has a brownish-yellow color, and is turned by acids to a pure yellow. This lutorceine dyes yellow.—*G. Vogt and A. Henninger.*

ENGINEERING INVENTIONS.

Mr. Henry A. Sessions, of Palestine, Tex., has patented an improved hand car in which the arrangement of the cranks and levers is such that the maximum amount of the power exerted upon the levers by the operators will be applied to the propulsion of the car, in other words, the object is to overcome largely the loss of power incident, through indirect action of the levers and unnecessary friction, to the common construction of car.

Mr. Thomas C. Steward, of Chattanooga, Tenn., has patented an improved car coupling attachment which is simple, convenient, and permits of coupling cars by means of the ordinary link and draw-head without requiring the operator to enter between the cars and endanger his life. This invention is an improvement on the car coupling attachment for which Letters Patent No. 236,855 were issued to the same inventor on the 18th day of January, 1881, and it consists of a bar or lever provided with an adjustable handle and pivoted to a collar loosely mounted on oue end of a J-shaped bar attached to the end of the car, this bar being of such length that it can catch under the link of a draw-head and lift the link, so that it can enter the draw-head of the next car.

Mr. Henry Roth, of New York city, has patented a novel self-lubricating car axle box in which the concave or friction surface of the brass and the journal upon which the brass rests will be kept lubricated so long as there is any lubricant in the journal box. This end is accomplished by a peculiar arrangement of capillary conductors which constantly draw up and deliver to the journal the required amount of lubricant. The same inventor has patented a device for preventing the lubricant from escaping from the journal boxes, and preventing dust from entering them, also to facilitate the insertion of the lubricant.

The Organization and Expense of a Force to Lay One Mile of Track a Day.

BY W. M. JOHNSON, TEMPLE, BELL COUNTY, TEXAS.

As an example to some one who may wish to engage in track laying, where one mile a day is required, I will give the figures from actual experience now in use.

THE ORGANIZATION.

The tie wrestlers: 1 panel spacer, 1 tie surfacer, 2 tie liners, 3 unloaders, 6 tie spreaders—13 men and a water boy.

The iron gang: 1 gauger, 2 beelers, 2 unloaders, 6 iron men—11 men and a water boy.

The front gang: 1 tie spacer, 1 spike peddler, 2 nippers, 4 spikers, 5 strappers—13 men and a water boy.

The tie loaders: 16 men, in 4 gangs of 4 each, and a water boy.

The back spikers: 1 tie spacer, 2 spike peddlers, 4 nippers, 8 spikers—15 men and a water boy.

The lining gang: 5 men and a water boy.

The back fillers: 15 men and a water boy.

Besides the above there is a man on the tool car to take care of and repair the picks, shovels, mauls, etc.

Making a total of 89 men, 7 foremen, 8 water boys, and 18 teams, viz: 16 hauling ties, 1 pulling the iron car, and 1 hauling water to the boarding train.

At the teamsters' camp there is also a camp boss, who takes care of the forage, harness, etc., a blacksmith, and a night watch.

Also, there is a superintendent of track laying, a general manager for the contractors, a bookkeeper, and a night watch at the boarding train.

Expense each working day:

1 superintendent or manager			$5.00
1 bookkeeper			4.00
7 foremen,	@	$3.00	21.00
4 men,	@	2.25	9.00
24 men,	@	2.00	48.00
18 teamsters,	@	1.80	32.40
65 men,	@	1.50	97.50
8 water boys,	@	1.25	10.00
Feeding 40 mules			15.00
Fuel and wages on train			24.00
10 per cent for wear and tear			26.60
Total			$292.50

The 24 men at $2 each include the 11 iron men, 12 spikers, and the tool man.

The 4 men at $2.25 are the camp boss, the blacksmith, and the two night watches.

The teamsters get $30 per month and board.

The 7 foremen include the wagon master; and the 8 water boys include 1 for the teamsters; and supposing the amount paid by the men for board will balance the expense thereby incurred, no account is taken of the labor and store bill of the boarding train, but $3.50 per week per man will just *only* pay out.

WORKING THE ABOVE FORCE.

The panel spacer, with his 30 foot pole and pick, keeps far enough ahead to do duty as the road maker.

The 2 unloaders in the iron gang assist in loading the iron car, and while this is being laid they throw off from the flats another iron car load of 30 rails.

The front gangs of spikers (a pair on each rail) spike three ties in each panel, always the joint and the sixth and eleventh ties, skipping four ties each time.

Of the 5 strappers, 1 untrims the plates, leaving plates, nuts, and bolts on the joint tie, and the other 4, working 2 on a side, strap up and bolt the joints.

The tie loaders also unload the ties from the flats as fast as needed.

Should the back spikers get behind they are assisted by the front spikers whenever material runs short.

Should the back fillers get behind they can be re-enforced by the tie gangs, and the iron gang and strappers can put in the sidings.

The 16 teams have 14 loads of 12 ties each per day, making 2,688 ties.

THE MATERIAL TRAIN.

As the ties and steel are delivered to the track contractor at the last side track, and these are about 8 miles apart, the haul is never long to the front.

The train is made up of 10 cars of ties in the rear and 3 cars of steel in the front of the locomotive, or just enough material for a half-mile, and is at the boarding train at 6 o'clock A.M., in time to take the force to the front as soon as they breakfast.

The back fillers, liners, and back spikers are dropped where they stopped work, and the 10 cars of ties are left far enough back to give the train room to pull off the unloaded steel for the iron car to get at it.

The 10 cars of ties are moved up as fast as the track will allow, so as to make the haul as short as possible, and only enough are unloaded at each time to keep the wagons busy and prevent any delay.

At noon the train carries the force back to dinner, and the empty flats are side tracked, and another load of 10 cars of ties and 3 of steel brought up to the boarding train in time to take the men back after dinner.

The ties are loaded, generally, 135 to a car, or 20 cars to the mile; while the steel is loaded 60 bars to the car, or 6 cars to the mile.

In loading the iron car only 30 rails are put on each trip.

Only one train is used in this work; and where water may be scarce, a 100 barrel water car is added.

The hauling of all bridge, depot, tank, telegraph, and other material, is left to the trains that supply ties and steel to the contractor.

The track is not surfaced by this force; but enough material is put on the track to keep the ties squared and spaced.

The back spikers (2 gangs on a side) spike 6 ties each, instead of 3, as with the front spikers, and in this way seem to do double duty; but, as they are not detained by the movements of the train, or the iron car, they accomplish it.

A push car accompanies them to pick up all loose spikes, nuts, bolts, etc., thus requiring 2 spike peddlers.

As the front spikers spiked the first (joint), sixth, and eleventh tie in each rail, there are 12 ties left for the back spikers, the front pair spike the third, fifth, eighth, tenth, thirteenth, and fifteenth ties, leaving as many more for the other pair.

The teamsters' camp is moved up every Sunday to some suitable place about four miles beyond the end of a track.

The force as above organized can lay 1½ miles steel per day, but cannot keep up the back work and lay much over 1 mile.

GENERAL REMARKS.

We are laying 50-lb. steel rail, square and supported joints, fish plates, no nut locks, ties all full spiked, 15 to the 30 ft. rail, spaced 2 ft. centers, square to the track, laid to a line on the right hand side.—*Engineering News.*

McDermott's Pantaloons Protector.

We give an engraving of a novel pantaloons protector, which has been patented by Mr. Chas J. McDermott, of Sandy Hook, Conn. This invention consists of a spring provided with a rubber ball at its upper end, and attached to the heels of boots and shoes (especially rubbers and other overshoes) for holding up the bottoms of the wearer's pantaloons and protecting them from mud, etc. This simple device is entirely out of the way when not in use, and when in use the bottoms of the legs of the pantaloons are placed between the rubber ball and the shoe, holding them securely out of the mud, snow, or slush.

Stripping a Negative Film from the Plate.

Herren Meyer and Gaillard lately described to the Berlin Photo Association the following process, which they always found successful: The plate should have no substratum which makes the film adhere, therefore, above all, there should be no albumen substratum; it is rather necessary to prepare the plate so that the film shall sit loose to it. When plate glass is used, rubbing with talc is sufficient; with other sorts of glass a substratum of caoutchouc, prepared rather stronger than usually used for negatives, does good service. They expressly remarked that the widespread notion that substratum makes the film adhere more firmly to the plate was erroneous. The finished negative should not be gummed, and, of course, not varnished. When dry lay it down horizontally and pour over it the gelatine mixture hereafter described. Leave it to dry in some place free from draughts. Run a knife round the edges of the film, and, as a rule, it may then be drawn off flat. The gelatine mixture consists of one part of gelatine to ten parts of water. More gelatine may be used, but then the film must be poured thinner. In order that the gelatine may not become brittle (which would be apt to cause rents and cracks) add a little glycerine, but not too much, otherwise the film will be difficult to dry, and it will remain tacky for a long time after. Unfortunately the amount of the addition of glycerine to be added cannot be given precisely, as it varies with the state of the atmosphere, the brittleness, and the relative quantity of the gelatine. Herr Meyer found that when the air was extremely dry the plate must be taken into a damp place before stripping it off, as, in spite of a proportionately large quantity of glycerine, the film would still be brittle. Fifteen parts of gelatine to one hundred of dry gelatine was suggested as a medium amount.

Herr Fäbling gave the following formula for the gelatine: Gelatine, 10 grammes; water, 100 grammes; alcohol, 20 grammes; glycerine, 1·5 to 2 grammes; glacial acetic acid, 1 gramme.

Herr Gaillard mentioned another method which had been recommended to him, but which he had not yet tried: A smooth sheet of gelatine is laid damp upon the moistened plate; the squeegee is passed over, and when dry the negative is stripped off.

The Prickly Pear as an Antelope Fence.

The prickly pear, that ugly, fleshy little cactus, with its sudden summer glories of crimson and golden blossoms, fulfills a strange purpose in the animal economy of the prairies. In itself it appears to be one of the veriest outcasts among vegetables, execrated by man and refused as food by beast. Yet if it were not for this plant the herds of prairie antelope would have fared badly enough. For the antelope, whenever they found themselves in straits from wolves or from dogs, made straight for the prickly pear patches and belts, and there, standing right out on the barren, open plain, defied their swift but tender footed pursuers to come near them. For the small, thick pads of the cactus, though they lie so flat and insignificantly upon the ground, are studded with tufts of strong, fierce spines, and woe to the wolf or the dog that treads upon them. The antelope's hoofs, however, are proof against the spines, and one leap across the belt suffices to place the horned folk in safety. These patches and belts, then, so trivial to the eye and in some places almost invisible to the cursory glance, are in reality towers of refuge to the great edible division of the wild prairie nations, and as unpassable to the eaters as was that girdle of fire and steel which Von Moltke buckled so close round the city of the Napoleons.—*World.*

Action of Acid Solutions upon Stannous Oxide.

Stannous hydrate may lose its water and become transformed into crystals of the anhydrous oxide under circumstances which are complex and imperfectly known. The crystallization may occur either in acid or alkaline liquids. The author examines the first case in detail, and shows that with reference to oxide of tin the acids may be divided into two groups. Those of the one group give, with this oxide, salts which are entirely decomposed by boiling water, and determine its transformation into the crystalline oxide in consequence of successive reactions. These salts, decomposable by water, yield free acid, and behave absolutely like the acids themselves, determining the crystallization of stannous oxide. The acids of the second class do not give rise to these successive reactions, and the hydrated stannous oxide never becomes anhydrous and crystalline under their influence.—*A. Ditte.*

Improvement in Steel Manufacture.

A promising test was recently made of the Griffith low-pressure fixed vertical converter in the presence of a number of prominent English iron and tin-plate manufacturers. Blows were made with a maximum blast pillar of 4½ lb. per square inch, each blow taking an average of twenty minutes. The yields were good, and the steel produced of excellent quality, soft and ductile, suitable for merchant bars or tin plates. Some of the steel was worked and welded during the test. No spiegeleisen was used, the only addition being 1 per cent. of ferro-manganese. The advantages claimed for the process are its simplicity and small cost of plant, and that no skilled labor is required to work it. It can be worked by an ordinary blowing-engine giving a maximum blast pressure of 5 lb. per square inch. A 2-ton converter, working ten hours per day, will make 120 tons of soft steel per week; the cost of such converter, under favorable circumstances, being about $1,250, thus placing a steel-making plant in the hands of small manufacturers. These converters can be increased in size and worked in duplicate to any extent. An important point in this converter is that it can be worked with four or six tuyeres fixed horizontally. By a simple mechanical arrangement, a stopper or plug in each tuyere is actuated by steam or air, and shuts the tuyere at the proper time. There is also a slag hole, which runs the cinder off during the early stage of the blow, relieving the metal of some of its impurities, thus reducing the time in operation to a minimum. The dephosphorizing process may also be applied to this method, which the inventor thinks is likely to take the place of the more costly plants, and eventually do away with the wasteful and laborious puddling process.

Cable Connection with Germany.

The new cable connecting Emden with the Anglo-American cable system at Valentia, and completing direct cable connection between Germany and the United States, was inaugurated April 22. The first direct cable message transmitted from Germany to the United States was from the German Emperor to President Arthur, sending greetings and congratulations upon the completion of the work. President Arthur appropriately replied.

Fishing in a Cornfield.

In Colorado is a ten-acre field, which is no more nor less than a subterranean lake covered with soil about eighteen inches deep. On the soil is cultivated a field of corn, which produces thirty bushels to the acre. If any one will take the trouble to dig a hole to the depth of a spade-handle he will find it to fill with water, and by using a hook and line fish four or five inches long may be caught. The fish have neither scales nor eyes, and are perch-like in shape. The ground is a black marl in nature, and in all probability was at one time an open body of water, on which accumulated vegetable matter, which has been increased from time to time until now it has a crust sufficiently strong and rich to produce fine corn, although it has to be cultivated by hand, as it is not strong enough to bear the weight of a horse. While harvesting the hands catch great strings of fish by making a hole through the earth. A person rising on his heel and coming down suddenly can see the growing corn shake all around him. Any one having sufficient strength to drive a rail through the crust will find on releasing it that it will disappear altogether.—*Territorial Enterprise.*

FOURTH TIME AS MAYOR.—Mr. Daniel F. Beatty, the well known enterprising piano and organ maker of Washington, N. J., is now rejoicing in the just pride of his election as mayor of that city for the fourth time.

An Ancient Grecian Cuirass.

One of the most interesting specimens of archaic Greek art in existence has been brought to light by Mr. Stillman, and is now exciting the keenest interest in the archæological circles of Athens. This treasure is the back of an elaborately wrought bronze cuirass, and is thought to be at least as old as the sixth century before Christ. There are seven subjects engraved on it, which are thus described: The main subject, which occupies the lower part of the cuirass, consists of two groups of three figures each, each six inches high, and it has been diversely interpreted to represent either the reconciliation of Apollo and Hermes or a king consulting Apollo. On the one side is Apollo playing on the lyre, attended by Lato and Artemis, and on the other a royal or divine figure, followed by two attendants. The personages are dressed in the most elaborate costume, and every detail is rendered with finished skill, the patterns even of the stuffs of their various garments being delineated with the utmost precision. The subordinate personages are barefooted, but Apollo wears a pair of sandals, and the other principal figure high peaked boots, such as are worn to the present day by the Epirotes. Above this row of figures, running across the lower part of the cuirass, there is on each of the clavicles a bull, and above the bull a lion, each facing his counterpart on the other clavicle. Between them are two leopards, rampant, supporting each other, surmounted by two sphinxes, also rampant and in the same attitude. Each of these subjects is framed in rich ornamental borderings of different patterns, that which runs along the lower edge of the cuirass under the chief design being especially quaint and elaborate. This unique art treasure was found some twenty years ago in the Alpheus by a fisherman, who caught it in his net and sold it as old metal at a shop in Zante, where it lay buried among a mass of worthless lumber until Mr. Stillman's critical eye discerned its value and rescued it from oblivion. It has been placed in the museum at Athens. —*N. Y. Tribune.*

Digitated Stockings.

From time immemorial stockings with toes have been used occasionally, particularly in the treatment of certain foot troubles. Lately they have come into more general use, and not a little public discussion has arisen over the fashionable novelty. The London medical authority, *Lancet*, is strongly inclined to favor them as likely to conduce to comfort, and spare many persons who now suffer from the development of soft corns between the toes, a serious trouble. "They would also be more cleanly than the stockings in common use, because they would naturally absorb and remove the acrid moisture which accumulates between the toes, and which is the general cause of offensive odors from the feet. They will, moreover, give the foot better play, allowing its phalanges greater freedom of action. And, lastly, a well-fitted digitated sock or stocking will remove a mass of material from the toe of the boot, and, at the same time, secure increased breadth and space for expansion across the base of the toes. The new stockings, supposing them to be well cut and fitted, possess many advantages."

Even if the toed stocking should have no other effect than to expel the ugly and unphysiological "French-toed" boot, it would prove a public benefit.

How the Manufacturer Helps the Farmer.

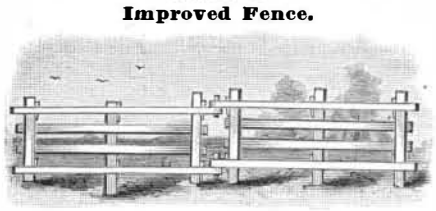
The national advantage of broadly diversified industries, and the local advantages to farmers and manufacturers arising from their close proximity, were set forth with rare directness and cogency by the Hon. Charles M. Shelley, of Alabama, in a recent speech in the House of Representatives, in the course of which he said:

A community which is blessed with these diversified industrial enterprises acquires wealth rapidly, and the temporary failure of one branch of industry does not bring that distress and suffering that comes from failure when you depend entirely upon a single industry, such as agriculture. The agriculturist who has a manufacturer for a neighbor is encouraged to grow every variety of crop that the soil is capable of producing. A market is found at his door for his product, and as these neighbors are multiplied the demand for his products is increased. This increased demand stimulates the price, which reacts upon the farmer, who improves and stimulates his land to increased production, and so on, each acting upon the other, until the highest productive capacity is reached in both agriculture and manufacturing. The farmer may have to pay higher prices for his goods, but he is able to do so because he sells his own products for higher prices and has more to sell. A large proportion of the products of the farm will not bear transportation to a distant market. These products, which in many instances could be grown without any additional cost to the farmer, would not be grown if they could not be sold at their doors.

To show the full force of this point I call attention to the condition of the farming class in Pennsylvania and contrast it with the farming class in Alabama. In Pennsylvania, where the manufacturing interests have reached a high degree of development, the farmers are thrifty and well-to-do. Every year they make a support and something over, which surplus is invested in the stocks of these manufacturing enterprises, from which they draw regular dividends, and thus become to a large extent the beneficiaries of this very system of protection which the free trader (assuming to speak for the farmer) denounces in such strong language. The profits of the factory added to the profits of the farm grow from year to year, until the poor farmer, whose pitiable condition is so pathetically portrayed by the anti-tariff politician, rejoices in the accumulation of a substantial fortune, and his little farm of twenty, forty, or one hundred acres becomes the source of a princely income. The lands upon which these fortunes are made are valued by their owners at an average price of about fifty dollars per acre.

These are the results upon communities who were prepared to avail themselves of the advantages of a protective tariff. Now turn to an agricultural country such as the southern and central portion of Alabama, and see the condition of things there. The farmers there devote most of their energies to the growth of cotton, because it bears the cost of transportation better than anything else they can raise, and if the season should happen to be unpropitious and the cotton crop fail, the whole people are reduced to a state of distress and poverty. A partial failure of the crop in Alabama last year has been most disastrous. Many farmers are not able to buy seed to plant their lands. The price of lands in Alabama averages about four dollars per acre. This condition of things would not exist if Alabama, like Pennsylvania, had a factory of some kind in every community.

Improved Fence.



The engraving shows a novel fence lately patented by Mr. Levi McNall, of Allegany, N. Y. It is an improvement in self-supporting wooden fences, and requires no posts set in the earth. The independent panels are connected so that they may be readily detached one from the other. Each panel is composed of three vertical parallel posts, two longitudinal rails, one at the top and the other at the bottom, and two boards attached to the posts between the rails.

The rails are made sufficiently thick to insure the strength and rigidity of the panels, and have three mortises for receiving the posts which are secured in the mortises by means of wedges. The panels are set zigzag, like a rail fence, and the ends are secured together by pins passing through holes in the projecting ends of the top and bottom rails of each panel. It will be seen that this fence is entirely self-supporting, and that the expense and trouble of digging post holes are entirely avoided.

Strikes.—Their Cause and Effect.

The labor disturbances which are rife in many sections of the country present a problem most difficult of solution, and one which bids fair to disturb the prosperity with which two seasons of activity in business, and a third in immediate prospect, had been viewed with promise and satisfaction by all classes. The labor disturbances in 1876–7 had for their basis exactly opposite causes from those which now prevail. Then all business was unsettled, and labor clamored for hire more than for increased compensation; the contest was more a battle of the outs who could not find work to do, than of the employed, who were in a measure compelled, through the influence of pernicious trade organizations, to side with the vast army of unemployed, which filled the country with restless tramps. The revival of business consequent upon the resumption of specie payment, gave employment to those who were suffering from enforced idleness, and, as if by magic, not only the army of tramps disappeared, but the content resulting from an ability to procure wages to keep one from starvation became the general rule.

In the strikes and disturbances of five years ago was found a most thorough confirmation of the truth of the old adage, "The devil finds some mischief still for idle hands to do." The labor disturbances of the present time arise from an exactly opposite cause, and yet, from causes which led to the state of things which precipitated the direful days of depression, and subsequent want of employment. Now, plenty of work is offered to the willing worker, and the compensation offered is such as would in days anterior to the war, and the speculative times which followed, have been considered munificent. Why, then, are they now looked upon as grinding and insufficient? Provisions and wearing apparel are in the main as cheap as they were when good mechanics were not only content, but found means for acquiring a competency upon much smaller wages than they can now command. But the war taught the use of luxuries to those who had hitherto been content with the necessaries of life, and the workers of to-day are largely the children of the period previous to the panic of 1873, and were then made accustomed to hearing higher wages and compensations spoken of as the normal condition and right of the toiler. The tastes then acquired still cling to them, and they cannot understand why the man who could then command $4 a day should now be compelled to do the same service for $2. The circumstances under which the higher compensation was paid, culminating, as they inevitably must, in disastrous panic and general distress, are forgotten, and are appreciated only by a small minority of such as were in the ranks of labor twenty years or more ago. But few of these latter will be found among the striking classes of to-day, for they remember that if the compensation was smaller, the cost of living was also much less, and that more money was saved against a rainy day by the laboring classes, as a rule, than was saved during the era of high wages and more than corresponding expenses.

One of the largest manufacturing houses of the Northwest bought, during the war period, a large tract of land convenient to its works, and, laying it out in lots of suitable size, encouraged its employes to become the owners of their own houses by paying a small amount each week from their wages, the employers assisting such as so desired, to erect a suitable cottage. Ten years later, and after the panic of 1873 had been most severely realized, the principal man of the firm asserted that in no instance had an employe whose compensation in the good times had been as much as $5 per day, paid for his place, while no man working at from $2 to $3 per day had failed to obtain his deed and become the rightful possessor of his home.

Here, then, is food for serious thought, and the only conclusion to be arrived at is that moderate wages induce economy, while high compensations induce extravagant tastes and expensive habits. It is not so much what a man earns as what he saves that counts for wealth and leads to prosperity. The strike among the mill and boom operatives at Muskegon has for its ostensible object a reduction in the hours of labor rather than in an increase in compensation, yet an analysis of the situation develops the fact that to cut down the hours of labor will, in a measure, deprive the mill owners and boom companies of the ability to pay the same rate of wages which they can now afford to pay for ten hours' work, or will so raise the cost of lumber to the consumer as to bring hardship and deprivation upon quite as many, and probably more, persons than would be benefited by the reduction. It is true that work about logs and lumber, whether in the woods, at the boom, or in the sawmill is extraordinarily laborious, and a man can readily tire his muscles with ten hours' work to a condition where rest is grateful. Yet the great masses of dwellers in cities are doing as hard, or more exacting, work for less compensation. There are to-day thousands of young men in Chicago wearing themselves out in clerkships, laboring from 7 o'clock in the morning until 6, or, in many cases, 10 o'clock at night, for scarcely more compensation than will, with economy, pay for their board and clothing, while their occupations are steadily undermining their health and unfitting them for the useful and successful futures toward which each one is looking with longing eyes.

There are thousands of young girls in this city who end up their day's work with an exhaustion the sturdy logger or mill hand never dreams of, and for a compensation of from 50 cents to $1 per day at that.

These must yield to the exactions of dress and appearance in order to gain even this miserable pittance. Thousands of working women are to be found not only in Chicago but in all other large cities, who esteem themselves fortunate if they can average $3 per week for the support of themselves and their little ones, while the exactions for rent and other needful expenses leave them but the plainest food, and the smallest quantity at that. The hard-working muscle of the logger and the mill hand may be tired at night, but not so tired as the hard-worked brain of his employer, who knows no limit of hours to his toil in keeping in motion those influences which enable him to keep his men employed. To the sober and steady toiler at muscular and out-of-door occupations, "tired nature's sweet restorer—balmy sleep," comes as a healing balm, and the morning finds him ready to exert himself anew, while his employer rises from a couch of restlessness, tired out before his work begins. Wealth has its disadvantages, and poverty has its compensations. Hard work and a good appetite are far more to be coveted than wealth and a big doctor's bill. Fair wages and a cheap market, enabling one to live and lay by even a few cents per day, are more desirable than high rates of compensation and a necessitated expenditure equaling if not exceeding the income.

When wages were $4 per day calico was from 15 to 20 cents per yard, and if the manufacturers of cotton goods were now to respond to the demands of their employes for increased wages, wage-workers, as well as capitalists all over the land, must be called to pay the increase through the additional price of cotton goods. If by cotton goods we were confined to the single item of prints, our assertion might well be received with a sneer, for the use of prints in this country has vastly decreased, and one of the prominent causes of labor commotion is found in the fact that plain clothes, be they never so neat and pretty, are no longer tolerated. But the same principle holds good, whether it be in cotton or silk manufacture, and it will invariably be found that if wages increase, the actual measure of accumulating wealth to the fairly prosperous is less in proportion than it is under a system of smaller compensation, with resultant necessitation of economy, while the poverty of the poor is more grinding.

While we sympathize with the man who has hard work to do, and can but acknowledge in the main the justice of his assertion that ten hours is long enough, we can sympathize yet more with the wife who can with truth assert and sing from her heart the refrain:

> "Man's work is from sun to sun,
> But woman's work is never done.'

Yet we cannot but assert, as the teaching of experience, that he is not the happiest who works the least, and were the woman to assert her rights to shorter hours of labor as does her husband, he would soon find cogent arguments to prove that, at least for the woman, long hours of labor could not be dispensed with in the workingman's home any more than upon the farm of the agriculturist. If then, as a thinking

man, each one of the strikers would become for the nonce a political economist, and, tracing cause and effect, give experience due credit in influencing his future course, strikes would be fewer and the employe would be surer of the steady wages which the prosperity of the employing classes would enable them to pay. As it is, a moment's reflection and a little figuring will enable him to come to the conclusion that if he gains his point, the value of the time lost, not to speak of the resultant demoralization to himself and family, will more than offset the advantages to be secured.—*N. W. Lumberman.*

IMPROVED BOILER AND FURNACE.

We give herewith an engraving of an improved steam boiler, patented by Mr. William Ord, of Brooklyn, Ohio. The body or main portion of this boiler is of the usual construction. The particular one illustrated is tubular, 12 feet long and 48 inches in diameter. The improvement consists in a water front of cast or malleable iron, which is fitted to the lower surface of the boiler and forms a support for its forward end. This water front is cast with integral stays at suitable intervals, and the inventor has taken great pains to avoid flat unsupported surfaces by making the water front externally convex between the stays and by providing strengthening ribs.

Two three-inch tubes enter the water front on each side of the door and enter the boiler at the rear end, one tube of each pair entering the boiler near the bottom of the water space, the other entering near the top. To guard against any possible injury by the unequal expansion of the tubes they are provided with swinging joints.

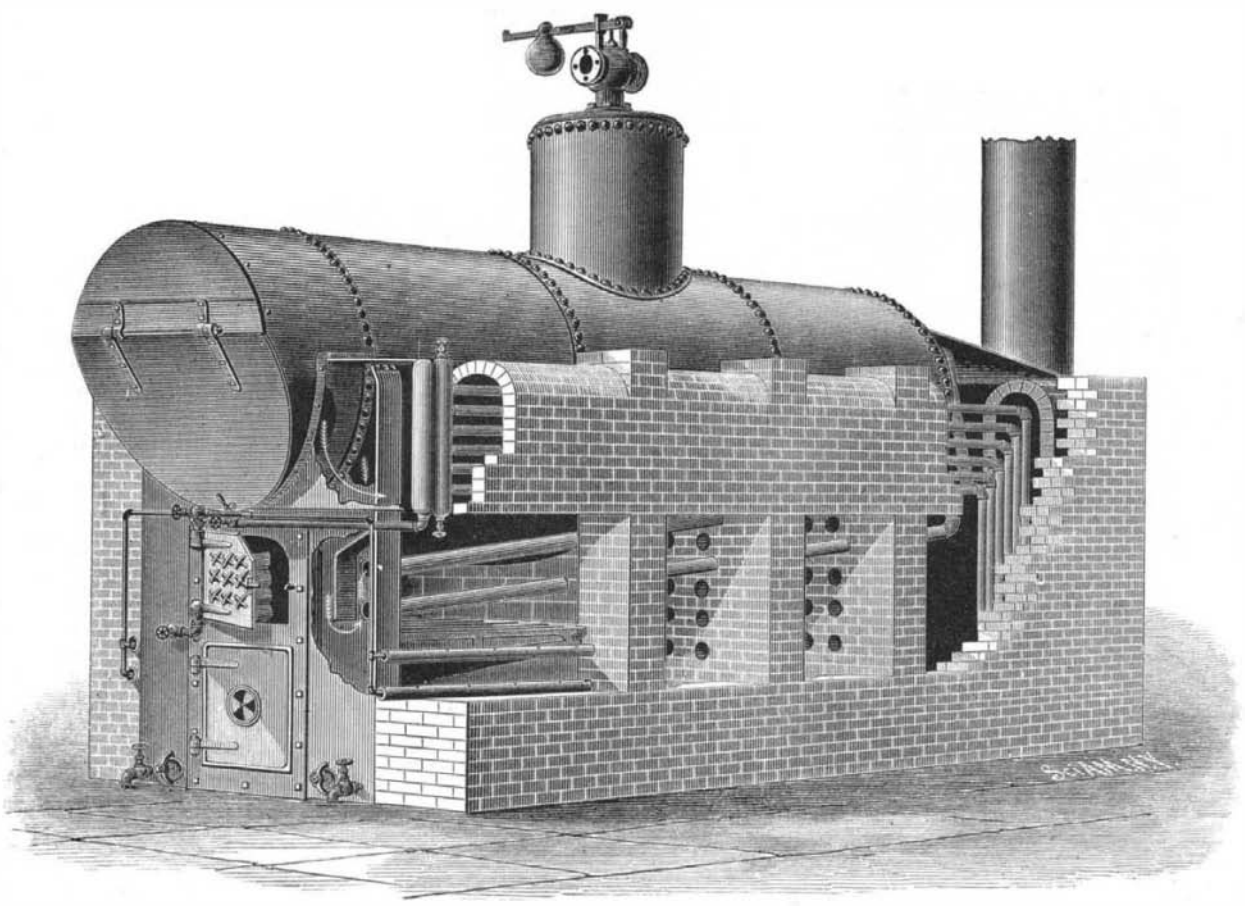
The water front is connected with the boiler directly as well as by means of the side tubes. The result of this construction is the deposit of all sediment in the lower part of the water front, where it is removed from the action of the fire. This relieves the boiler from deposits of sediment and improves its steaming qualities, besides greatly increasing its capacity without proportionally increasing the consumption of fuel.

The door of the furnace is chambered, and receives water through tubular hinges, adding still further to the capacity of the boiler and at the same time increasing the durability of the door.

The furnace between the grate and rear end is provided with a series of perforated walls, which are designed to retain heat and aid in the combustion of the gases that escape unconsumed from the fire. To facilitate this operation the inventor provides a series of hot-air pipes, and forces hot air into the furnace and between the heat-retaining walls. This results in a very perfect combustion and in the suppression of a great proportion of the waste due to the escape of unconsumed gases.

In a side flue, shown in the engraving, there is a feed water heater composed of a series of tubes connected by manifold and communicating with the feed pump and boiler. These tubes have a great capacity, and the water in passing slowly through them deposits much of its sedimentary matter. The heater is arranged with valves so that it may be employed whenever necessary. In the improved boiler the cost of the combined water front and mud drum is less than that of the usual cast iron front and mud drum. The heating surface is largely increased by the application of this improvement, and as the tendency of the water to lift is greatly decreased, the steam is furnished dry. These and other advantages will be acknowledged by steam engineers and others familiar with the requirements of a practical and economical boiler.

Further information may be obtained by addressing the Buckeye Bridge and Boiler Works, Cleveland, O., or the inventor as above.



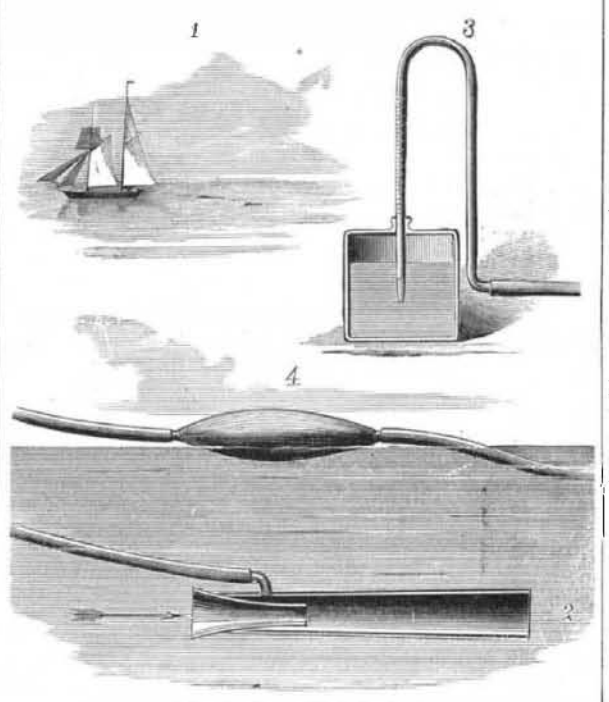
ORD'S IMPROVED BOILER AND FURNACE.

Cheap Oxygen.

Les Mondes states that the Boussingault process of obtaining oxygen by the alternate peroxidizing and reoxidizing of barium has been greatly improved in the hands of MM. Brin. Four hundred separate charges were taken off, yet failed in any way to deteriorate the mass. These manufacturers anticipate being able to supply the gas at about twelve to fifteen centimes per cubic meter. As this is something like ten or fifteen cubic feet for a cent, the realization of such anticipations would prove of the highest importance in the arts.

NOVEL SHIP'S LOG.

The engraving shows a novel device for readily and accurately determining the speed of a vessel moving through the water, regardless of the time, position of the vessel, or condition of the water. This is effected by means of a device for creating a vacuum in a pipe extending to such a distance from the vessel as to be outside of the body of water affected



IMPROVED SHIP'S LOG.

by the vessel's movements, yet communicating with an indicating device upon the vessel, so graduated as to show the extent of the vacuum, and consequently the speed at which the vessel is moving through the water.

The instrument consists essentially of a flexible pipe, an indicator or gauge upon the ship, with which one end of the pipe is connected, and a vacuum device of any suitable construction, connected to the opposite end of the pipe, towed after the ship, and constructed to permit the water to so flow past the end of the pipe as to create a partial vacuum in the latter.

Fig. 4 shows a tube open at both ends, the forward end being flaring, the better to catch the water as the tube is drawn forward. This tube is provided at the front end with a sleeve, forming a surrounding chamber, open at the rear end and communicating with a long flexible and non-extensible pipe, which at the opposite end communicates with a vacuum or other gauge, shown at Fig. 3, arranged in any desirable position upon the vessel. The flaring tube is so constructed and connected to the flexible pipe that the tube will be maintained in a substantially horizontal position, and floats are attached to it for this purpose.

As the tube is towed after the vessel and carried through the water the air or water is withdrawn from the flexible pipe to an extent proportioned to the speed of the vessel, thereby creating a partial vacuum in the pipe and in the gauge on the vessel, which indicates, by the position of the mercury or index finger of the gauge, the speed of the vessel. This invention was recently patented by Mr. William S. Hogg, of Washington, D. C.

The St. Gothard Parasite in India.

Professor J. F. P. McConnell announces that he has discovered in Calcutta the parasite *Dochmius duodenalis*, which caused so much trouble among the workmen of the St. Gothard Tunnel. Professor McConnell states that the worm is by no means confined to the upper division of the small intestines; on the contrary, the majority of the specimens were removed from the mucous membrane of the jejunum. They were firmly fixed to the gut. As Professor McConnell found the parasites in a large number of post-mortems, in cases where the victims, who are natives, died of many different diseases, he does not feel justified in stating that they were the sole cause of death in any case. In many patients he admits that anæmia was the prevailing feature, but attributes this rather to dysenteric and malarial complications.

Railway Progress in the Southwest.

The president of the Atlantic and Pacific Railway Company, Mr. H. C. Nutt, has lately returned from an inspection of the line in New Mexico and Arizona, and of the Atchison, Topeka, and Santa Fé Railroad. Mr. Nutt said (April 21) that the track laying had been completed to Cañon Diablo, 311 miles west of the Rio Grande. A viaduct is being built over the cañon 525 feet long and 254 feet high, to be completed by May 25, at a cost of $250,000. The track will be pushed west to the Colorado River, 250 miles, at the rate of two miles a day. One hundred miles of that distance is graded, and steel rails for 200 miles are delivered. Plans are just completed for a bridge across the Colorado River, to cost $250,000. He will also extend the Central Division 100 miles west from Vinita, Indian Territory.

NEW INVENTIONS.

An improved cyclometer has been patented by Mr. John J. Morton, of Albion, Mich. The object of this invention is to apply odometers to bicycles in an inexpensive and convenient manner, and so as to secure accuracy of operation without liability of derangement. Heretofore odometers have been applied to the axles of bicycles; but, the space being limited, it has been necessary to remove the lamp to make room. Further, the application has not been such as to secure accuracy nor render the instrument convenient for observation. This invention consists in an odometer suspended face upward by means of a weight or by the lamp, so that it can be freely observed by the rider.

Mr. Edmund T. Spottswood, of Perrysville, Ind., has patented a revolving sickle bar for mowing and reaping machines, the particular form, construction, and arrangement being such, relative to each other and to the fixed cutting edges, that the spiral edges, as the sickle bar revolves, travel across the fixed cutting edges continuously or in such rapid succession as to cause all the grain to be cut as effectually as with the ordinary reciprocating section bar or sickle.

Mr. Jared R. Woodfill, of Aurora, Mo., has patented certain improvements upon that form of repeating instrument in which the instrument for each line has a magnet with independent helices about the same core, one of which helices in each instrument is charged by their respective main line circuits, and the other of which helices is charged by a local battery current, and in which each instrument is provided with two sets of contacts controlled by the armature lever of that instrument, one of which set of contacts in the first instrument controls the second main circuit in the other instrument, and the other of which set of contacts in the first instrument controls the local battery in the second instrument, and in which the two sets of contacts of the second instrument act reciprocally to the first in the same way to produce the same result.

CAPT. LAMB, of the bark Elizabeth Ostle, from Calcutta, March 23, saw, the day before, in latitude 39° 30', another immense field of dead fish. For a distance of forty miles the dead fish were seen floating about. They appeared to be quite fresh, and looked like shad. Another ship, from Rio Janeiro, passed through a great multitude of dead fish, the same day, about sixty miles from Barnegat.