MARENGO CAVERN.

BY H. C. HOVEY.

During a geological excursion through Southern Indiana, undertaken about thirty years ago, my attention was called to the remarkable springs flowing out of cavernous openings in the village of Springtown, now known as Marengo. We explored the largest of these grottoes for perhaps three-quarters of a mile, following the margin of an underground stream. The entrance was wide and symmetrical, and the walls were gradually contracted so as to form a tubular passage way, by means of which powerful sonorous effects were produced, resembling those for which Echo River in Mammoth Cave is famous. There were a good many fish in the stream, but all of them seemed to be visitors from surface waters. This cave contained many interesting objects, especially several large stalagmitic columns. The temperature was uniformly 52° F.; and the atmosphere, like that of many other Indiana caves, possesses antiseptic properties, of which the villagers take advantage, using the place as a general storehouse for fruit, vegetables, and other provisions liable to decay.

The geological formation of the region is favorable to caves, heavy beds of St. Louis limestone being overlaid by Chester sandstone. Here and there the surface rocks have broken down, forming sink holes varying in size, and supposed to communicate with subterranean passages. Pankey Cave and several other small excavations have long been known in the vicinity, and along the banks of a little stream known as Whiskey Run, a tributary of Great Blue River. Wyandot Cave, frequently described, and probably next in size to Mammoth Cave, is located about eleven miles south of Marengo, and in the same geological formation. Both are in Crawford County, celebrated for its cavernous rocks.

On the 9th of September, 1883, five young men, while rambling over the grounds of Mr. Samuel Stewart, near Marengo, discovered a crevice at the bottom of a large sink hole, and resolved to explore. The first to enter the orifice opened were Messrs. Charles Jones and Sherman Stewart. Finding that the passage widened into a vast subterranean chamber, they returned for their comrades, and, having provided themselves with lights, renewed their explorations. The reports of their discovery were so strange as to be almost incredible. On the 12th of September Mr. Applegate, of New Albany, from which Marengo is about thirty miles distant, made a careful examination of the newly found cave, and published an account in the *Daily Ledger* of that city. Dr. E. S. Crosier, of the U. S. Surveyor's office, Louisville, Ky., writes to me that Marengo Cave is magnificent, and no "Mulhattan affair," alluding to several notorious hoaxes for which a person of that name is held responsible. The description thus far furnished shows the cave to resemble closely other great caves of the region. There are large halls embellished by stalactites, frost work, drapery, and various formations fantastic or grotesque. There are lateral branches from the main cave, leading to pits and domes. There are gypsum rosettes, alabaster columns, limpid pools, sparkling incrustations, resonant pendants, and other subterranean wonders.

No map has yet been made, but the trend of the excavation is said to be southward, showing an axis of erosion parallel with that of Wyandot Cave. The portion explored is estimated to exceed two miles in length. The more interesting localities have been named Arthur Avenue, Ledger Hall, Statue Hall, Stewart's Grotto, Diamond Dome, Organ Hall, etc. The suggestion may not be out of place that these appellations should be regarded as provisional until the entire cavern shall have been explored; then let some individual of good taste and judgment, like Dr. Crosier for instance, be authorized to revise the list and substitute an agreeable and sensible nomenclature for the meaningless medley so frequently fastened upon some of Nature's most marvelous works.

PETROLEUM FOR HEAT.

To the Editor of the Scientific American:

In your SUPPLEMENT of September 22 is an article on "Liquid Fuel as Used in Russia." The details there given seem to show that the Russians are a little in advance of us. They have made some progress, though it is not very decided, nor is it fully successful, toward the use of petroleum for heat. Let us see what we need to accomplish, and what difficulties stand in our way, and then we will look at what the Russians have already done.

All our theories of combustion, and of course of the heat derived from combustion, depend on the use of carbon in combination with hydrogen. And inasmuch as the mineral coals, soft and hard, give us a hydrocarbon in most convenient form, and at a cheap rate as well as in overwhelming abundance, we have dropped into the habit of basing all our calculations in that way, and the engine is reckoned the highest, theoretically, which can give the greatest available return of work from a pound of coal.

Now, all this is very well if we can do no better, but we may be justified, perhaps, in inquiring whether it is necessarily true that we must be thus restricted. Every coal is a hydrocarbon, but it is something more; it contains a large amount of material which is of no value, and which, after combustion, we call ashes, clinkers, etc. Every ton of coal which we buy gives us several hundredweight which we do not want. We pay for mining waste material, for hauling it many hundreds and perhaps many thousands of miles, for handling it over and over again, and then at last for *throwing it away*. Surely this does not seem like good common sense, that is, unless it is Hobson's choice with us. And as we have in great abundance another hydrocarbon which *prima facie* promises well, let us spare no efforts to learn how we may use it.

Petroleum is chemically most closely allied to the soft coals, but, unlike them, it is free from foreign matter. It is a hydrocarbon through and through; when we set it on fire, we can *burn it all;* there is nothing to throw away. It takes fire readily, burns freely, giving out a great amount of heat, and when under proper restraint is extinguished at once, economizing fuel greatly at the commencement and at the close. Its fluid form makes its transportation easy and cheap, and it can be obtained in quantities that are apparently inexhaustible.

And still, with all these advantages, it has never yet become a common fuel. We have grown so thoroughly accustomed to the use of kerosene, and so dependent on it for the light and comfort of our dwellings, that we should regard its loss as a calamity too great to be expressed in words. The term Petroleum for Light conveys our main idea of the essential value of rock oil. But why should it not read for us as well, Petroleum for Heat? Theoretically the difficulties in the way of such a result do not seem to be so great as those which have been overcome in giving us kerosene.

The difficulties lie directly in the line of its excellent qualities and spring from them. They are caused by the ease, and rapidity, and perfection with which petroleum burns. Open masses of it readily take fire, and the fierceness and extent of the conflagrations in the oil regions, and at the centers of refining, are too well known to need comment; they have been really terrific.

And with this comes another evil. Whoever has witnessed a large petroleum fire must have been much impressed with the vast and dense clouds of black smoke which poured up into the air, and often masked every object to leeward for miles in extent. The volatile nature of the fluid allows a very great amount of its carbon to be driven off before it reaches a sufficient degree of heat for combustion. This dense and offensive smoke is not only a great waste of material, but it is also such a nuisance to the senses that petroleum can never become a fuel for common use until the nuisance is abated.

Here, then, are the two lines in which invention must run; combustion must be restrained and, at the same time, it must be increased, paradoxical as this sounds. It must be restrained by feeding the petroleum to the scene of combustion at precisely the required speed; speed enough to give the bulk of flame demanded for the service, and yet not enough to prevent complete and perfect combustion. And it must be promoted by giving a supply of oxygen, that is, of air, to unite with all the carbon. This last would seem easily done, for we can force in a blast of any power asked for, but this sending in a current of air brings with it an evil which is manifestly difficult of removal; it drives off mechanically the carbon before combustion can be effected, as we will presently see.

With these, however, as the two objective points to be reached, it surely does not seem unreasonable to expect a successful result. And the degree of advance which the Russians have already secured, gives ground for encouragement. They have by no means solved the problem, but their work is full of instruction. All their efforts have been in one direction; it does not appear certain that direction is the wisest and best. At all events, it is allowable to look for a better.

Several forms of apparatus are described and figured in your paper, but they embody this one idea—they *atomize* the combustible by driving it into spray, through the agency of a jet of steam, air being combined with it. This is their *modus operandi* in each of the different forms.

Their results, as reported, condensed, are these: The heat produced is intense, so intense that from its unequal action it "destroys the tube sheet, starts the tube ends, and does not heat the firebox equally all over." At the same time there is a "great accumulation of soot" from incomplete combustion, and they are "uneconomical of fuel." This is the report of use on locomotives of three railways, but it is stated that the methods work more satisfactorily on board ship and on stationary engines.

All these forms of apparatus are planned for burning the "naphtha refuse" remaining from the Baku petroleum after the kerosene is distilled. Baku affords a petroleum decidedly different from our Pennsylvania oil, and what we propose is to burn the crude petroleum as it flows from the wells. Still the two fluids are so far similar that probably the difficulties in regard to the combustion of the one will not vary greatly from those affecting the other. It is therefore reasonable to infer that the Russian failures of success may show us what we need to avoid. And it is perhaps fair to think, though with some degree of uncertainty, that the powerful draught is to be avoided, and possibly the atomizing.

A correctly graduated supply of oil, and a free influx of air which shall utilize the oil fully without waste—these seem to be the two points. And we will interpolate here a statement of what we have seen done, and perhaps some one who has the divine afflatus in the way of invention may take from it a hint. The material burned was common crude petroleum, and the quantity burned was sufficient to heat thoroughly a kitchen range of good size, and to cook with it as fully and as well as could be done with a good coal fire.

The apparatus, very simple, is this: Across the whole length of the range grate runs an iron tube of suitable size, pierced with multitudes of very fine holes. This tube revolves steadily by the agency of a coiled spring or any other device. One end of this tube is closed and turns in an ordinary box or bearing; the other end, which is open, penetrates a small cistern or box, the side of which makes its bearing with a suitable stuffing box. From this cistern a pipe leads to a reservoir of petroleum placed at a proper elevation. A stop cock regulates the supply of oil, and it is forced out through the minute holes by gravitation only. This is the only atomizing, and it is certainly effective, for we have seen it in operation. On turning the stop cock and applying a match the tube is instantly a mass of flame, and by properly regulating the pressure the oil is consumed without any dropping. A very few minutes, however, would clog it badly, were it not for the revolution, for at one side a scraper or knife is fixed so as to clean the entire length of the tube as it revolves against it. Nothing remains on the tube, and that which is continuously scraped away is at once burned.

To accomplish this combustion air is admitted freely at as many points as possible, but no forced draught; only the draught which a good chimney produces. This has been found so far effectual that the accumulation of soot has been very small, as well as the escape of smoke.

We do not by any means assert that this plan can be made effectual in using petroleum on a large scale, but the idea is well worth studying. It certainly seems to promise fully as well as atomizing and powerful draught.

Now let us turn to the question of cost, for on this everything depends. In your paper of September 29, you publish an article on "Petroleum as Fuel," in which the writer proves to his own entire satisfaction, that its cost is so much greater than that of coal that it can never come into active service. He says that crude petroleum "is not fit to be used as a fuel without distillation," and then quite remarkably states a few lines further along, "there is no difficulty in burning mineral oils, notwithstanding what may be said to the contrary by anxious inventors." Perhaps he will show us how it is to be done, for the plain fact remains that up to the present time no one has practically succeeded in the attempt. Of course the oil will burn; but if it does it wastefully, as, for instance, in the experiments of the French Academy, where they give as their result an evaporation of eleven pounds of water only to the pound of fuel, it is certain that economy will be against its use.

This writer, after going through his figures, carefully arrives at the conclusion that the relative efficiency of coal to petroleum as an agent for the production of heat is as 1 to 2, and from this estimates their relative expense in service. He counts his coal at 15 shillings (sterling) per ton, and his petroleum at sixpence per gallon, and thus "makes the actual cost of evaporating a given quantity of water with petroleum to be 4·63 times as much as it is with coal."

His figures are doubtless accurate, but it must be remembered that they pertain to England and not to this country, to London and not to New York. We will turn to the slate and figure for ourselves. Our coal will cost us at least a dollar a ton more, and our oil very much less than his estimates give. Expressed in fraction of a dollar, a pound of coal on his basis costs 0·001875, while a pound of petroleum costs 0·015, whereas in New York, at average prices, a pound of coal costs 0·0025, and a pound of petroleum costs 0·0?375. Taking now his estimate, which from all trustworthy data appears to be a fair one, that one pound of petroleum is equal in efficiency to two pounds of coal, $3.75 expended for petroleum will have evaporated as much water as $5.00 expended for coal at New York prices.

In making this calculation we have counted coal at $4.75 per ton, and petroleum at $1.25 per barrel. It is plain, therefore, that we can allow a decided increase from any price that petroleum has borne for some time past, and yet find that it ought to be, in New York, a more economical fuel to use than coal.

But one thing more is to be said: there is so much coal consumed in starting a fire, and in its continuance after the need for its service is ended, that petroleum would have an actual advantage in cost, even if its rate per hour were the greater of the two; and when to this we add the economy in point of labor, the expense of firemen, etc., we are certainly entitled to ask whether there is not good reason for studying "Petroleum for Heat."

W. O. A.

Memory.

A man's memory is like his stomach. To do its best work it must have good treatment. It must neither be neglected nor overloaded. It can easily be so abused by neglect, or by irregular and unsystematic employment, as to become chiefly a cause of annoyance and discomfort; or, again, it can be so overworked and heavily taxed that it becomes practically the chief organ or agent of the entire system; every other portion dwindling in its comparison. The latter course is the great danger of those who value the help of a tenacious memory.

Both memory and stomach are valuable, not in proportion to the burdens they can carry, but in proportion to their training for their part in the work of the system as a whole; and either of them is made effective as much by what is kept from it, as by what is packed into it.—*S. S. Times.*

How to Cleanse the Waste Pipes.

One of the most frequent and trying annoyances of house-keeping, as many can testify, and which a writer in the Philadelphia *Ledger* freely asserts, is the obstruction to the free, quick outlet of the waste water of the washstand, the bathtub, and the kitchen sink.

This is caused by a gradual accumulation of small bits of refuse material, paper, rags, meat, bones, or other offal, which check and finally entirely stop the outflow of the waste water, and then the plumber is called to remove the stoppage with his force pump.

Sometimes this is effective, at others the offending waste pipe is cut out, and a new one put in its place at considerable cost.

But the plumber is not always near at hand or free to come at one's call, and the matter demands immediate attention. A simple, inexpensive method of clearing the pipe is as follows: Just before retiring at night pour into the pipe enough *liquid* potash lye of 36° strength to fill the "trap," as it is called, or bent portion of the pipe just below the outlet. About a pint will suffice for a washstand, or a quart for a bathtub or kitchen sink. *Be sure that no water runs into it till next morning.*

During the night the lye will convert all of the offal in the pipe into *soft soap*, and the first current of water in the morning will remove it entirely, and leave the pipe as clean as new. The writer has never had occasion, in over thirty years' experience, to make more than two applications of it in any one case.

A remarkable example of the value of this process was that of a large drain pipe which carried off the waste of an extensive country house, near Philadelphia, and ran under a beautiful lawn in its front. A gallon of the lye removed all obstruction in a single night, and saved the necessity of digging up the pipe and disfiguring the greensward of the lawn, as the plumber intended, until advised of this process.

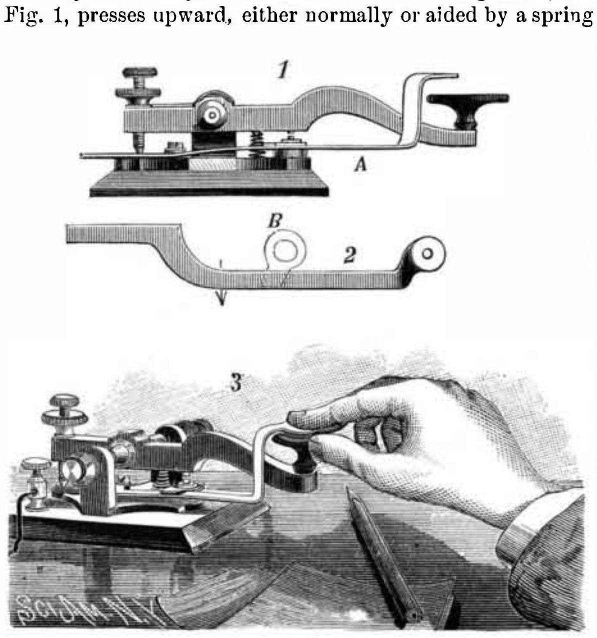
The so-called potash lye sold in small tin cans in the shops is not recommended for this purpose; it is quite commonly misnamed, and is called caustic *soda*, which makes a *hard* soap. The lye should be kept in heavy glass bottles or demijohns, covered with wicker work, and plainly labeled; always under lock when not in actual use. It does not act upon metals, and so does not corrode the pipes as do strong acids.

Typhoid Fever in New York.

The death rate in this city so far this year has been unusually low, and the prospects are that the record for the year will correspond. The greatest danger is from the increasing prevalence of typhoid fever. The impression that the fever infection results only from contamination by ingestion is gradually giving place to the belief that a lodgment may also be effected in the air passages. In conjunction with the Board of Health, physicians can do much toward stopping the advance of the disease by enforcing the immediate disinfection of typhoid fever excreta. The Board has issued circulars giving directions for the best means of accomplishing this object.

AUTOMATIC CIRCUIT CLOSER.

This simple device is designed to automatically close the circuit of telegraph keys, and may be applied to either old or new keys or to keys of various sizes. A spring lever, A, Fig. 1, presses upward, either normally or aided by a spring

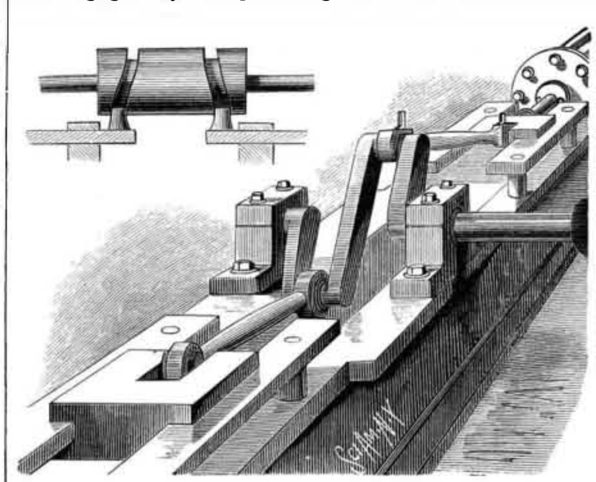


AUTOMATIC CIRCUIT CLOSER.

placed beneath it, against a projection, B, from the side of the key. Fig. 2 is a plan view of the lever and projection. One end of this lever is so bent that its extremity rests about three-eighths of an inch above the finger button of the key. The rear end of the lever is secured to the frame by a screw. When operating, the forefinger is placed on the end of the lever, A, which is pressed down until it rests on the button of the key, which is grasped by the thumb and middle finger. When the lever is released, it presses against the projection and automatically closes the circuit. The device is very convenient, as the operator need not take the trouble to close the circuit every time he stops telegraphing, as it can never be left open. This invention has been patented by Mr. Samuel J. Spurgeon, of Liberty, Missouri.

COUNTERBALANCE.

The counterbalance herewith illustrated can be applied to all kinds of machines having a reciprocating motion, such as saw mills, gig saws, steam engines, grain separators, mowing machines, etc. It consists in the use of a weight connected with the crank or other moving part so that the weight of the parts is counterbalanced and an even and steady motion produced, permitting the machinery to run at a high rate of speed. The counterbalance can be placed upon the same side of the shaft as the cross head or upon the other side, as shown in the engraving, when it runs upon its own slides. When applied to a cam, the cam is made double, or with two grooves inclined in opposite directions and engaged by reciprocating bars that counterbalance



ELWELL'S COUNTERBALANCE.

each other upon the cam, as shown by the small engraving. The principle is applicable to motions obtained by other devices than the crank or cam.

This invention has been patented by Mr. Orlando Elwell, of Van Ettenville, New York.

Biography of a Mosquito.

If the mosquito were a very rare insect, found only in some far off country, we should look upon it as one of the most curious of living creatures, and read its history with wonder—that an animal could live two such very different lives, one in the water and the other in the air. We speak of the mosquito as if there were but one, while really there are over thirty different kinds, all, however, having similar habits, so that a description of one answers for all. The female mosquito lays her eggs on the water. She forms a little boat, gluing the eggs together side by side, until she has from 250 to 350 thus fastened together. The boat or raft is oval in shape, highest at the ends, and floats away merrily for a few days. The eggs then hatch and the young mosquito enters the water where the early part of its life is to be passed. You can find the young insects in this, their larval stage, in pools of fresh water, or even in a tub of rain water which has been standing uncovered for a few days. They are called wrigglers, on account of the droll way in which they jerk about the water. They feed upon very minute creatures, and also upon decaying vegetable matter. Near the tail the wriggler has a tube through which it breathes. If you approach the pool or tub very quietly, you can see them in great numbers, heads downward, with their breathing tube above the surface. If you make the least disturbance, they will scamper down into deep water. After wriggling about for two weeks, and changing their skins sevreal times, the larva becomes a pupa.

You know that most insects in the pupa state do not move, but take a sleep of greater or less length. Not so the lively little mosquito. In its pupa state it becomes a big headed creature which does not eat. It moves about quite rapidly, but not with the same wriggling motion; it now has a pair of paddles at its tail end, and takes in air through tubes near the head. In five or ten days the mosquito ends its life in the water, and becomes a winged insect. The pupa comes to the surface, and the skin cracks open on the back, allowing first its head and chest to come forth, finally the legs, wings, and rest. This is a most trying moment in the life of the insect; if a slight puff of wind should upset it before the wings are dry, it will surely drown; only a small proportion of the whole number succeed in safely leaving the pupa case; the greater share become food for the fishes. If the wings once get fairly dry, then the insect can sail away, humming its tiny song of gladness. How does it sing? Perhaps when you heard its note at night you did not stop to consider. It is a point which has puzzled many naturalists, and it is not certainly known how the note is produced, but probably the rapid motion of the wings and the vibration of the muscles of the chest are both concerned in it. The most interesting part about the insect—the "business part," as some one has called it—is its sting, or sucker. This is not a simple, sharp pointed tube, but consists of six parts, which lie together in a sheath, and are used as one. How sharp these must be to go through our skin so easily! After the puncture is made, it then acts as a sucker to draw up the blood. The insect which visits us is the female. We rarely see the male mosquito. Blood is not necessary to the existence of the mosquito, and probably but a small share of them ever taste it. The countries in which mosquitoes live in greatest numbers—actual clouds—are not inhabited, and there are but few animals.—*Donahoe's Magazine.*

Glycerine as a Preventive of Crystallization in Strained Honey.

Having for several years had considerable trouble and loss in keeping pure strained honey, on account of its tendency, in a short time (particularly in warm weather), to crystallize, I have been ready for any remedy that was feasible. One lot that I purchased in the comb and strained myself soon became almost worthless from this cause. Some two months ago I had a small lot that I found crystallized when wanted for use, although I had taken the precaution to cork tightly and put in a cool place in the cellar. It occurred to me to see what would be the result from melting and adding a small amount of glycerine. Placing the bottle in a water bath, I soon had it melted and added one ounce of glycerine to about one and one-half pounds of the honey, setting aside to cool. It has shown no sign of recrystallization as yet, and I am just using the last of it. I can see no objection to this on the score of adulteration or any harm from its use. In making simple sirup I have occasionally found it crystallized in the bottom of the bottle, causing some trouble to remove, and several times have found some chemical change, which has caused an unpleasant odor, which I have not at all times been able to obviate, although using distilled water and the purest sugar obtainable. Have not as yet had an opportunity of trying the effect of glycerine, but think it might prove beneficial and in no way objectionable. Have been accustomed to add a small amount to my beef, iron, and wine for a long time, and find it prevents souring and, in a large measure, precipitation.—*J. W. Colcord, Amer. Pharm. Assoc.*

Novel Rheostat.

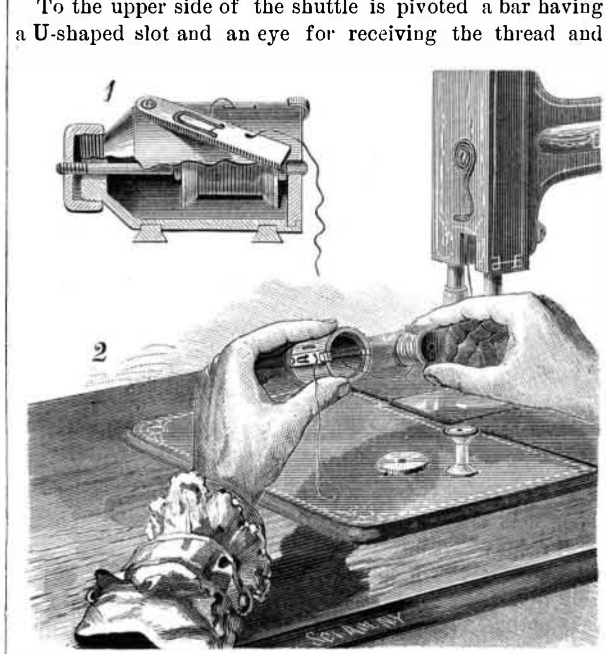
A very useful rheostat has been devised by M. Trouvé, the well known Parisian inventor. It consists of a German silver spring inclosed in a nickel plated tube, the spirals not being allowed to touch each other, and insulated from the tube by a pasteboard sheathing. Inside the spring is a rubbing contact formed of a metal rod split into four parts, like the split plugs of a resistance box. This rod is graduated in divisions. The current enters at one end of the spring, traverses it, the rubbing contact, and the graduated rod. When the rod is deeply inserted into the spiral coil, the current only traverses a few turns, and the resistance in circuit is very small; but when the rod is pulled out, the number of turns inserted is considerable.

The divisions on the scale tell the number of turns in circuit. The device is employed by Trouvé in connection with his polyscopes to regulate the strength of current supplied by a small Plante accumulator.

NOVEL SEWING MACHINE SHUTTLE.

The improved shuttle shown in the engraving is made so that it can hold any ordinary spool of thread or silk, and thus avoid the trouble of rewinding, and save the expense of a number of bobbins. The shuttle is a hollow cylinder tapered at one end and fitted with a screw cap which receives the spindle upon which the spool is loosely mounted. This spindle extends through the opposite end of the shuttle and is provided with washers to hold the spool in place. The plate forming the larger end of the shuttle is retained in place by a spring.

To the upper side of the shuttle is pivoted a bar having a U-shaped slot and an eye for receiving the thread and



IMPROVED SEWING MACHINE SHUTTLE.

giving it a certain amount of tension, and the shuttle is slotted for the passage of the thread, which passes thence to the U-shaped slot and the eye in the bar. The bar is held in working position by a spring catch. The spool is removed from and replaced upon the spindle after taking out the larger end of the shuttle. When it is necessary to remove the spindle, it can be done by unscrewing the cap on the conical end of the shuttle.

Fig. 1 shows the shuttle with a part broken away to exhibit the internal arrangement. Fig. 2 shows the method of removing and replacing the spool.

This invention has been patented by Mrs. E. Chavers, of Seddon, Mich., who may be addressed for further information.