fects in the manufacture; 2. Improper mechanical or chemical composition; and 3. Physical changes.

A very large number of rails are annually made which should never be put in any track. Their defects are often imperceptible to the naked eye, but they very soon begin to break. Statistics show that the breakage from defects in making increase until they have been used 18 months; then it decreases to zero, and after that rails break from different causes. In France, breakage usually begins in December, reaches its maximum in January, and becomes normal in April. As a more intense cold would be necessary to explain such breakage than that which is felt in that climate, the cause must be sought in the stiffness and inelasticity of the frozen road bed. The impact of the locomotive is then apt to break the rail, very much on the same principle that is taken advantage of in breaking them up for the manufacture of smaller objects. A nick is made somewhere, and the workman then strikes a blow with a hammer at a point between the nick and the place where the rail is supported. This will sever the rail at the nicked place. Sometimes more than a second intervenes between the blow and the fracture. Now, whenever holes are punched in rails for the fish plates, flaws are apt to radiate from them; and if these flaws are not planed or filed out, they may cause the rail to break, just as the nicks above mentioned. Such rails have been known to last no longer than 18 months, and some have actually broken on the way from the manufacturer to their destination. There are establishments in this country and in Europe where they "doctor" such rails by filling up the flaws with a mixture of iron filings, sal ammoniac, and some adhesive substance. Beware of them; a poor cheap rail is dear at any price. The French government stipulates in its contracts for rails, that flaws shall be planed, drilled, or filed out; that the rails shall not be allowed to drop on the ground, but shall be carried by men and slid down. The Lyons railroad does not pay for its rails until 15,000 trains have passed over them.

By imperfect mechanical composition is meant imperfect union of the parts of rails. Steel heads are welded to the rest of the rail in a variety of ways, and this welding is necessarily imperfect. A number of sections of rails etched with acid plainly showed this want of homogeneity, as did likewise prints taken from the etched surfaces. Before such rails have lost weight appreciably, they are used up by the constant rolling they undergo. The advantage of a steel rail is its homogeneity, but a good iron rail, such as those made under the direction of the speaker, for the Reading Railroad Company, is likely to prove better than one of poor steel. The life of a steel rail is chiefly affected by the temperature at which it is rolled and annealed. It ought not to wear off more than 1 mm. for 20,000,000 tons of traffic, and is usually calculated to wear 10 mm. before it is taken up. In other words, it would last about 20 years on roads doing as much business as the New York Central. It is, however, unlikely that our steel rails will stand more than half this amount of traffic.

The effects of chemical composition are but little understood. Some of the purest irons have turned out utterly worthless. Apparently the absolute quantities of carbon, silicon, aluminum, phosphorus, etc., present are not of so much importance as their relative proportion. One specimen containing carbon 0·16, silicon 0·08, and phosphorus 0·012, could be bent double when cold, while another, containing carbon 0·58, silicon 0·56, and phosphorus 0·011 broke at once.

The physical tests for tensile and torsional strength, usually made on a portion cut out of the head of the rail, are not sufficient, because the flaws before spoken of exist mostly in the flange of the rail, and fracture usually begins there.

The effect of cold rolling and shocks that a rail is exposed to was shown by a piece of rail made by the Campbells, Sheffield, Eng., which had been worn 3 mm. by a traffic of 60,000,000 tons at Spuyten Duyvel. The head had been somewhat flattened, and the flange driven down into the foot to a certain extent. Under such usage an iron rail would have gone to pieces long ago.

Sometimes steel rails crumble all at once and pieces fall out of the head. This is probably due to some physical defects or to crystallization from shocks. The cause has not yet been definitely ascertained.

Mr. Collingwood stated that of a rail only a section of ⅜ square inch was pressed by the wheel of a locomotive, the effect being to cause this portion to act like a wedge, and thus to contribute to the disintegration of the rail. He also exhibited a hook which had been used to hoist stones of 10 to 12 tons, and then suddenly broke with a weight of only 6½ tons. It had been worn from a thickness of 2 inches to 1⅜. The pressure at the upper surface crowded the particles and caused them to act as wedges. Their fracture was crystalline, while that of the lower surface, which parted more slowly, was fibrous.

Professor Egleston asserted that there was no such thing as fibrous iron; what appeared so being simply crystalline with the ends drawn out. A sharp blow would cause this to fall off and show the crystalline structure beneath.

The discussion was continued by Professors Trowbridge, Egleston, and Newberry. C. F. K.

FORMATION OF IODIFORM.—All mixtures in which alcohol and iodine enter in combination with any alkali forming colorless solutions go in part to the formation of iodiform. Even chloroform and iodine, forming a colorless solution, give rise to the same product.—*L. Myers Connor.*

SANITARY SCIENCE IN THE UNITED STATES.

The following is an abstract of a paper on the Present and Future of Sanitary Science in the United States, read by Professor Albert R. Leeds, of the Stevens Institute of Technology, before the New York Academy of Sciences at their meeting, November 11th, 1878:

Sciences, such as the one under consideration, that have in them a side largely practical, are sure of a welcome in our midst. The study of the laws of public health grew into prominence in this country during the war, when the Sanitary Commission undertook to supervise the camps and hospitals. Sanitary associations were then formed in many States and smaller communities, and these have led to the establishment of State and city boards of health, clothed to a greater or less degree with executive functions. Every epidemic has been the cause of wider dissemination of sanitary knowledge by the daily press. The yellow fever plague, by which more than twelve thousand people have perished, has thoroughly aroused public interest. During its continuance the papers were full of homilies on private and public hygiene, the people everywhere sent aid and sympathy to the afflicted, and a lady offered to defray the expenses of a scientific commission of sanitary experts to inquire into the cause and prevention of the scourge. The proper execution of sanitary laws depends on the free and intelligent co-operation of individuals much more than on the influence of a strong central authority. A general health department at Washington could not legislate pure air, pure water, and pure food into use throughout the nation. The people themselves, in each community, must be educated to demand these requisites of health and to secure them in their own way.

I. *Vital Statistics.*—The first "Bill of Mortality" in New York city extended from November 1st, 1801, to January 1st, 1803. In it people are said to have died of "flux," "hives," "putrid fever," "breaking out," "stoppage," "fits," of "rash," and, by way of contrast, of "lingering illness." This rude beginning gradually led to the organization of the Metropolitan Board of Health, whose first report was made in 1866. Their second report showed a decrease of 3,152 deaths, mainly in districts where the greatest amount of sanitary work had been done. Valuable illustrations of the relation between damp houses and consumption were obtained by constructing maps of certain wards, on which every death from phthisis for several years was noted opposite each house. It was found that the disease was most fatal in the lowest levels, in rainy seasons, and in crowded localities.

The registration of marriages continued so defective that a writer on the subject declares it would be impossible for a large portion of the adult native population of the United States to prove by any legal document that they have a right to the name they bear, or that their parents were ever married. The mortality returns of 1871 were probably nearly perfect, and their very accuracy told against New York city, whose death rate was 28·6 per thousand, while St. Louis reported 17, Rochester 16, Buffalo 14, and Jersey City 7 per thousand. To secure accuracy in the returns of marriages and births, etc., more stringent legislation will be necessary.

In New Jersey the State Sanitary Association has conclusively shown the utter worthlessness of the State vital statistics. They memorialized the legislature, and caused the passage of a law which gives to New Jersey one of the best systems of registration yet devised. It owes its excellence to the following features, which should be universally copied:

1. *Burial Permits* are issued only after registry has been made by a properly qualified person; and

2. The returns are made to an *expert,* who collates them and deduces practical lessons from them.

II. *Registration of Disease.*—A large class of diseases may be prevented from becoming epidemic if their existence is known in time. For this purpose the boards of health should be invested with power and provided with means to investigate, reform, and, if necessary, to punish delinquency. Yet in the face of so practical a requirement little more is annually appropriated for the Board of Health of New Jersey than for the pay of two policemen.

III. *State Sanitary Legislation.*—The agitation for sanitary reform caused by the yellow fever should not be allowed to die out with the pressure of the calamity that aroused it. It should continue until every State that has been the seat of yellow fever, year after year, has as efficient a health code as Massachusetts and Michigan. The necessity of educating the people before it is possible to secure the requisite legislation will cause a considerable period of time to elapse before all the States have laws in accordance with modern knowledge. Probably no community takes the trouble to protect itself until it has actually suffered. To the distress of London the world owes the report of the Royal Commissions on water supply and the pollution of rivers, still the best repertory of the best knowledge on the subject. The manufactories of England have made it necessary for the government to take cognizance of aerial impurities. Similarly in this country the pollution of the Passaic has caused inquiries to be set on foot in the same direction.*

An attempt was made to deprive the inhabitants of New York of their public parks, and to occupy them with buildings devoted to military and other purposes; but the people had already been sufficiently educated up to an appreciation of their sanitary value not to permit it. Dr. Seguin eloquently advocated the improvement of the parks, to make them not only pleasure grounds, but places of æsthetical and practical out-door education of the public school children.

IV. *Ventilation.*—It would be a great step in the interests of sanitary science if builders, vestrymen, and school or hospital trustees could be persuaded that their offices did not make them temporary authorities on ventilation, and that they had best intrust this matter to specialists who have fought their way into successful practice.

It appears that both the system of ventilation by aspiration and that by propulsion have had great successes and great failures. Many authorities have declared in favor of mechanical ventilation, yet in most institutions where fans had been introduced they are now standing still. In Roosevelt Hospital, New York, they ran their fan backwards for months and then stopped it.

V. *Physical Education.*—Instruction in hygiene and physical exercise as a part of the college curriculum was first successfully accomplished at Amherst College, and has now had a trial of nearly twenty years. The importance attached to it is shown by the fact that only distinguished members of the medical profession are appointed as professors, and that they have the same rank as the rest of the faculty. Their first duty is to know the physical condition of every student and to see that the laws of health are not violated. In case of sickness, the students are given certificates to excuse them from attendance and are put in the way of obtaining suitable treatment. The records kept are of great interest. All the classes are required to attend the gymnastic exercises four times a week. For a full account see Professor Hitchcock's report on Hygiene at Amherst College to the American Public Health Association. The excellent results of this feature—it can no longer be regarded as an experiment—recommend its introduction in all our colleges and public schools.

VI. *Health Resorts.*—The number of people who leave the cities in the summer to visit the seashore, the mountains, and the country is annually increasing. A healthful village is often changed to a center of pestilence merely by such an influx of strangers, the ordinary means of removing offal, etc., being no longer adequate. The town of Bethlehem, N. H., became so popular by reason of its pure air that several thousand hay fever patients sought relief there in 1877. The consequence was insufficient drainage; but as the inhabitants understood their interests, this defect was at once remedied.

The sea shore of New Jersey from Sandy Hook to Cape May is becoming an almost continuous city, and harbors a multitude of visitors every summer. Those whose interest it is to retain this patronage cannot have it too strongly impressed upon them to preserve their healthfulness by introducing cemented cisterns, by causing garbage to be removed daily, and by encouraging local boards of health.

VII. *Illuminating Gas* not only withdraws from the air of our rooms a considerable amount of oxygen, but fills them with noxious products of combustion. All this may be avoided in the future by the introduction of the electric light.

VIII. *Sanitary Surveys.*—Dr. Bowditch has shown that a thousand deaths from consumption in Massachusetts are due to a wet and retentive soil, and this fact alone will show the importance of sanitary surveys of the country, such as that made of Staten Island by Professors Newberry and Trowbridge, who determined the influence of the surface soil, of the underlying rock, its porosity, its bedding and its joints, upon the drainage and upon the local climate and health. A similar survey of Hudson county, New Jersey, has been recently made by L. B. Heard, C.E.

IX. *Composition of the Atmosphere.*—The English government has been obliged to appoint the celebrated Dr. Angus Smith to examine the effects of atmospheric contamination. In Philadelphia there is scarcely a house front that is not disfigured by the stain of magnesia and lime salts, caused by acid vapors in the atmosphere.

A discussion followed, which was introduced by Mr. Collingwood, who remarked that the problem of the sewage of cities was still far from being solved. Though the recent experiments in England on utilizing sewage for agricultural purposes by filtration and otherwise were reported to be successful, we had only dodged the question in this country. Our sewage is still emptied into rivers to poison the water of cities further down their course. When the country becomes more thickly settled, this will answer no longer.

It was also stated that while gas in large chandeliers could be made an effective means of ventilation, there was another objection to its use in the fact that the soil of the city was everywhere impregnated with it from leaky mains, thus causing poisonous exhalations and an insufferable odor whenever the ground was opened. Attention was also called to the evil effects of the system of tenement houses, which led to an unfavorable comparison of the health and morality of New York with those of cities like Philadelphia and Cleveland, that abound in small homes.

Dr. Minor attributed disease to what Richardson calls "ultra-microscopic molecular aggregates," which always exist in the air, but take hold of us only when our vitality is reduced to a certain point. It has been shown that decay is absolutely impossible in vessels from which they are excluded. But for them the earth would now be heaped with the undecomposed remains of animals and vegetables. According to this view, the future efforts of sanitary science must be simply in the direction of learning how to protect ourselves against the "ultra-microscopic molecular aggregates." C. F. K.

* See Report to Board of Public Works of Jersey City by Professors Wurtz and Leeds; also, Analyt. Beiträge aus dem Laboratorium des Stevens Institute of Technology, by Professor Leeds, in *Zeitschr. fur Anal. Chem.* 1878.

Felling Trees by Electricity.

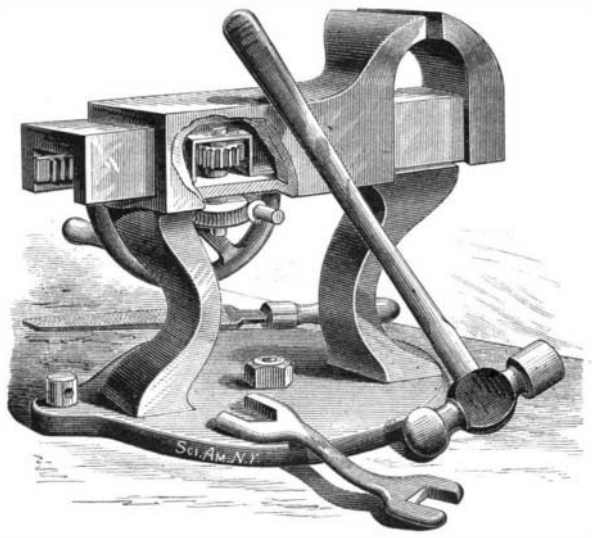
Some years ago a Doctor Robinson of this city obtained a patent through the agency of the SCIENTIFIC AMERICAN for Felling Trees by Electricity. Subsequently a description of the invention was published in this paper, soon after which the newspapers in this country and Europe teemed with the account of a gentleman in India having contrived an apparatus for felling trees in the same manner. Since these several years have elapsed we have heard nothing of the gentleman from India till a few days ago our papers have taken up the subject anew, and annexed is the account they give of the inventor's progress in developing his discovery.

The electric fluid in the form of lightning oftentimes proves itself a very efficient wood cutter, and it has occurred to some ingenious gentleman in India that artificial electricity may be so applied and controlled as to cut down trees a good deal faster than the clumsy ax or that American notion the chain saw. The two ends of the copper wires of a galvanic battery are connected with platinum wire, which of course instantly becomes red hot, and while in that state it is gently seesawed across the trunk of the trees to be felled. When arrangements were made for the experiment, it turned out that the thickness of the thickest platinum wire that could be got was only that of crochet cotton. It was at once seen that such a wire would be consumed before the tree was half severed from its trunk. However, the attempt was made. The burning wire performed its task very well as long as it lasted, but, as anticipated, the wire continually broke, and at length there was no wire left. There can be little doubt that, with a stronger battery and a thicker wire, the experiment would have been entirely successful. As it was, the tree was sawn one fifth through.

AN IMPROVED VISE.

The novel vise shown in the engraving was recently patented by Mr. William Starkey, of Pittsburg, Pa.

The fixed jaw is supported by two standards from the base piece, and has a square boxing or tube for receiving the slide of the movable jaw. This slide is hollow, and contains a rack which is engaged by a pinion on the short vertical



STARKEY'S VISE.

shaft, which is supported by the fixed jaw. At the lower end of the vertical shaft there is a worm wheel, that is engaged by a worm on the horizontal shaft on which is placed the hand wheel. By turning the hand wheel the vertical shaft is rotated and the movable jaw is drawn against the object to be clamped by the vise.

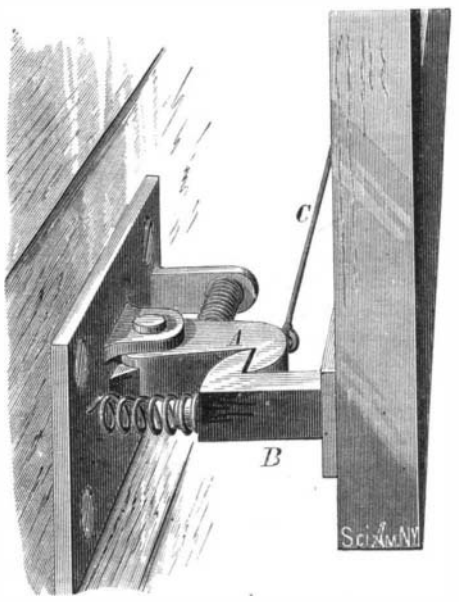
Culinary Uses for Leaves.

A writer in the London *Iron Trade Exchange*, calling attention to a neglected source of culinary flavors, says:

"With the exception of sweet and bitter herbs, grown chiefly for the purpose, and parsley, which is neither bitter nor sweet, but the most popular of all flavoring plants, comparatively few other leaves are used. Perhaps I ought also to except the sweet bay, which is popular in rice and other puddings, and certainly imparts one of the most pleasant and exquisite flavors; but, on the other hand, what a waste there is of the flavoring properties of peach, almond, and laurel leaves, so richly charged with the essence of bitter almonds, so much used in most kitchens! Of course such leaves must be used with caution, but so must the spirit as well. An infusion of these could readily be made, either green or dry, and a tea or table spoonful of the flavoring liquid used. One of the most useful and harmless of all leaves for flavoring is that of the common syringa. When cucumbers are scarce, these are a perfect substitute in salads or anything in which that flavor is desired. The taste is not only like that of cucumbers, but identical—a curious instance of the correlation of flavors in widely different families. Again, the young leaves of cucumbers have a striking likeness in the way of flavor to that of the fruit. The same may be affirmed of carrot tops, while in most gardens there is a prodigious waste of celery flavor in the sacrifice of the external leaves and their partially blanched footstalks. Scores of celery are cut up into soup, when the outsides would flavor it equally well or better. The young leaves of gooseberries added to bottled fruit give a fresher flavor and a greener color to pies and tarts. The leaves of the flowering currant give a sort of intermediate flavor between black currants and red. Orange, citron, and lemon leaves impart a flavoring equal to that of the fruit and rind combined, and somewhat different from both. A few leaves added to pies, or boiled in the milk used to bake with rice, or formed into crusts or paste impart an admirable and almost inimitable bouquet. In short, leaves are not half so much used for seasoning purposes as they might be."

NEW SHUTTER FASTENER.

We give herewith an engraving of a new shutter fastener, recently patented by Mr. P. F. Fernandez, of San Juan, Porto Rico, West Indies. This fastener is designed for holding doors or window shutters in position when open, to prevent them from closing or swinging in the wind.



IMPROVED SHUTTER FASTENER.

To the wall is secured a plate to which is pivoted the spring-acted hook, A, and upon the shutter in the proper position for engaging the hook, A, there is a rigid hook, B. A coil spring is attached to the plate that supports the hook, A, and when the shutter is open is engaged by a boss formed on the end of the hook, B. By this means the hook, B, is pressed forward into close contact with hook, A, thereby preventing all jarring and rattling.

The hook, A, is provided with an eye for receiving the cord, C, which extends to the window casing and is within easy reach, so that when it is desired to close the shutter the hook, A, may be readily disengaged from the hook, B, by simply pulling the cord.

Further information may be obtained by addressing the inventor as above.

AN IMPROVED GARDEN SPRINKLER.

A novel garden sprinkler, which may be carried on the back, is shown in the accompanying engraving. The cylindrical vessel has a removable cover, and contains a perforated plunger which is operated by a hand lever from without. The cylindrical vessel is provided with shoulder straps, and it has two sprinkling nozzles connected with it by flexible tubes.

This sprinkler is especially designed for applying insect-destroying poison to plants. The operator, as he goes

HODEL & STAUBER'S GARDEN SPRINKLER.

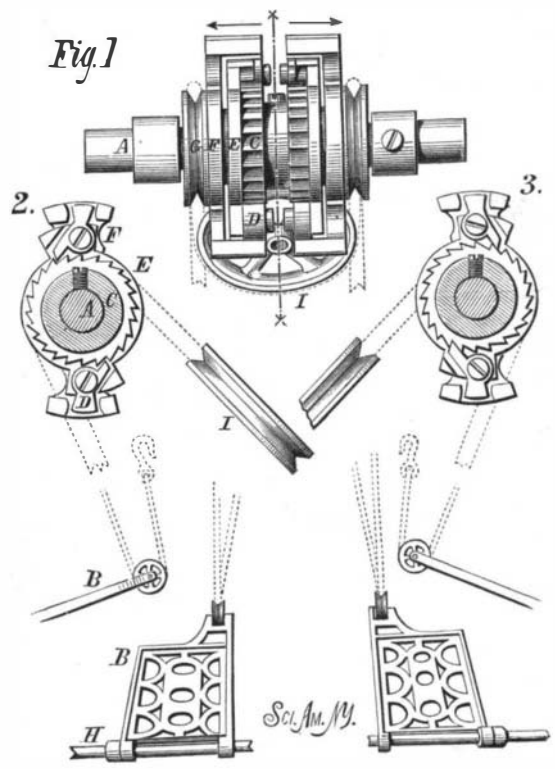
through the field or garden, takes one nozzle in each hand and distributes the liquid upon the plants. From time to time the liquid will be agitated by moving the perforated plunger.

This invention was recently patented by Adolf Hodel, of Jefferson, and F. A. Stauber, of Chicago, Ill.

A NEW FOOT POWER.

In our issue of November 9 we illustrated and described a sewing machine having W. F. Lane's improved foot power applied. We give herewith views of the foot power in detail, Fig. 1 being a side elevation, and Figs. 2 and 3 sectional views. The device is designed for application to any light machinery that can be propelled by foot power. A is the shaft to which motion is to be imparted by the treadles, B, the latter being pivoted to oscillate on the shaft, H. Two ratchet wheels, C, are secured to the shaft, A, and are each worked by pawls, D, which are pivoted to a carrier, E, which turns loosely on the shaft. The pawls are in the form of an elbow lever, and the movement of their tooth ends is limited by lugs or shoulders on the carrier, E. The outer ends of the pawls are received between lugs that project from the plate, F, which turns loosely on the shaft, A, and has attached to it the rope pulley, G. When the plate, F, is turned in one direction the pawls are raised and ride loosely over the teeth, but when the plate turns in the other direction the pawls engage the ratchet teeth and carry them and also the shaft, A. A guide pulley, I, is pivoted below the shaft, A, with its axis at right angles to the shaft.

The motion from the alternately-oscillated treadles, B, is transmitted to the pulleys, G, by means of a rope (shown in dotted lines), both ends of which are fastened by hooks to some fixed point. This rope runs from one of the hooks down under a pulley pivoted in the toe of one of the treadles, thence around one of the pulleys, G, thence around the pulley, I, over the other pulley, G, and downward around the pulley in the other treadle, and upward to the second fixed hook. The depression of one of the treadles causes the



LANE'S FOOT POWER.

shaft to rotate, and also lifts the other treadle into position to be operated.

For further information address Wm. F. Lane, Elgin, Ill.

New Inventions.

Mr. Samuel Heaton, of Cedar Rapids, Iowa, has patented an improved Iron Fence Post, which is particularly adapted for wire fences. It is formed of a slotted iron bar, constituting the post proper, and a triangular brace, which is so connected with said bar that it may be easily adjusted at different angles, corresponding to the undulation or unevenness of the ground surface where the post is used.

Mr. Thomas S. Alexander, of Meriden, Conn., has patented an improved Drawer Pull, which is neat, strong, and durable, and is less expensive than when made in the usual way.

An improved Earth Scraper has been patented by Mr. Benjamin Slusser, of Sidney, Ohio. This is an improvement in that class of earth scrapers which are arranged to revolve for the purpose of dumping the load, and during the intervals, or while being filled, are locked in rigid position.

An improvement in Wagon Bodies has been patented by Mr. James H. Paschal, of Camden, Ark. This invention consists, essentially, in a frame provided with spurs projecting therefrom for engagement with the bales to prevent them from slipping, and the combination therewith of removable extension side and end pieces, for enabling the wagon to be used for other purposes when not employed for hauling cotton bales; there is an extension of the frame forming a feed trough for the horses employed to draw the vehicle.

An improved Scraper has been patented by Mr. George Eiteman, of Round Grove, Ill. This is a double-ended scraper hung at its center on a rod connected to the handle arms, whereby either end of the scraper may be used. It has catches to prevent the scraper from revolving backward, and spring actuated dogs on the handle frame to retain the scraper in position and prevent it from turning over until released.