with an invested capital of $12,301,830, employing 9,283 persons, to whom are annually paid in wages $4,636,099. The value of materials used is figured at $4,829,105, and the value of the products at $13,863,188. Sixteen States monopolize these manufactures, through nearly half of the invested capital and one-half the value of the products are centered in New Jersey and Connecticut.

But, as said before, the original companies hold the field now as they did before their patents expired. Only four of the principal of these extend their operations over the whole range of work on a sewing-machine, beginning with the proprietorship of forests and getting out raw material, to transportation facilities and a network of agencies for disposing of their machines throughout the world.

LATHE FEEDS.

For many years our tool makers have almost universally discarded other feeds for lathes for the screw. Forty years ago, and later, the chain feed was a favorite for all work on the lathe but screw cutting. It had its advantages. So had the rack and pinion feed. Both these feeds took hold of the tool carriage midway between the V-ways, the proper point to avoid a diagonal strain. The rack protected its teeth and those of its pinion from falling chips and dirt, and it could be instantly reversed without much backlash. With it the carriage could be run from end to end of the bed between the heads very rapidly. In fact, many of the screw feed lathes of to-day have their run-back or traversing movement by means of a gear engaging with the threads of the screw, which thus serves as a rack.

As the best of toothed racks and gears are now cut, there is no need of any backlash; the epicycloidal curve to form the contour of the teeth insures a perfectly free rolling action without looseness. Such a cut rack with pinion or wheel would be just as accurate for the finer qualities of lathe work as the screw; and with properly arranged gearing such a feed could be used in screw cutting. In fact, there would be some advantages for some jobs in having a rack and pinion feed instead of the present screw feed. If there should be fear of sufficient wear of the teeth by use to create a backlash which might affect the integrity of the proposed screw, a double disk pinion would obviate this fault.

MUSCULAR CONTRACTION AFTER DEATH.

Dr. Brown-Sequard, SCIENTIFIC AMERICAN, July 12, maintains that fixed and rigid positions after death, speedily ensuing, are due to the last vital act, which has induced a "tonic contraction," and that causes of death which produce sudden dissolutions without pain or excitement may be the means of such a contraction. Assuming this to be true, still the *modus operandi* by which a vital act can leave such a "tonic contraction" after all vital power has ceased is not suggested by him, and we need one step further in the way of enlightenment. Let us see if we cannot take that step now.

In accordance with the observations of Du Bois Reymond, it has been pretty generally accepted that the normal state of even quiescent living muscle is one of electrical tension, and that during muscular contraction the tension diminishes in such a way that as the wave of contraction moves along the muscle it is preceded by a wave of negative variation. This variation is slight for a single contraction, but in those of great rapidity it may become so great as to completely neutralize the galvanometric deflection due to the normal current of the quiescent muscle.

These views have been attacked and sharply criticised, notably by Hermann in 1867, and as lately as 1877 Engelmann has come to Hermann's aid in Pfluger's *Archiv.* They maintain that normal muscle currents do not exist; and that those observed by Du Bois Reymond were due to the unnatural conditions of the muscles examined by him. He, however, has replied to their criticisms with great ability, and his views are now, as already stated, very generally adopted by physiologists. A consideration of these views may perhaps help us to a clearer idea of the position of the headless soldier of Sedan, as shown in Brown-Sequard's figure.

The conditions required, in order that a limb or the entire body should be in a state of rigidity, are simply that the antagonistic muscles, the flexors and extensors, for instance, should be braced at the same moment to full activity, and the rigidity continues so long as the mutual action remains. If this action is not local, but general, such a figure will continue without motion indefinitely, excepting that gravitation may cause it to fall to the ground, if unsupported. But even such a fall would not affect the limbs; they would necessarily retain their position.

Now Du Bois Reymond has shown us that tonic contraction is the *normal state* of muscle fiber, and that relaxation is due to an accession of vital activity through the agency of nerve force. We know well that commonly when life ceases muscular contractility ceases with it. And we can readily see that when death comes as the result of disease or exhaustion, and is attended with suffering, the perturbation of nerve force and of muscle currents must be so great that such a result will surely follow. And as these include death in almost every form in which we ever witness it, we have naturally come to understand that muscular relaxation is its normal attendant and its immediate result. "He bowed his head" is the fearfully expressive term employed when death came on Calvary.

But in the very few instances where death occurs suddenly and without suffering, it seems possible that the instantaneous cessation of the nerve force may leave every muscle fiber in its *normal condition*. If that could be, universal rigidity would instantaneously ensue, and the last position assumed in life would be retained in death. Now we know that the one cause of all causes which can bring a death into which the element of time does not enter is a wound which obliterates the base of the brain as well as the commencement of the spinal cord. That there is an interval between the cause and effect is doubtless theoretically true, but practically the interval has no existence, for it is infinitesimal. Such a stroke must necessarily be painless, for life (including of course sensation) is abolished at its occurrence. The two chief cases cited by Brown-Sequard are cases precisely in point.

The cannon ball at Sedan left nothing remaining above the lower jaw. The brain of the soldier at Goldsborough had been swept by a bullet from a Springfield rifle, that struck him in the right temple, while his head was turned toward his right shoulder, and beyond question inclined downward, for his leg had that instant crossed the saddle, and the stock of his own rifle was still on the ground. Following Du Bois Reymond, it is difficult to see how instantaneous rigidity should not ensue in each of these cases; it did ensue, whether our explanation be correct or not. And with each one the state of support was such that he *could not fall* so long as the rigidity continued.

Many questions and conclusions of intense interest are associated herewith, but for the present we must leave them untouched. W. A. O.

FORMS OF COLD CHISELS.

The cold chisel is not so often used in the shop as formerly, much of its old time work being done by the planer, the milling machine, and the shaper: but the time will never come when it ceases to be one of the most convenient hand tools ever made and used. There are a hundred occasions when it is better than any and all other appliances, and in emergencies it and the hammer are a whole kit of tools combined. But so much has the art of chipping declined that there are shop workmen who do not know the proper form of a cold chisel. Recently an ambitious machinist—a journeyman just out of his time—exhibited a collection of tools "picked up here and there, and made at odd jobs," and among them were some cold chisels, which were worthless as tools unless they were remodeled. The flat chisels had the bit point wider than the blade, and these and the cape chisels had the bit and blade one—a simple wedge extending from the stock to the edge, with a cross section precisely like that of the blade of a pocket knife. With such a chisel there would be no means of raising a chip, and every blow would merely drive the chisel, like a wedge, deeper into the metal until the bit broke off. The widening of the bit beyond the edges of the blade is a certain source of weakness.

The blade of a flat chisel should be flat, of an equal determinate thickness, one-quarter of an inch thick for a blade one inch and an eighth wide, and correspondingly thinner for narrower blades. At the bit, or point, the blade should be ground off at an angle of 60°. Then, the bit should not be quite so wide as the blade; if the blade is one inch let the bit, or edge, be one thirty-second of an inch less. Still another requisite: the cutting edge should not be straight across, but it should form a convex line, so that the corners shall be back of the center of the edge. The ridge between the 60° edge and the flat blade forms a fulcrum for lifting the chip at each successive blow. The narrow cape chisels should be made by similar rules, except, of course, the uniform thickness of the blade, which is impossible, but observing the same narrowing of the bit and the same "stunt" edge of 60°.

It may be asked: How can a clean job be done where corners are required, as in cutting keyways, if the bit is to be narrower than the blade? Simply by using a narrower bladed chisel for finishing the corners. There is no ordinary job that cannot be finished with chisels with bits appreciably narrower than the blades, using differing widths of chisels. It may be that on a cleaning, scraping finish in a keyway a full width chisel with flush bit may be useful, but even here a narrow finishing chisel with drawn-in corners will make better work going down each corner in succession. These elegant, wedge-bladed, spreading bit chisels are beautiful to look at, but they are not necessarily useful because some manufacturers for the trade send them out in this form.

In the article to which reference has been made composite chisels—wrought iron with steel bits—were commended for certain work. It would be well, also, if, when the chisel is made solid from the steel bar, the head or hammer end be occasionally annealed. The continual hammering on the end of the chisel not only brooms and disintegrates the steel, but it hardens it harder than any fire and water can do it, and from this cause come sometimes serious accidents. The writer suffered for years from a disease in the eyes engendered by a flying particle of glass-hard steel from the head of a cold chisel with which he was working.

Fire at the Emerson Saw Works, Beaver Falls, Pa.

The interior of about one-third the area of these works was burned out on the 23d of July. The walls all being of brick and stone are still standing, and none of the roof fallen in. Are fully insured, and with their accustomed enterprise have already commenced rebuilding, and expect to be in operation again inside of two weeks.

Death of Thomas Dickson.

Scotch energy, capacity, and thrift, no less than the manifold opportunities presented to every industrious young citizen of America, were well illustrated in the life of Thomas Dickson, who died July 31, at Morristown, N. J., of heart disease. He was born in Berwickshire, Scotland, in 1822, his parents removing to Canada in 1832, and to Susquehanna County, Penn., in 1834, where Thomas, quarreling with a schoolmaster, hired out at the age of thirteen, to ride a mule in the mines. He then engaged as a clerk, and subsequently became a porter in a country store, afterward purchasing an interest in a foundry and machine shop at Carbondale. In 1856 he took the initiative in starting the Dickson Manufacturing Company at Scranton, Penn., a firm which has been eminently successful in the manufacture of steam engines and mining machinery. Since 1860 Mr. Dickson has been connected with the Delaware and Hudson Canal Company, of which he has been President since 1869, and had become one of the principal owners of coal and iron lands in the country. The output of coal of the company when he took charge was not more than 500,000 tons yearly, while now it exceeds 4,000,000 tons.

The mining operations have been extended over an area of about 44 miles, and, step by step, control has been acquired of a very extensive railroad system. In 1873 Mr. Dickson organized a company with $1,500,000 capital, purchased 23,000 acres of iron land on the shores of Lake Champlain, and erected furnaces, which are producing pig iron and Bessemer. Mr. Dickson was also director in 20 or 30 gas, iron, banking, insurance, and other companies, many of which were planned and organized by himself. In 1872, with his wife and son, he made a trip around the world. He was a member of the Presbyterian Church, and was highly esteemed by a wide circle of friends and acquaintances.

Ready for Any Honest Work.

A recent writer defines "worry"—a trouble which makes many people sick, and even some to die—to be labor done without faith. He means by this, efforts made without confidence in the success aimed at. There is a world of truth in the saying, Courage, always courage! A successful man who overheard a less sanguine person drawl out, "I wish I *could*," turned upon him suddenly with the words, "Say I *will*, and you can!" That is what the energetic man had proved in his own experience, and what many a languid individual might prove too, if he would only once wake up. "Our doubts," the great poet has it, "are traitors."

The passengers and idlers in a certain street in New York were once upon a time amused by the proceedings of a poor fellow whom the police did not interrupt, though his movements gathered crowds, who stopped to look on and inquire. They went their way, admiring a persistence which almost argued insanity. The man had applied at the door of a store for assistance. "You are strong and able," was the answer, "why don't you go to work?" "Work! I would gladly, if any one would give me work to do." "Will you do a day's work if I give you a day's wages?" "Try me," was the answer. "Well, take that brick—put it on the curb at the corner of Nassau Street. Pick it up again and carry it to the corner of the Park. There lay it down. Take it up again and carry it back. Repeat the walk until working hours are over, and I will pay you a day's wages." If the man who gave this apparently senseless direction imagined that the other would refuse the arrangement, he was mistaken. The man took him at his word, plodded on through a long summer day, and received not only his money, but the applause of the crowd, quite as well bestowed as those upon the victor in any walking match.

If he had "worried" over such questions as "What is the use?" he could not have done it. His aim was to honestly earn a day's wages, and he accomplished it. It was not, to be sure, a very ambitious purpose, or a very dignified employment of muscle without mind. But it was done without "worry," and he survived that day and provided for himself food for the next. And it is safe to say that man got around all right in other employment. He was a philosopher in humble attire, capable of teaching many a more pretentious individual, with ample means, one great secret of life. We have only one day at a time to live in, and it is never worth while to shorten the work of that day, while we lengthen the hours in weary speculations as to the utility of any honest pursuit, or in doubts as to results. "Meeting trouble half way" is, in the timid sense, even more foolish than "dropping buckets into empty wells, and growing weary drawing nothing up." The world and its doings are made up of trifles, any way—some sad, some glad, and others foolish. But any honest folly which *pays* is better than worry, which is usually only compensated, when the best comes, or the worst is over, with the reflection, "What a flat I was!"—*Phila. Ledger.*

The Venerable Captain Ericsson.

The inventor of the *monitors* which did such useful service during our war with the South, and the author of the sun motor, the hot air engine which bears his name, and scores of other inventions, reached his eighty-first birthday on the 20th of July. Captain Ericsson does not look or appear to be a man much past sixty years of age, and he seems as hale and hearty as he did a quarter of a century ago. Captain Ericsson is very methodical in all of his ways, abstemious in his habits, and is always at work; he begins immediately after an early breakfast, and is so busy with tools or pen for sixteen hours of every twenty-four that no one ever finds him at leisure.

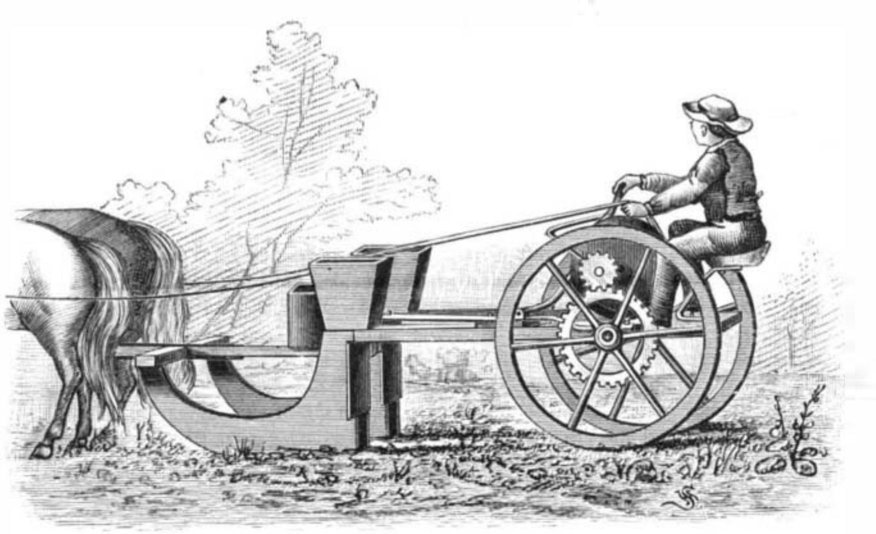
The Doorway of Furnaces.

The *Locomotive* concludes that probably every man who owns or has run a boiler has experienced a vast deal of trouble with the cast iron mouth pieces around the furnace doors. These pieces invariably warp, crack, and burn out in a short time, and the firebrick lining falls down, the cast iron front becomes burned, and where the boilers are set with the flush front setting the portion of the shell which projects beyond the front tube sheet gets overheated, which generally results in its fracture, and in many cases the longitudinal seam where the head is attached to the shell is so severely strained that it begins to leak, and sometimes this leakage is very difficult to stop, owing to the joint being permanently strained. This warping and burning away of these castings may be prevented by simply slitting them back from the edge for about one-half their depth. The slots should be from one-half to one-fourth of an inch in width, and may be from eight to twelve inches apart over the furnace door. This width is necessary, as they close up gradually under the influence of the intense furnace heat.

CHECK ROW CORN PLANTER.

To the wheels are secured gear wheels, with which mesh pinions placed upon the ends of a shaft revolving in bearings in supports attached to the frame. Upon the inner ends of the hubs of the pinions are formed annular grooves that receive the forked outer ends of two rods, whose inner ends are pivoted to a lever upon the opposite side of and equally distant from the pivoting point of the lever. This lever is pivoted to a support attached to the frame, and its rear end projects to such a position that it can be readily reached by the driver from his seat, and operated to throw the wheels into and out of gear.

To the middle of the shaft is attached a wide wheel, in the face of which is formed a cam groove to receive a pin attached to the end of a lever. The lever at its middle part is pivoted to a cross bar of the frame, and is pivoted at its forward end to the seed dropping slide, so that the slide will



BARRETT & FORSTER'S CHECK ROW CORN PLANTER.

be operated to drop the seed by the advance of the machine. To the center of the seed dropping slide is attached the rear end of an arm whose forward end enters a slot in a hopper, so that lime, plaster, sand, or other white substance may be dropped from the hopper to the ground. This hopper is attached to the center bars of the forward part of the frame, a little in front of the line of the seed hoppers, and in such a position that the white substance dropped from it will fall upon the ground midway between and in a line with the hills, so as to mark the cross rows and thus enable the driver to plant the corn in accurate check row. By means of a lever attached to a pawl engaging with a ratchet wheel on the pinion shaft, the driver is enabled to adjust the seed dropping mechanism when starting in at the side of the field and at any time when the cross rows get out of true.

This invention has been patented by Messrs. E. P. Barrett and J. A. Forster, of Holden, Mo.

The Clock in Trinity's Tower.

The clock in Trinity Church tower in this city is the heaviest in America. The frame stands nine feet long, five feet high, and three feet wide, The main wheels are thirty inches in diameter. There are three wheels in the time train, and three each in the strike and the chime. The winding wheels are formed of solid castings thirty inches in diameter and two inches thick, and are driven by a "pinion and arbor." On this arbor is placed a jack, or another wheel, pinion and crank, and it takes 850 turns of this crank to wind each weight up. It requires 700 feet of three inch rope for the three cords, and over an hour for two men to wind the clock. The pendulum is eighteen feet long, and oscillates twenty-five times per minute. The dials are eight feet in diameter, although they look little more than half that size from Broadway. The three weights are about eight hundred, twelve hundred, and fifteen hundred pounds respectively. A large box is placed at the bottom of the well that holds about a bale of cotton waste, so that if a cord should break the cotton would check the concussion.

THAT time-honored association, the Massachusetts Charitable Mechanics, holds its fifteenth exhibition this year, at Boston, beginning September 10. See advertisement.

Glass Bearings.

Bearings made of glass are now being experimented with in the rolling stock of railroads, in regard to their frictionless quality. This material is a hard, clear substance, and must wear down smooth and give a fine bearing surface for an axle to rest upon. It is a non-conductor of electricity, if not of heat, and the fine particles have as good a chance to work down the bearing of the axle to a running fit as in the grinding in of a valve seat for a brass valve, and much power is expected to be saved by converting the wearing of a journal into some other agency than by converting it into heat.

How a Salt Well is Worked.

The stratum of salt having been once pierced, a saturated solution of the saline matter frequently rises in the boring to within eighty feet of the surface. This, however, cannot always be depended upon—and here center the increased difficulty and expense. When a few dozen feet have been drilled, a 6 or an 8 inch iron pipe is inserted as a "casing." Inside of this a 2 inch pipe—also of iron—is placed. The "casing bead" has two openings—one for the entrance of pure water from a neighboring spring into the larger pipe, at the lower end of which it becomes saturated with saline matter ; the other at the end of the smaller pipe, to allow the expulsion of the brine. Of course, the wells become foul or leaky at times, and then resort is had to torpedoes of nitro-glycerine, which are sent down to the bottom of the "casing," and after them is sent an iron weight which secures the explosion. The rusting of the "casing" is the great enemy of the salt worker ; and, when his engine cannot lift the mass of rusted iron, a "knife" cuts the rusted metal, and the engine tears it away piecemeal. But the salt wells are exempt from any danger of taking fire ; and it is never necessary, as in the case of oil wells, to shoot off the "casing head" with a cannon ball.

After the brine has once reached the surface it is forced into large reservoirs, whence it is drawn off through "string" after "string" of "covers," until solar evaporation has left the coarser grades of salt. The "covers" or vats are usually 16x18 feet, and the product to each one per year is estimated at 150 bushels; while the product at Syracuse is only about half that quantity. It is also claimed, adds *The Age of Steel*, that the slope of the valley at Warsaw is peculiarly adapted to rapid evaporation by the sun. When the finer grades of salt are wanted, the brine is led from the reservoirs to an evaporating pan, where a gentle heat is applied. Similar treatment in another pan completes the process, and the residuum of salt is raked upon a shelf at the side of the evaporator. After a slight draining it is taken to the bins, where a more thorough draining is allowed for a space of two or three weeks.

SLIDE TROMBONE VALVE FOR CORNETS, ETC.

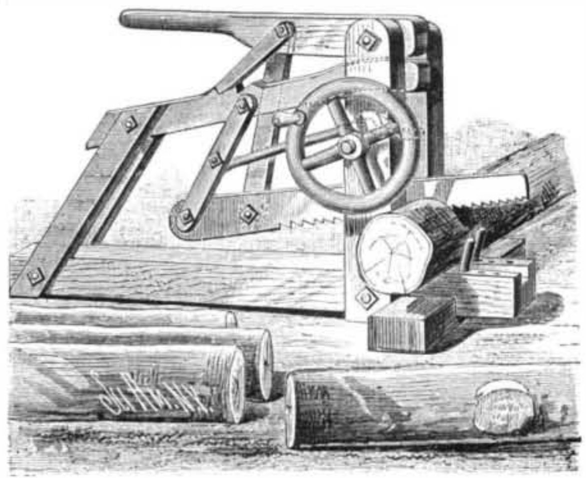
The body of the instrument between the mouth piece and bell is wholly severed once or more for the purpose of connecting with one or more extensions, in order that the tone may be changed by thus increasing the tubular length of the air passage. To make and break this connection at will a peculiar slide valve is interposed, in which one or more flanged and lipped plates, fixed to the body of the instrument, serve to guide one or more valve plates. Each plate carries two short tubes, one of which is telescoped at one end with the body of the instrument, and at its other end is secured in the plate, through which it communicates with the body when in its normal position; the second tube is wholly mounted on the sliding plate, and both ends open through the plate. Mounted on the fixed plate is an extension, both ends of which open through the plate. One end of the body opens through the fixed plate, and the other end may extend directly to the bell, or to the telescoping end of another slide valve. Each slide valve is provided with a poppet having a spring which raises the valve to its upper position, in which condition the air passage from the mouth piece to the bell is through the shortest tube connection. When a poppet is pressed down, the length of both the movable and fixed tubes is added to the air passage by a quick movement of the operator's finger. These interposed tubes may be of any suitable length, and any desired number of valves may be added to a single instrument.

Made after this plan there are three fixed parts, three sliding parts, and a telescoping joint, making eight pipe ends that are brought to connect in two different ways by pressing or releasing a single poppet. The telescoping joint prevents disturbing the vibrations in the instrument during the instant of sliding the valve. While only two very short and light tubes are carried by the slide valve, they serve to connect a tube of any desired length with the air passage, there by preventing friction and requiring but a slight pressure of the finger to operate the valve.

This invention has been patented by Mr. G. W. L Schweich, of Richmond, Missouri.

DRAG SAW

On one end of the base are secured two standards in which is journaled a transverse shaft, upon one end of which is mounted a wheel provided with a crank handle. A top beam is held between the upper parts of these standards, and two inclined standards fastened to the rear end of the base. To the lower end of a connecting bar pivoted to the side of the top beam is pivoted the butt end of the saw that projects between the forward standards. This bar is connected by a rod with a crank on the shaft, so that by revolving the latter the saw will be reciprocated. Pivoted to the forward standards is a lever which is connected by a rod to the saw a short distance in front of the butt end. On the



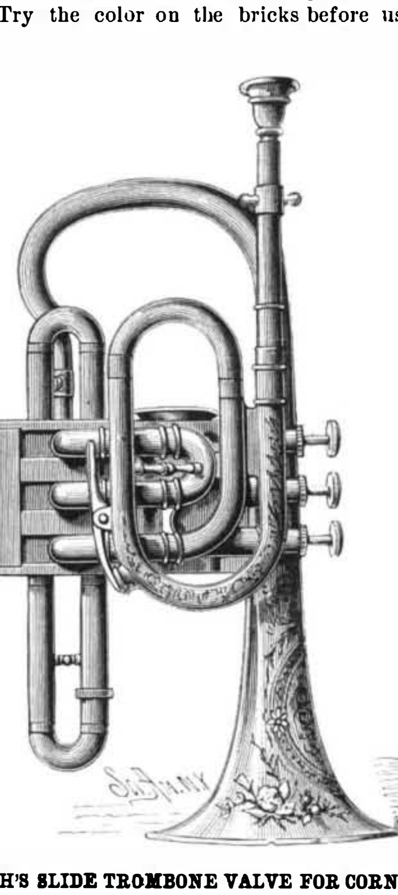
CRAWFORD'S DRAG SAW.

top edge of the top beam are formed teeth, against which rests the free end of a pawl pivoted to the lever. The front of the base is supported upon a transverse beam, and in the upper surface of this part of the base is a groove at the sides of which are apertures for receiving the pins for holding the log in place. The groove receives the edge of the saw after it has passed through the log. By means of the lever and pawl the saw can be raised and held in any desired position. By increasing the height of the rear standards so as to accommodate the lever, the saw can be reversed so as to project from the rear.

This invention has been patented by Mr. Edward F. Crawford, of Honey Bend, Ill.

About Bricks.

An average day's work for a brick layer is 1,500 bricks on outside and inside walls; on facings and angles, and finishing around wood or stone work, not more than half of this number can be laid. To find the number of bricks in a wall, first determine the number of square feet of surface, and then multiply by 7 for a 4 inch wall, by 14 for an 8 inch wall, by 21 for a 12 inch wall, and by 28 for a 16 inch wall. For staining bricks red, melt one ounce of glue in one gallon of water; add a piece of alum the size of an egg, then one-half pound of Venetian red and one pound of Spanish brown. Try the color on the bricks before using, and



SCHWEICH'S SLIDE TROMBONE VALVE FOR CORNETS, ETC.

change to light or dark with the red or brown, using a yellow mineral for buff. For coloring black, heat asphaltum to a fluid state, and moderately heat true surface bricks and dip them. Or, make a hot mixture of linseed oil and asphalt, heat the bricks, and dip them. Tar and asphalt are also used for the same purpose. It is important that the bricks be sufficiently hot, and be held in the mixture to absorb the color to the depth of one sixteenth of an inch.—*The California Architect.*