SCIENTIFIC AMERICAN

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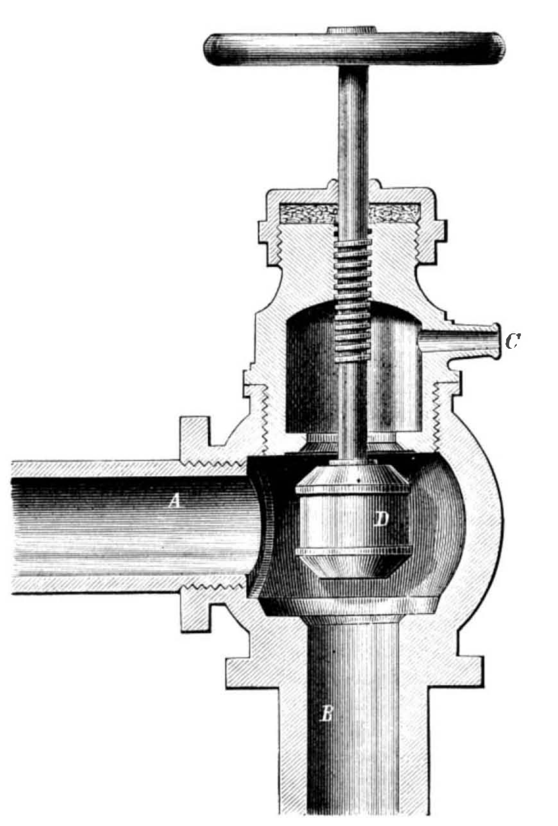
The Speaking Telephone in New York.

Professor A. Graham Bell has recently completed a series of three lectures, in which he introduced his speaking telephone to New York audiences. There can be no question but that the instrument is a most wonderful invention. Without the aid of any battery, using only the current induced in the circuit by its permanent magnet, the telephone on the occasion of the last lecture transmitted musical sounds and speech from Yonkers to New York, a distance of 26 miles. With the battery attached, melodies and chords played on a small organ at Yonkers were distinguishable throughout the large hall where the lecture took place. It is a most bewildering sensation to hear a song faintly emitted first from a box on the stage, then from another suspended overhead, and finally from a third across the room, as the operator switches the current from one telephone to another.

Professor Bell prefaced the exhibition of his instrument with a brief account of the principles on which it is based, and gave an interesting statement of the investigations leading to its invention.

WIGGINS' IMPROVED RELIEF AND SAFETY STOP VALVE.

The improved stop valve illustrated herewith is designed to prevent the accidents due to the careless closing of the feed pipe while the pump is in motion. It is so constructed as always to leave an open discharge. In the annexed engraving, A is the opening leading to the pump. B is the conduit to the boiler, and C opens into the atmosphere. There are two valve seats, one on each side of the opening, A. D is a double valve which may be adjusted to rest upon the lower seat, and so close the passage to the boiler, or upon the upper seat, and so shut off the discharge. It can never close both openings at once; so that there is always a free discharge for the water. In the shell above the upper seat, there is a chamber through which the water passes to



the discharge opening. The stem is screw-threaded, so that the valve may be easily adjusted to either seat. It will be seen that, should the discharge of water into the boiler be stopped while the pump is at work, the water will escape through the passage, C; and there will be no danger of bursting the pipes or breaking the pump.

This valve is used exclusively on the Atlas farm engine, made at the Atlas Works, 700 North Second street, St. Louis, Mo.

Patented through the Scientific American Patent Agency, March 20, 1877. For further information, address the inventor, Mr. Charles P. Wiggins, 1940 O'Fallon street, St. Louis, Mo.

THE SOUTH STREET BRIDGE, PHILADELPHIA, PA.

The large and handsome engraving on this page is a perspective view of the South Street Bridge, Philadelphia, Pa. We select the engraving from the pages of *Engineering*, which journal published the following description, from the pen of Mr. W. Barnet Le Van, a well known engineer of Philadelphia.

The bridge commences at the intersection of Chippewa and South streets upon the eastern side, to the high ground of the Almshouse property beyond the Junction and West Chester Railroads on the west side of the river, connecting with Spruce street. The entire length of the structure is 1,934 feet 7 inches, consisting of two fixed spans 195 feet 8 inches each, and a draw 198 feet 2 inches in length, supported by a pier at each end of the draw and one in the center to receive the pivot. Each end pier is formed by two columns of cast iron 8 feet in diameter, cast in sections 10 feet in length, 1¾ inches thick, with inside flanges 2¾ inches wide by 1¾ inches thick at top and bottom of each section. The flanges are pierced with holes 5 inches apart, from center to center, to receive 1¼ inch bolts. The bottom flange is omitted in the section forming the bottom of the column, when in position, for greater facility in penetrating the soil.

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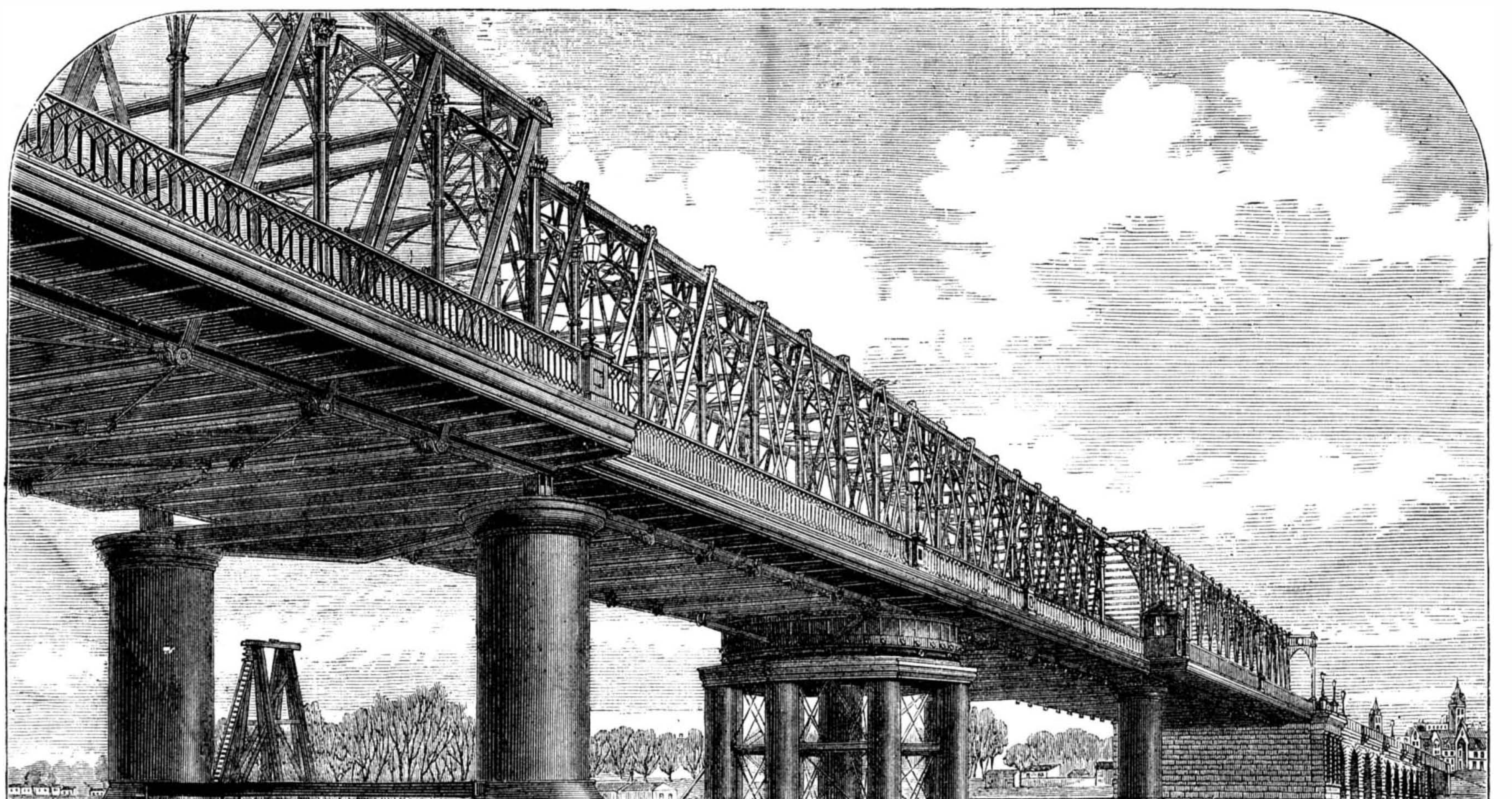

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Sewage Works for Small Towns. Complete and simple plans for Utilizing Sewage by Irrigation. Designed for the town of Skipton, England, by BALDWIN LATHAM, C.E. With 2 pages of illustrations.

New Steam Launch. With 1 page of illustrations, to Scale. Dimensions: Length, 40 ft.; breadth, 8 ft. 4 in.; draught, 3 ft. 3 in.; 6 H. P. nominal; 36 H. P. indicated; 6 in. cylinders; stroke, 6 in.; revolutions, 300; speed, 10 knots. Engine arranged for control by the helmsman.—Corrugated Iron for Building Purposes.

II. TECHNOLOGY.—Wool Dyeing, by GEORGE JARMAIN. (Continued from SUPPLEMENT No. 74.) An able, valuable, and practical paper; showing the latest, best, and most economical processes, including a general statement of the requisites for practical success, the proper water, and how to remove impurities therefrom; Clark's Soap Test; Logwood as a Reagent for Water Impurities; the Dyeing Test; Influence of Impurities contained in Water on Scouring, Rinsing, and Dyeing; Influence on Mordanting and Dyeing; Impurities in the Form of Iron Salts, Alkaline Carbonates, Organic Impurities, Free Acids and Salts; how to Purify and Correct Waters that are to be Used in the Treatment of Wool; Exposure to Air, Subsidence, and Filtration; Clark's Softening Process for Hard Waters; Wanklyn's Method; Treatment of Hard Waters with Soap; Correction of Waters in the Dye Bath; Purification of Refuse Waters from Woolen Mills; Scouring, and Scouring Materials; Wool Scouring; Yarn Scouring; Cloth Scouring; Wool Bleaching; Recipes for Liquid and Gas Bleaching; Tinting or Dyeing White; Testing of Indigo; Utensils; Woad, Madder, Bran, Lime, Indigo, Setting the Woad Vat; Advantages of various Vats.

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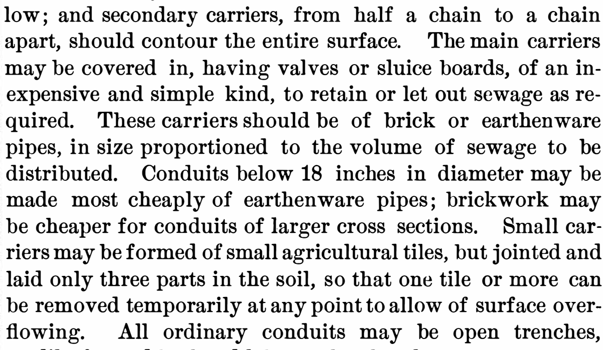
VI. MEDICINE AND HYGIENE.—Sanitary Science.—Prescriptions and Formula. With 25 valuable prescriptions.

SEWAGE IRRIGATION ON A SMALL SCALE.

It is now generally conceded that the application of sewage to purposes of irrigation is the only process which fully meets all the requirements attaching to the disposal of that material. It is the only one which, while it purifies the sewage, efficiently realizes the highest profits, and may be carried on without creating any nuisance or detriment to the health of the neighboring inhabitants. This is the opinion expressed by Dr. Wilson in his recent admirable work on "Hygiene," and it is fully corroborated by the very extensive review of the whole subject of the disposal of sewage which is embodied in that model official document, the Report of the State Board of Health of Massachusetts for 1876. The conditions under which the sewage of a village may thus be turned to agricultural profit, and at the same time the pollution of streams be prevented and a public source of disease removed, are by no means complicated; while the advantages which actual experiment has shown to be secured are so great as to render the matter one which may be strongly commended to the careful attention of village authorities and farmers throughout the country.

The simpler the details of the work, the better; and in this view it is recommended that for villages the application should be by surface carriers, in lieu of underground piping. Land which has been worked in ridge and furrow will require leveling, that is, the soil should be stripped and the ground be broken up, so as to bury the surface even. The English Rivers' Pollution Committee state that main carriers should be laid in nearly level lines, so as to command the area below; and secondary carriers, from half a chain to a chain apart, should contour the entire surface. The main carriers may be covered in, having valves or sluice boards, of an inexpensive and simple kind, to retain or let out sewage as required. These carriers should be of brick or earthenware pipes, in size proportioned to the volume of sewage to be distributed. Conduits below 18 inches in diameter may be made most cheaply of earthenware pipes; brickwork may be cheaper for conduits of larger cross sections. Small carriers may be formed of small agricultural tiles, but jointed and laid only three parts in the soil, so that one tile or more can be removed temporarily at any point to allow of surface overflowing. All ordinary conduits may be open trenches, readily formed by hand labor or by the plow.

In the first place, the land must be prepared so that the beds shall have a slope varying from 1 in 50 to 1 in 150. If not loose and porous, the ground must be underdrained. The sewage must be delivered (by pumping if necessary) at the highest point on the irrigated area, whence it is distributed by gravitation. The annexed diagram exhibits the



arrangement usually adopted where only the main carrier is of brickwork or pipe and the branching carriers mere trenches. A is the main conduit, dammed at various points by gates, as shown at F. By opening the gates, G, any trench, B, C, etc., may be made to distribute the sewage over any part of the field; and the flow is limited by placing the dam, D, at any desired point. The sewage flows uniformly over the surface of the land, each plot being irrigated for a few hours at a time, and once in every three to twelve days, as is necessary: grass, for instance, may be treated much oftener than vegetables.

The amount of land necessary depends somewhat upon the character of the soil and the climate. The English Rivers' Pollution Committee prefer one acre for the sewage of every 150 people. The Earl of Warwick, however, who has one of the most successful sewage farms in England, has one acre of land for every 50 people. In England, Scotland, and France, no difficulty has been found in irrigating through the winter. In our northern climate, where the ground often freezes to considerable depth, the results, it might be expected, would not be so uniformly successful; but judging from experiments made at Berlin, where the soil sometimes freezes to a depth of three feet, there is reason to believe that irrigation is well accomplished the year round.

The effluent water from sewage farms is often so pure as not to reveal any evidence of contamination to the chemist; and it has been freely used for drinking purposes without bad effects. The following data relative to the utilization of the sewage of the Augusta (Maine) State Asylum will serve to show how the system may be put in practice on a small scale, and the results it secures. In this case, the sewage passes by gravitation into large tanks where it is mixed with a quantity of absorbents (straw, leaves, muck, etc.). The solid parts are from time to time carted on to the land, and the liquid passes off, often quite clear and sparkling, to be used on the land for irrigation. A portion flows over a few acres, from which three crops of fine hay were cut in 1875. Another part is used for hose irrigation of the vegetable garden, care being taken not to sprinkle the leaves. A third part is carried to different sections of the farm and distributed from a vehicle which acts on the principle of an ordinary street watering cart, though different in principle. Seven thousand gallons of sewage are disposed of in this way daily, and the results are as follows: What was formerly a nuisance has become inoffensive. The hay crop on the land irrigated by gravitation had increased sixfold, and increase is also noted in other crops. The system pays for itself through the greater value of the crops raised (labor, however, being that of patients, costs nothing); and irrigation was efficiently carried on during the coldest weather. In such cases as the above, and generally in all where the sewage of a comparatively small number of people is to be disposed of, the subsoil method of irrigation may likewise be advantageously used. By this system the sewage is carried to a safe distance from the houses in tight pipes, and is then distributed in open jointed pipes about one foot below the surface of the ground. Subsoil drains are placed at a depth of four feet to carry off the purified liquids. Colonel G. E. Waring some time ago described in the *Atlantic Monthly* his application of this system to the removal and utilization of a country house as follows: "The house drainage is discharged into a tightly connected and thoroughly ventilated tank. Its outlet pipe, starting from a point one foot below the surface of the water, and about two feet below the capstone, passes out near the surface of the ground, and is continued by a cemented vitrified pipe to a point about 25 feet further away. Here it connects with a system of open jointed drain tiles, consisting of one main 50 feet long and eight lateral drains, six feet (the writer has since stated that half this distance is better) apart, and each about 20 feet long. These drains underlie a part of the lawn and are only about 10 inches below the surface." The slope from one extreme of the system to the other is only 15 inches. The pipes require cleaning about once a year.

PREVALENT MANIAS.

The blue glass mania has had its day. The bar rooms are removing their signs of "cocktails in blue glass," and the cerulean goblets, wherein those seductive and presumably sun-strengthened beverages were dispensed, may be purchased for small sums from the cheap china vendors on our sidewalks. We notice a diminution in the sheets of blue glass hung in windows of private dwellings, "signs," some one calls them, "to inform the public of the gullibility of the inmates;" and in fact the only evidence at hand which exhibits any vitality of the now rapidly collapsing blue glass mania is the production of a cheap variety of note paper, called the "Pleasonton," because the pasteboard box in which it is contained has a blue glass lid. The General can doubtless explain the efficacy of the glass in this connection. Blue glass, therefore, has had its run, its inventor has earned his notoriety, and also the thanks of the glass dealers, who have reaped a fine pecuniary harvest.

Two new manias are at hand, to wit, the celery cure and metallo-therapy. "Celery is the greatest food in the world for the nerves," says one of our contemporaries; and the information is traveling the length and breadth of the land. It is fashionable nowadays to call every ailment that flesh is heir to a nervous disease; and where our ancestors would have resorted to such homely remedies as a hot drink and simple cathartics, the present practice demands chloral, and bromides, and quinine, and strychnine, and phosphates, and rare chemicals without number. Of course celery is pleasanter to take than most drugs; and now that it is brought forward as a new nervine, plenty of people will use it. As it can do no harm, and, indeed, may actually work good by checking the too prevalent consumption of "nervous specifics," the mania is rather a benefit than otherwise, and should be encouraged. Wild celery or smallage is known to possess some narcotic effect, and is reputed as unhealthy. As regards the medicinal properties of cultivated celery, there are no utilizations of them in the United States Pharmacopœia; but as celery (*apium graveolens*) belongs to the same family as the parsley (*apium petroselinum*), it is probable that it would yield apiin and apiol, as such substances are obtained from the latter. Apiol acts as a tonic, similar in its effects upon the system to quinia.

The other mania, metallo-therapy, to which we have already briefly alluded, is perfectly harmless, and at present is confined to France. *Les Mondes*, of recent date, reports another "astonishing cure"—a child four years old this time, almost dead with meningitis. The metallo-therapy inventor enveloped the infant—there is no Children's Protective Society in France—in plates of iron and copper from head to foot. Half of the body was covered with one metal, half with the other, in order "that both metals might have an equal chance of doing good." In eight hours, the child revived; in six days, it was out of danger; in a month, it was well. Manufacturers of iron and copper plate may now consult with blue glass makers as to how to advertise this.

SAFETY VALVE TESTS.

In September, 1875, a Special Committee of the United States Board of Supervising Inspectors of Steam Vessels made a series of experiments to determine the proper proportions for safety valves and to test the relative merits of such valves as were furnished by manufacturers. Their report has just been published by the Government; and as it contains considerable information that will not be generally accessible, we propose to furnish a synopsis to our readers that shall embody the most important points determined by the Committee. As nearly all the prominent safety valves in the market were submitted to test, this report is useful in showing what is still required to produce the ideal safety valve. It is scarcely necessary to say that a perfect safety valve is one which will rise as soon as the pressure at which it is set is attained, will prevent the pressure increasing if the boiler is forced to its utmost extent, and will close promptly as soon as the pressure commences to fall. It may well be doubted, in the light of experience, whether it is possible to design a valve possessing all the above features; but they can be closely approximated, as will appear.

The boiler which was used for making the experiments was cylindrical, with internal furnaces, of the modern marine form, and was capable of evaporating about 1,900 lbs. of water an hour on an average, at a pressure of 20 lbs. by gauge. Before experimenting with the competing valves, the committee made a number of experiments with common safety valves of different sizes, the valves being carefully constructed, with knife-edge points of support for the lever and valve stem, as shown in Fig. 1. These experiments fully confirm the opinion, held by many experienced engineers, that the common safety valve, when made of sufficient size, is about as effective in relieving a boiler and closing promptly as the best special forms that have been devised. It is a matter of regret that the Committee's experiments did not include a test of what is sometimes called the "positive safety valve," in which the weight is suspended directly from the valve stem and acts without the aid of levers or springs, the valve being spherical and thus exposing a greatly increased area when opened, as these features are very meritorious, at least in a theoretical point of view. The experiments with these ordinary safety valves enabled the Committee to give rules for general practice which agree well with those determined by other experimenters. The Committee recommend the following rules for determining the evaporation in lbs. per hour of stationary and marine boilers: 112×square feet of grate surface, for natural draught; 168×square feet of grate surface, for forced draught.

It was found, when experimenting with the common safety valves, that the lift decreased as the pressure at which the valve was set was increased; and by observing the areas of openings, the Committee derive the following rule for calculating the area of opening, in square inches, required to discharge a given weight of steam per hour: Multiply the number of lbs. of water evaporated per hour by 0·0011, if the valve is set to blow off at 10 lbs.; by 0·0010, if at 20 lbs.; by 0·0009, for 30 lbs.; by 0·0008, for 40 lbs.; by 0·0007, for 50 lbs.; by 0·0006, for 60 lbs.; by 0·0005, for 70 lbs.; by 0·0004, for 80 lbs.; by 0·0003, for 90 lbs.; by 0·0002, for 100 lbs.

By observing the lifts of the ordinary valves when discharging at different pressures, the Committee obtain the following rule for calculating the area of valve that will give the required area of opening for any particular case: Multiply the number of lbs. of water evaporated per hour by 0·005; the product will be the area of the valve in square inches. This rule gives a smaller area than the similar formula proposed by the late Professor Rankine, in which the multiplier is 0·006. It is to be remembered that the valves used by the Committee were constructed especially for the experiments, and may have acted more effectively than the average; so that the multiplier given by Professor Rankine will probably be safer for general use. It may be added that rules of this form are the only safe ones for general use, the ordinary formulas giving very discrepant results, as shown by the following example in the report: The area of safety valve required for the boiler on which the experiments were made, at a pressure of 70 lbs., would be: For the rule of U. S. Board of Supervisors, 37 square inches; for that of the English Board of Trade, 11·8; for that of the French Government, 6·75; for that given by Molesworth, 18·88; for the 1st rule given by Professor Thurston, 8·3; for the 2d, 29; for that given by Rankine, 12; for that proposed by Committee, 10. Attention has been directed to the discrepancies of these rules on several occasions; and in spite of the distinguished authority on which they rest, it is reasonable to hope that all but the last two will speedily find the oblivion they so justly deserve.

The Committee observe that, when very large valves of the common form is used, their action is not satisfactory, as at high pressure the lift is scarcely noticeable, the pressure being relieved by a kind of tilting of the valve; and they fix the limit at valves having an area of 10 square inches, recommending that two or more valves be used, when a greater area than 10 inches is required.

TESTS OF COMPETING VALVES.

Valves of special form were sent by 27 makers, and tested

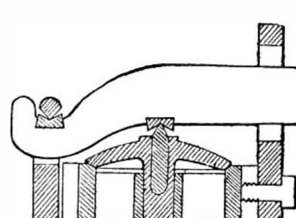


Fig. 1

by the Committee. The general object of all of these valves was to give an increased lift as soon as the valve was opened. The valves are divided by the Committee into 6 classes, according to their construction:

1. Reactionary safety valves, in which the escape of the steam is opposed by a lip or stricture with the idea that the reaction will force the valve further from its seat. One form of this class is shown in Fig. 2.

2. Disk safety valves, in which a disk is secured to the valve having a greater area than the valve, so as to force the

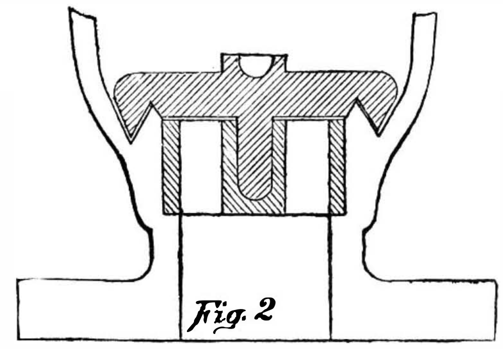


Fig. 2

valve further from its seat, when it opens. Fig. 3 is an example of this class.

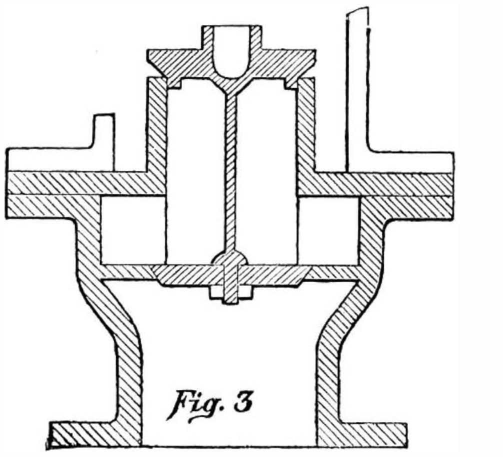


Fig. 3

3. Annular safety valves, with two seats upon an annular opening (as shown in Fig. 4), with a view of obtaining a greater area of opening for a given lift.

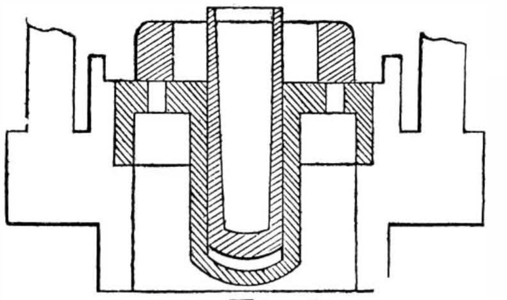


Fig. 4

4. Double seated safety valves, of the same general form as the double puppet valve, the upper and lower parts being of different areas, so that they move easily and expose large areas of opening. The practical difficulties of construction, however, will probably prevent the adoption of this plan. The Committee report that they "can say nothing favorable of any of this construction that were tested."

5. Combination safety valves, which are assisted in their operation by small auxiliary valves or a combination of levers. One of this class is shown in Fig. 5, the valve being held down by a spring balance attached to the lever, and being assisted to rise, when opened, by the action of the rod and bell-crank lever, the other end of the spring balance being attached to the long arm of the latter.

6. Piston safety valves (see Fig. 6 for an example of this class), in which a piston connected with the valve assists it to rise. A uniform method of test was adopted for all these valves. Each was attached, in turn, to the boiler, was set to blow off at 30 lbs., and was allowed to operate for 10 minutes, with a strong fire in the boiler, was then set to 70 lbs. pressure, and the experiment was repeated. The following table gives a summary of the results obtained with 12 of the competing valves, and 2 of the common valves constructed by order of the Committee. The table in the report contains results of the list of 22 valves, but the data were only complete in the case of 12, as the area of opening was not observed for the others, or they were tested at different pressures. The different valves are distinguished by numbers in the table given below. Several of the valves tested gave such unsatisfactory results that they were not included in the Committee's table.

It will be observed that some of the special forms of valves, with considerably larger areas of openings than the common valves, allowed the pressure to increase as much or

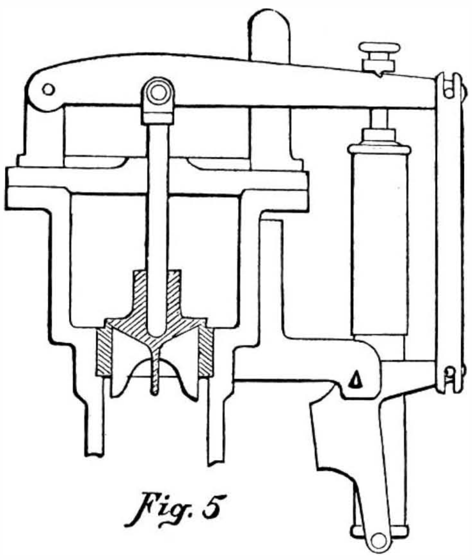


Fig. 5

more. This is probably due to the fact that the very form by which the greater lift was obtained made it more difficult for the steam to escape, and thus rendered a larger opening necessary to discharge the same quantity of steam. In

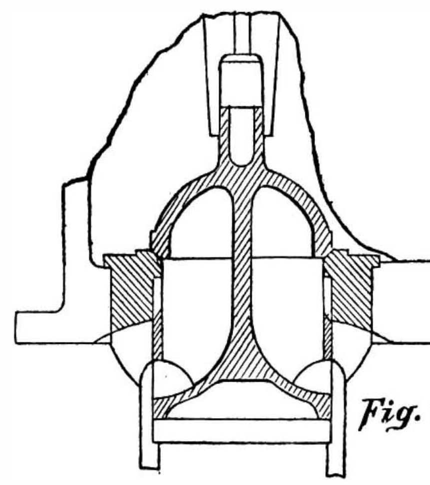


Fig. 6

the case of several experiments with the same valve, where the table shows considerable differences in the results, these were generally due to lack of adjustment, so that the best results represent the action of the valve when properly adjusted. This remark applies both to the common and special forms of valves. There is one peculiarity, quite an important one, which the table does not show, but is noted in the records given in the case of each experiment.

With the common valves, when the valve opened, the pressure gradually increased to the maximum, when the boiler was forced, and, when the pressure was allowed to fall, it closed at the points indicated. With nearly all the other valves, however, after the valve opened, the pressure fell below the opening point, the valve sometimes closing several times, and the pressure falling below the opening point several times, in the course of a 10 minutes' trial,

			SET TO OPEN AT 30 LBS.				SET TO OPEN AT 70 LBS.			
No. of valve.	Area of valve in sq. in.	Class of valve.	No. of trials.	Greatest and least excess of pressure.	Greatest and least area of opening.	Greatest and least closing pressure.	No. of trials.	Greatest and least excess of pressure.	Greatest and least area of opening.	Greatest and least closing pressure.
					sq. in.				sq. in.	
1	5	Reactionary.	..	....	....	....	2	0	1·231	65½, 67¼
2	5	"	5	5¼, 2½	1·257	26½, 29	5	4, 3	·729, ·628	64, 68¼
3	5	"	2	7, 6¾	1·580	27¼, 28	1	9¼	·92	67½
4	5	"	2	6, 0	2·934	20¼, 26	2	0	1·427	55½, 56
5	5	"	1	16	·457	30	1	4	·284	61
6	5	"	5	7, ¼	·869, 1·455	27½, 29½	3	3¾, 1¼	·691	66¼, 68
7	7	Combination.	2	2, 0	1·11	17, 26	4	4, 1	·574	60, 67½
8	5	"	3	1¼, ½	1·171	27¼, 29	4	½, 0	1·171	64¼, 70
9	5	Disk.	2	0	1·82	27	2	¼	1·18	67¾, 68½
10	5	"	2	4½, 1½	1·11	26½, 29	5	0	·555	65, 69¾
11	6	Annular.	1	0	1·42	27	3	0	·84	59½, 69½
12	5	Piston.	3	1¼, ¾	1·231	25½, 28½	5	4, 3	1·231	60½, 66
13	5	Committee's	2	7¼, 4½	·929	28	1	5¼	·633	68
14	10	valves.	..	.....	....	....	1	2	·725	68¾

and sometimes the pressure fell at once and the valve blew off at a less pressure than that at which it was set, during the whole trial. It is evident that this is not a desirable feature in a safety valve, if safety can be secured without this loss; and the records of the trial seem fully to confirm the opinion previously stated that the common valve, represented in Fig. 1, is not excelled in any important particular by its competitors—at least for stationary purposes. For use upon locomotives, and steamers in rough water, some of the special forms may be advantageously employed, and the Committee especially recommend three, constructed on the reactionary principle, viz: Ashcroft's, Crosby's, and Richardson's (Nos. 1, 2, and 6 in the preceding table). It is believed that these recommendations are justified by experience. The Committee state that there are objectionable features in the other forms of valves presented to their consideration, which may possibly be removed, and think the instruments should be further perfected before their adoption for steamer use can be recommended.

[*Continued from first page.*]

This end is not beveled, as is generally done, but left square, so as to retain the full value of the thickness of the column for a bearing surface on the rock, each section weighing about 14,600 lbs., averaging seven sections to each column.

The pivot, or center pier, is formed by a cluster of nine columns, a 6 foot column in the center supporting the pivot of the draw, and a surrounding circle of eight columns 4 feet in diameter, carrying the track on which the draw revolves. This circle is 36 feet in diameter from out to out, while the pier columns are placed with their centers directly under the main chords of the bridge, making them 36 feet apart from center to center, and at right angles to the center line of the bridge, giving an opening of 77 feet on each side in the clear. The section of 6 foot columns average 10,800 lbs., and the 4 foot columns 6,800 lbs. each. These columns were cast from government cannon, originally made from cold blast charcoal pig, being an exceptionable material for this purpose. The columns were placed in position by the use of compressed air, by the plenum pneumatic process. In sinking these pneumatic cylinders, the late Mr. Murphy, the engineer who erected the bridge, introduced a more economical air lock than was heretofore used, which enabled the workmen to pass from the normal atmosphere outside the column to the denser atmosphere of the interior, and to prevent the escape of the compressed air while so doing. He also adopted, for the first time, brackets in sections, and extending clear round the whole inner circumference of the bottom of the column, and secured to its side by four $1\frac{1}{4}$ inch tap bolts, and to the rock by four bolts 18 inches long, with fox wedges at the lower end, and thread and nut on top, thereby adding much to the stability of the work. This was necessary on account of the small amount of holding ground for the cylinders, overlying the bed rock.

The bed of the Schuylkill, at the site of the bridge, is a micaceous gneissic rock, undulating in surface, with overlying strata of sand and tough, compact mud, intermingled with gravel and small boulders. Lying directly on the rock, considerable quantities of driftwood were found, its appearance evincing great age and a long occupation of its present position. The average depth of this bottom material is about 30 feet at the western pier columns, diminishing to only 5 feet at the eastern pier. At the draw the thickness is about 18 feet. The draw span of this bridge is 198 feet 2 inches long from end to end of chords, and 23 feet wide between centers of trusses, with two outside footways of 6 feet 8 inches in the clear, making the total width from out to out 39 feet 4 inches, equal to the outside diameter of the pivot cluster of columns supporting the span at its center, leaving two water ways of 77 feet each, as required by the specification. The decrease in the width of the bridge at this point from 55 feet (the width of permanent span) to 39 feet 4 inches is unfortunate, but to have maintained the width of 55 feet would have made not only a wider span, but also a much longer draw span (necessary because of the requirements of navigation) adding enormously to the weight, already very great (being now nearly 400 tons), and involving increased dimensions throughout, and as a consequence increased cost of pivot, curb, and supporting columns. The truss of the draw span is similar in design to the two permanent spans, but modified in section and position of members so as to meet the duties of a bridge supported on a pivot at its center, and as a permanent span, which it practically becomes when closed.

The pivot on which Mr. Murphy originally proposed to rest the draw span was one of his own design, and consisted of two smooth lubricated surfaces 6 feet in diameter, made of gun metal with spiral grooves, being arranged so as to equally spread the lubricating material. From the large area of the working surfaces the distributed load would have been only about 200 lbs. to the square inch. This was a feasible plan, and perhaps the most economical way of solving the problem. But this was changed to a pivot center of two sets of small conical rollers running on steel plates, which is now working satisfactorily. The entire draw is carried directly by the stone filling of the central 6 foot cylinder; an arrangement of radial arms with wheels under the circular curb (which is 32 feet in diameter) which prevents any undue tipping of the span when open or during the opening or closing of the span. The width of the approaches is 55 feet, consisting of carriage way 35 feet wide, and two footways 10 feet wide on each side. The eastern approach is 518 feet 10 inches in length, consisting of 363 feet 6 inches of broken range ashlar retaining wall of sandstone, and 114 feet 6 inches, being three conoidal or flue arches of original design, composed of brick with stone rings and a granite abutment of 40 feet 10 inches, with pilasters and Doric capitals.

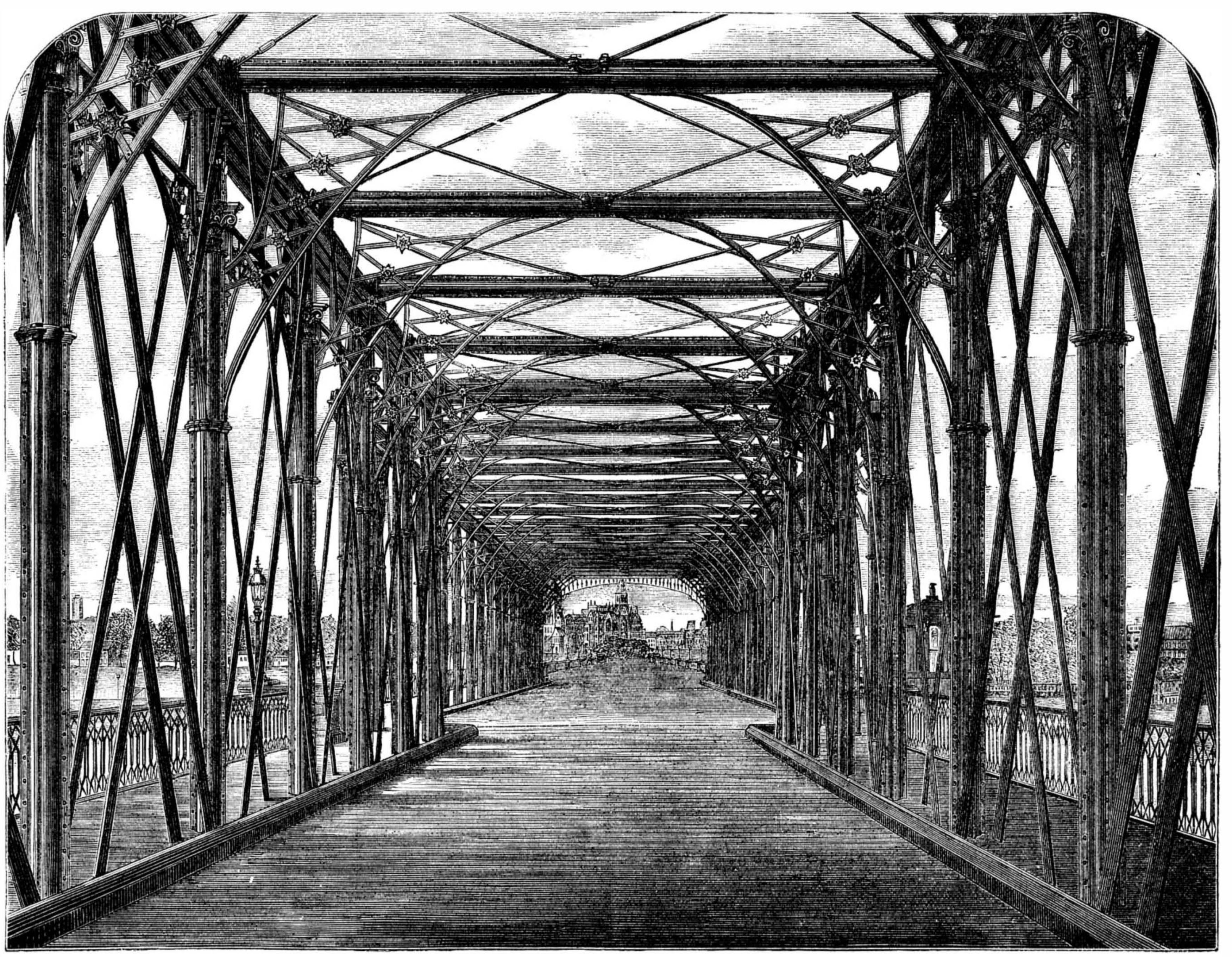
The western approach is 826 feet 6 inches in length, consisting of 87 feet 4 inches of regular range ashlar retaining wall of granite, and three trussed spans 244 feet 9 inches in length, supported by eight wrought iron columns over the Junction and West Chester Railroads, to an abutment of 62 feet 4 inches in length, and thence by nine brick arches 43 feet 6 inches span, from center to center, with stone rings, 391 feet 3 inches long, with granite piers, to a granite abutment of 40 feet 10 inches, same character as eastern abutment.

The contract price for the bridge was $770,000, but the ice breakers or fenders for the center pivot pier of the draw span formed an extra contract, for which Mr. Murphy received $65,000 additional.

Improved Whaling Gun.

During last year, Captain Eben Pierce, the well known manufacturer of bomb-lances, and Selmar Eggers, after much planning and experimenting, perfected an invention which is destined to prove vastly beneficial to our community in swelling the revenue accruing from the whale fishery. This is a breech-loading whaling gun, varying from the ordinary weapon as much as a modern sixteen-shooting rifle does from the flint-lock shot gun of our ancestors.

The weight of the gun is 18 lbs., or nearly the same as the old style, while it is much better balanced and proportioned, reducing the comparative weight of the barrel that renders it so difficult to steady and aim the ordinary guns. The length and base of the barrel is the same, admitting the use of the usual size bombs. The great superiority of this weapon lies in the manner of loading. The old guns were loaded with loose powder, and were more dangerous to handle when charged; the powder would also become dampened with flying spray when in a boat that was going through the water at a lively rate, and it has often occurred that, when the pursuers had arrived within easy range of their prey, they would find the charge moistened and the weapon consequently useless. Mr. Eggert's gun is so constructed that, by touching a spring in the butt, a chamber in which the barrel terminates is opened; in this a cartridge with a seven-eighths inch copper shell is inserted, charged with $2\frac{1}{2}$ drachms of powder, or about half the quantity required to load the ordinary guns. The chamber is then closed upon pulling the trigger, the hammer strikes a sharp blow upon a cap in the end of the cartridge, and the piece is discharged. The whole operation of loading, fixing, and reloading can be accomplished in two minutes' time. It will be seen at once that the gun is much surer and safer, as these cartridges can be kept in the pocket until needed; and no water can lessen their power after they are placed in the chamber. With the breech-loader a lance can be sent with destructive effect over 750 feet when fired at slight elevation. The weapon is constructed of gun metal, and thus is almost impervious to wet, another weakness to which the old style gun was susceptible.—*New Bedford Mercury.*

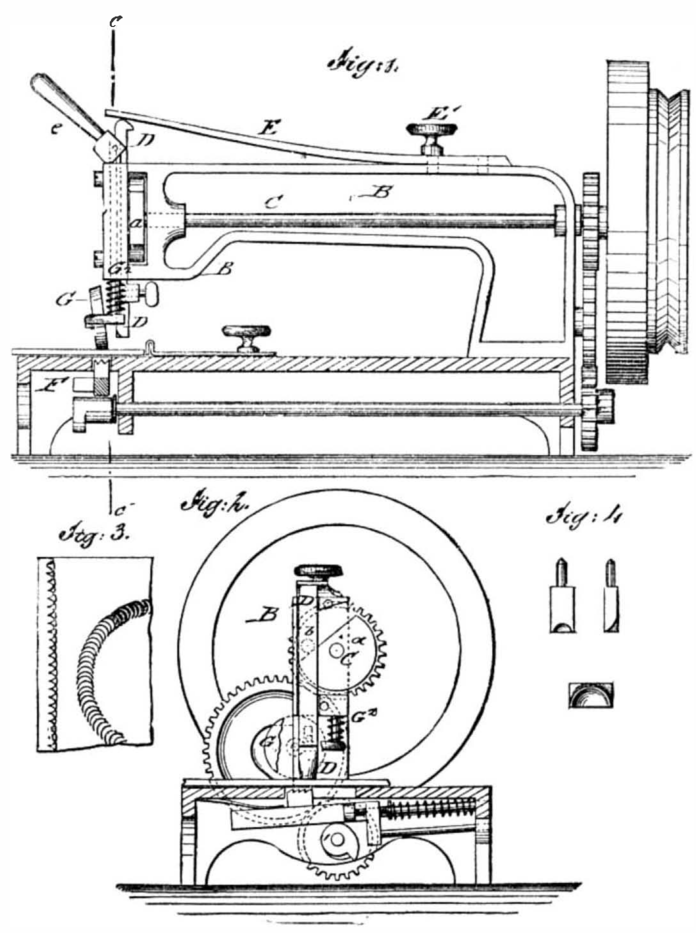


INTERIOR VIEW OF SOUTH STREET BRIDGE PHILADELPHIA PA

IMPROVED MACHINE FOR STAMPING LEATHER GOODS.

In the accompanying engraving is illustrated a novel machine for stamping ornamental designs on the leather work of hide tree saddles and of carriages. It may also be used for producing the embossed leather employed for furniture covering, bookbinding, etc. The upper revolving shaft, C, in the side elevation, Fig. 1, works the stamp rod, D, which moves in a guide in the arm, B, and is acted upon by a band spring, E. Said spring may be adjusted by the clamp screw, E'. The shaft, C raises the stamp rod by means of a cam, *a*, which engages with a friction roller, *b*, on the rod, as shown in Fig. 2; on being released from the cam, the rod is brought down forcibly by the spring. Fig. 4 shows the various shaped stamping bits, which are clamped into the lower portion of the stamp rod, D. The leather is fed by a vibrating feed mechanism, F, and retained by a presser wheel, G, which is attached to an arm on a presser rod, G^2, which is pushed down by a coiled spring, and raised or lowered by the lever, *e*. Fig. 3 represents a piece of leather, as marked by the machine, the uniformity of the impressions being secured by the regular movement of the feeding device. The mechanism is operated by the belt wheel and gearing on the right in the usual manner.

Patented through the Scientific American Patent Agency, April 3, 1877, by Mr. Lewis H. Urner, Nevada, Mo.



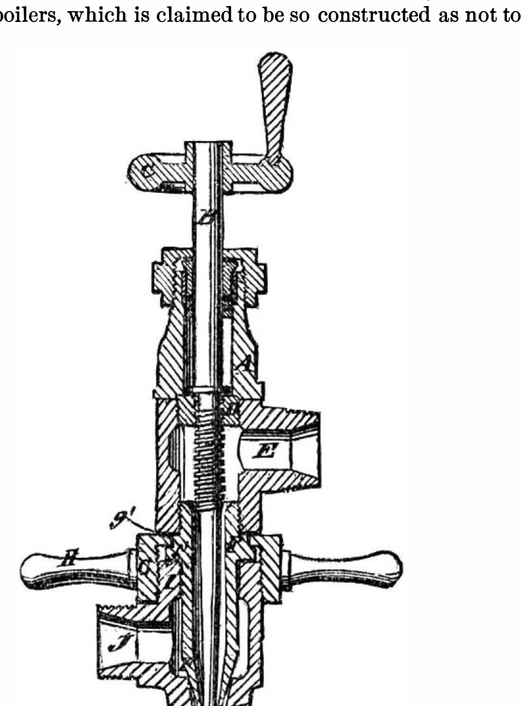
URNER'S LEATHER-STAMPING MACHINE.

Sleep.

Sleep, Dr. W. A. Hammond says, may be defined as general repose. Almost all the organs rest during sleep. The heart, popularly supposed to be in perpetual motion, is at rest 6 hours out of the 24, the respiratory organs 8, and the other organs more or less. The brain alone is constantly employed during wakefulness, and for it sleep was formed and made needful to its preservation. It is true that sleep does not give the brain a total recess from labor; imagination and memory are often vividly active during sleep, and unconscious cerebration likewise takes place, but enough rest is obtained for the renovation of the brain, and that which has been torn down during wakefulness is to a certain extent rebuilt. Sleep is a most wonderful power—often stronger than the will, as in the case of the sleeping soldier—and more mighty than pain, as when sick persons and tortured prisoners sleep in the midst of their suffering. No torture, it is said, has been found equal to the prevention of sleep. The amount of sleep needed differs according to the constitution and habits. Big brains and persons who perform much brain labor need a large amount of sleep. Children need more sleep than grown people because construction is more active than decay in their brains.

A NEW INJECTOR FOR STEAM BOILERS.

We illustrate herewith an improved water injector for steam boilers, which is claimed to be so constructed as not to



require any internal packing, as to prevent locking or bursting and side leakage, and as to work equally well at any pressure of steam. It may be detached, examined, and again attached in a few minutes without interfering with the working of the boiler.

A is the outer part of the injector, through a stuffing box in the outer end of which passes the spindle, B. The spindle has a hand wheel, C, and a screw thread formed upon its middle part, which fits into a female screw, D, in the part, A, at the outer side of the steam inlet, E. The forward part of the spindle, B, passes into the nozzle, F, the base of which is screwed into the inner end of the part, A. Around the base of the nozzle, F, is formed a flange, *f*, which abuts against the end of the part, A, and is rabbeted upon its outer side to form a ring groove to receive an inwardly projecting flange, *g'*, formed upon the outer part of the inner surface of the ring or wheel, G. The wheel, G, is provided with handles, H, for convenience in turning it, and has a screw thread formed upon the inner surface of its inner part, to receive the screw thread formed upon the outer end of the part, I; with which, near its outer end, is connected the water inlet, J. With the part, I, near its inner end, is connected the overflow, K. With this construction, by turning the ring or hand wheel, G, the water supply can be regulated according as the steam pressure in the boiler may require. This device was patented through the Scientific American Patent Agency, March 20, 1877, by Mr. James Westley, of Manchester, England.

Soiree of the Louisville Microscopical Society.

A large audience assembled in the Hall of the Louisville Library to attend the annual soirée of the Louisville Microscopical Society. Arranged on tables were nineteen instruments representing the most famous makers of this country and Europe, from a small old fashioned Bascule to a large and magnificent Ross. The objects selected for exhibition were selected from the various departments of Nature.

Professor Brach, with a Zentmayer "Grand American," with the paraboloid, exhibited a series of beautiful picked diatoms. On a second instrument he showed the effect of polarized light on crystals and various animal and vegetable tissues. Mr. W. R. Belknap exhibited fine specimens of gorgonia and spicules of sponge. Dr. Clapp showed various animal parasites, *trichinæ spiralis*, tape worms, etc. Dr. Holland showed the various ferments in different stages of development. Dr. Jenkins, with the micro-spectroscope, showed the spectra of blood and various colored liquids. Dr. Keohler exhibited a number of handsome slides of fossil woods. Mr. A. L. McDonald, with a beautiful binocular, gave both eyes a chance to see crystals of arsenious acid cinnabar, and *polycystinæ*. Dr. J. B. Marvin had under an instrument a frog so arranged as to show the circulation of the blood. He also showed beautifully injected specimens of animal livers, kidneys, tongues, etc. Professor C. Leo Mees showed, with a magnificent Ross instrument, Moeller's phototype plate, *Deutzia gracilis*, etc. Mr. I. Pettus exhibited the lower forms of vegetable life, diatoms and *protococcus*, also *rotifer vulgaris*, who seemed especially voracious on this occasion, and vinegar eels. Professor Lawrence Smith illustrated the formation and growth of crystals under polarized light. He also showed a series of micro-photographs, under his peculiar inverted microscope. Dr. Sloan, with a handsome Grunow instrument, showed blood of various animals, magnified 2,000 diameters. Mr. Pack Thomas exhibited tracheal vessels of silkworms, tongue of fly, eye of beetle, etc. Mr. David Lane, with the oxyhydrogen microscope, projected a number of objects on a screen, the circulation of blood in a frog's foot, many common insects, and plants, *drosera rotundifolia*, etc., were shown.

The exhibition was a decided success, and the society will give another soirée in the first week in June.

A Good Portable Printing Press.

A small portable printing press is a convenient and useful article in almost any business house. It will serve to print letter heads, envelope advertisements, cards, and small circulars, notices, etc., and thus will save printers' bills. It is a capital present for boys, as it induces them to acquire the rudiments of an important trade, which in after life may be turned to practical account. An excellent little machine of this description is known as the Excelsior Press, and is made by Messrs. W. A. Kelsey & Co., of Meriden, Conn. The advertisement of this firm will be found in our advertising columns.

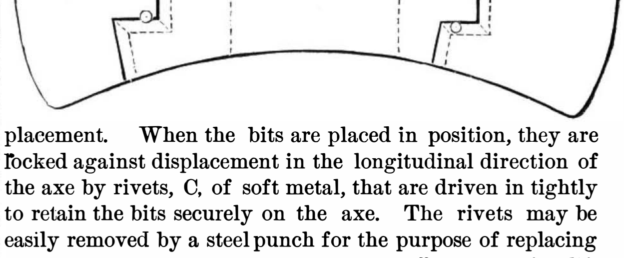
Composition for Covering Boilers and Steam Piping.

The process has been employed for some time with great success for preventing the loss of heat from steam pipes, domes of generators, cylinders of steam engines, etc. It consists in covering the same with a mixture of sawdust (no matter from what wood) and ordinary flour paste in a very liquid state. The sawdust being added to make a thick paste, and applied according to the following directions, will form a compact mass, the adherence of which is very great when applied on clean surfaces of wrought or cast iron; but on copper pipes it is more difficult to apply the first coat: in which case it is necessary to wash the copper pipe to be covered with a clay wash made with potter's clay until it forms a thin coating, after which the sawdust and paste will adhere firmly. It is very simple to apply; any ordinary mason with a small trowel is all that is necessary. Lay on five successive coats one fifth of an inch thick, each layer making, when finished, one inch thick. Let the pipes or other objects to be covered be kept warm by the aid of a little steam, and let one coat be perfectly dry before applying a second. Should the pipes be outside, exposed to the open air, give them three or four coats of coal tar to make them waterproof, but if inside a building it is not necessary. It is well to pass the sawdust through a riddle, to cleanse it from the coarse fragments of wood which are always to be found among sawdust. There is no contraction in drying the composition, therefore no leakage. Steam pipes so covered, the correspondent believes, lose less heat than when covered by any other patented process sold for that purpose. It is much less expensive, and much more efficient. The sawdust is to be found in most factories, scarcely of any value. With 1 cwt. of flour (about $3.75 worth), he says he can cover as much surface as formerly with $200 worth of the composition he was then using, which cost him at the rate of 75 cents or $1 per cwt. Its lightness renders it still more valuable for such purposes. There is very little expansion or contraction in the pipes, being well protected; therefore no leaky joints.—*Textile Manufacturer.*

A NEW AXE.

Mr. John O. Rollins, of Truckee, Cal., has patented through the Scientific American Patent Agency an improved axe, having detachable bits that may be readily interchanged and securely attached, so as to admit the use of one axe with thick or thin bits, for different purposes, and the replacing of dull bits by sharp ones.

The body, A, may be made of cast iron if desired, which admits of cheaper manufacture. The ends of the body are provided with tapering grooves, or with beveled edges, to which the corresponding beveled bits are fitted, both methods being shown in the illustration. The middle part of the axe body is centrally recessed back of or extended beyond the slightly inclined side parts, the bits being in the same manner made with a central extension or recess, so as to be connected to the axe, and thereby protected against lateral displacement.



When the bits are placed in position, they are locked against displacement in the longitudinal direction of the axe by rivets, C, of soft metal, that are driven in tightly to retain the bits securely on the axe. The rivets may be easily removed by a steel punch for the purpose of replacing dull or broken bits, or inserting bits of different size for different work, as required.

Spurious Flowers of Sulphur.

Mr. Hanks recently exhibited to the San Francisco Microscopical Society specimens of the spurious and the genuine flowers of sulphur for comparison. The real article is obtained by subliming sulphur; and except that there is with it usually a little sulphurous acid, the product is almost chemically pure. But a great deal of what is sold as the sublimate now turns out, under the microscope, to be merely crude brimstone, ground to a powder. Instead of "flowers" it should be called flour of sulphur. The spurious article contains many impurities.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

Since my last, there have been several changes in the examining corps of the Patent Office. Dr. Jayne has been removed from the class of "metal working" to that of "agricultural products," to fill the position made vacant by the reduction of Mr. Connolly to first assistant, and Dr. Jayne's old place is filled by Mr. Church, who was formerly law clerk. Mr. Tasker, who had charge of the class of "wood-working," has resigned, and Mr. Bartlett has taken his position. This left the classes of "navigation" and "firearms" without a head; and Dr. Antisell, who many years since had charge of the class of "chemistry," but resigned during the war, has been appointed to fill this place. It is said that Dr. Antisell, in addition to the class of firearms, is to examine patent medicines, which is considered by some as rather a curious combination; but others are of opinion that the two classes will go very well together, as many of the medicines are thought to be as dangerous as the firearms, and as a parallel instance to this cite the sub-classes in charge of Dr. Wilkinson, who not only has "surgical instruments" to kill people with, but "coffins" to bury them.

In continuation of the system of surveys carried on by the government, the Wheeler expedition is about to take the field for 1877. It will be divided into three sections, one of which, to be known as the Colorado section, will rendezvous at Fort Lyon, Colorado, on the Arkansas river; a second one, the Utah section, at Ogden, Utah; and a third at Carson City, Nevada, to be called the California section. There will be six regularly organized parties prosecuting systematic surveys, the work of each one of which will finally appear in a complete atlas sheet. An additional base-measuring and triangulation party will operate in connection with the Utah section, and another special party will survey certain points in the Sierras, south of Lake Tahoe, a most interesting section in a topographical view. A distinct party will continue the survey of the Washoe mining district, while a special observer will prosecute underground inquiries relating to the disposition of bodies of ore; temperature at different levels; presence or absence of water and its temperature; the treatment of ores; and the ventilation of mines.

The official returns to the Bureau of Statistics show that, during the last month, the exports of fresh beef from the United States were 8,416,829 lbs., of a value of $821,431, and that 169,043 lbs. of mutton, valued at $17,648, were exported from New York alone. During the four months ending March 31, 1877, over 2,000,000 lbs. fresh beef and 339,002 lbs. of mutton produced in Canada were exported from Portland to England. That we may not lose this addition to our exports, nor be deprived of our own supply of this food, the State Department has addressed a communication to our consular officers in Europe calling for all the information that can be obtained in reference to the foot and mouth disease and rinderpest, and whether these diseases are likely to be communicated by the importation of dried and salted hides.

An official notification has been received by the State Department from the Chinese Government, that it has opened to American trade four more ports, namely, Tchang, Wuhu, Wenchow, and Pakhoi.

The same department has received information that the emigration from Hamburg, Bremen, and Stettin, during 1876, was 50,577, all of which, except about 5,000, sailed for this country. This, however, is a falling off from last year of about 6,000, which is attributed to the hard times.

The bids for supplying postal cards for the next four years have just been opened, There were twenty bidders, and the bids ranged from $69\frac{56}{100}$ cents to $\$1.15\frac{3}{4}$ for single tinted cards, and from $73\frac{43}{100}$ cents to $1.25 per thousand for double tints —the lowest bidder on either class being the American Phototype Company of your city. The price paid the present contractors is $\$1.39\frac{7}{8}$ per thousand, and their bid for the next four years was 75 cents. It is estimated that over one billion cards will be required during the ensuing term, which will take 3,125 tons of cardboard, and if spread out would cover 250 acres of ground. The difference between the prices on the two contracts on the whole number of cards required will amount to $701,900.

Washington, D. C. OCCASIONAL.

Compressed Air vs. Steam.

To the Editor of the Scientific American :

In a recent number of the *Iron Age*, it is stated that air compressors, now at work in some of our Western mines, yield ninety per cent of the compressing power. In other words, a one hundred horse power steam engine compresses sufficient air to run a ninety horse power air engine. If this is so, it would seem that a system of locomotives might be worked quite as cheaply with compressed air as with steam; for the reason that a stationary engine has at least from ten to twenty per cent the advantage of a locomotive in the consumption of fuel, owing to the great radiation to which a locomotive is exposed. The air locomotive has also another important economic advantage in its less costly and more durable air tank, as compared with a locomotive boiler.

A plain cylinder of boiler plate with hemispherical ends is a very simple affair, requiring no staying, and containing about three times the capacity of a locomotive boiler of equal weight and strength. A single charge of compressed air in such a tank, at a pressure of 250 to 300 lbs. to a square inch, would probably run a car load of passengers several miles on a level line. To present the case in a practical way, let the Greenwich Street Elevated Railway Company, for instance, locate a one hundred horse power air compressor and an ample reservoir at a central position between the termini of their line. The reservoir may consist of a number of cylindrical tanks with hemispherical ends, 4 feet in diameter and 40 to 50 feet long, made of the best boiler plate, so as to be perfectly safe and tight at a pressure of 300 lbs. to the square inch. Let the tanks be so placed that every part of their external surface may be easily got at for an occasional coat of paint to prevent corrosion. The expense for current repairs and for fuel for such an apparatus would be very light, it would seem, as compared with that of their present system of locomotive boilers. If the length of their line or other exigency should require the locomotive tanks to be charged at other than the central point, a three inch pipe may be laid from the central reservoir to any other point of the line desired for that purpose. The valve gear of the locomotives should be so arranged that the cylinders may be used as compressors when making stops and when going down grade.

I can see no reason why the air locomotive, in connection with the elevated railway, shall not eventually give us the most desirable and perfect system of city transit possible. No other system embraces so many excellent features as this, especially for passenger transit, namely, pure air and sunlight and a fine outlook, freedom from mud and snow, and non-interference with other travel. The reader will find an interesting and finely illustrated article upon air locomotion in the SCIENTIFIC AMERICAN SUPPLEMENT of January 1, 1876.

Worcester, Mass. F. G. WOODWARD.

The Flight of Birds.

To the Editor of the Scientific American :

In regard to the flight of birds, I think that there is no necessity to resort to such theories as the figure of 8 motion to understand how a bird flies when it beats the air with its wings. I think that the formation of the feathers, and their imbrication in the wing, ought at once explain that kind of flight. When the bird makes the down stroke, the wing offers a solid resistance to the air, and the motion imparted to the body of the bird must be upward. The wing must then be raised to come into position for another stroke. In so doing, each feather lets the wind pass through in an oblique manner, which causes them to act as sails on a windmill or on a ship, thereby propelling the bird forward. The bird instinctively knows how to direct these strokes, as it wishes to ascend, descend, or move straight forward. The effect of the down stroke can be seen when a large bird such as a turkey buzzard begins to fly in a place where there is not room for rapid headway. Each down stroke is more violent than the up one, and the body is jerked up each time.

A flying machine might be made so that the wings would have a sufficient resistance to the air to keep it up, and the propelling part could be arranged independently. But there is another mode of flight that has puzzled the minds of men. It is a remarkable thing that man has seen beyond the Milky Way, and is now studying the constituents of the sun, yet he cannot understand the sailing of birds. I have seen many attempts, but they all fall short of the mark. I have seen buzzards with outstretched wings rise in a spiral course, when it was so calm that a leaf on a tree was not moved. I have seen the frigate bird wheel in graceful curves upward when the sea was as smooth as a mirror. I have seen the buzzard sail nearly in the eye of a strong wind without any other motion being perceptible than a little balancing. I have looked down hundreds of feet on them as they sailed beneath me, and never could detect any motion of the wings. The theory of inclined planes will not explain it. I have also noticed large butterflies float about in a most heaven-like enjoyment, in some cozy opening among trees, on a fine summer evening, when there was not a breath of air, without once moving their wings, as if they were some disembodied spirits that had neither attraction or gravitation, but only will. I have seen a motion very similar to the sailing of birds in fishes. I saw a number of porpoises sailing immediately in front of the prow of the steamer. They were packed quite close together, and moved exactly as fast as the steamer. As it was necessary that they should breathe occasionally, they were continually rolling over each other to come to the surface. Sometimes half the fish would be out of the water, yet the uniform motion was kept up, and no one on board could detect any motions of fins or body to warrant such speed. There are other modes of flight such as by bats and insects, the dragon fly as an instance; but the sailing of birds is a most interesting study for philosophers, and it will be safe to say that man will never be able to put it in practice. But the knowledge may come in play in explaining some things yet in embryo.

Hagerstown, Md. JOHN H. HEYSER.

Reclamation of the Sahara.

To the Editor of the Scientific American:

Your article, in the SCIENTIFIC AMERICAN of May 12, entitled "Lands below the Ocean Level," presents a statistical discussion of present and future results of converting the great Sahara Desert into an inland sea, by connecting it with the ocean. The conclusion that the expiration of 100 years would be sufficient to convert the great desert of sand into a desert of salt is doubtless correct, on the supposition of a communication having a water discharge equal 525 times that of the German Rhine. But the construction of such a channel is practically impossible. A channel conveying, say, ten times the volume of the Rhine might, however, be possible; and from it entirely different results would probably ensue. The quantity of water delivered by such a channel would cover $\frac{10}{525}$ of the area of the desert, or about 76,000 square miles. Almost immediately upon the admission of water to the arid plain climatic changes would ensue, reducing the temperature and the rate of evaporation. As the formation of the new sea progressed, its surface and shores would become the recipients of the gentle shower and the driving storm. These causes would continue to operate with increasing force as the sea augmented in size. If we suppose evaporation to be reduced one fourth by the new conditions, and that another fourth is returned by rainfall, it will follow that a body of water would ultimately result, having an area of 152,000 square miles—that is, the area will have been doubled from these two causes—an area one half larger than that of the Caspian Sea. The presence of such an enormous body of water in the Great Desert would, we may well conceive, establish a tributary river system of its own and maintain an independent meteorological area of vast extent. Taking 15 feet as the annual evaporation (since we have supposed it to be diminished one fourth), and allowing 2 feet rainfall yearly as sufficient to insure productiveness of the surrounding desert, we shall have an area $7\frac{1}{2}$ times that of this new sea, or 1,160,000 square miles of reclaimed territory, to say nothing of the incidental benefits accruing to Morocco, Algeria, and Tripoli, and possibly to Egypt and Nubia also.

As to the stability of the new condition of things, no present fear need be entertained. For, since 525 times the flow of the Rhine would require 100 years in which to fill the great Sahara with a deposit of salt, the proposed 10-Rhine channel would occupy 5,250 years in accomplishing the same end. Indeed, it is doubtful if a much longer period would accomplish it. For it must not be forgotten that a sea *fauna* and *flora* would be developed, capable of converting a very large amount of salt into organic compounds, thereby eliminating it. Moreover, the consumption by humanity and the surrounding animal life would effect a not insignificant postponement of the supposed final result.

Platte City, Mo. R. T. ELLIFRIT.

A Fire Escape Invention Wanted.

To the Editor of the Scientific American :

Cannot some ingenious Yankee invent a wire bed bottom, that will form a spring bottom when on the bed, and which can, when necessary, be unfolded to form a ladder of any required length, say for one, two, three, or four stories of a house? It would be of little use unless it was so simple as to require no skill to operate it; and it should have one end attached to the bedstead, so that the occupant could throw off the bed clothes, throw the wire ladder out of the window, and go to the ground.

Beaver Falls, Pa. J. E. EMERSON.

Sheep Farming in California.

It is estimated that from one half to two thirds of the sheep in the State have perished from starvation. The loss of cattle is not so large, as they were taken to the mountains in time. Dr. Swain, of Watsonville, recently started for the mountains from Fresno, with over three thousand sheep, and the lifeless carcasses of over twenty-five hundred of them now mark the route taken. The doctor says that unclaimed dead and dying sheep cover the plains, and hundreds of sheep and lambs fall into line behind the wagon of the traveler, and follow, in the hope of getting a morsel of hay. One man from the San Joaquin Valley lost every sheep he had—eleven thousand—during a storm, and went home a penniless man. Another, an Italian, thought he could save the cost of ferrying his sheep across the Tuolumne River by swimming them, and eight hundred were drowned in the attempt. Another man east of Visalia, despairing of ever getting his sheep to where there was feed, turned twelve thousand out to starve. If he undertook to drive them to the mountains many of them must die of starvation before reaching there, because there is no feed on the way; and then, when the mountains are reached, all the good feed is already taken up by men who hold possession, shot gun in hand, and who are desperate enough to fight to the death. There will probably be a good many cases of bloodshed and death in the mountains this summer, and many stock men will mysteriously disappear to return no more.—*Watsonville (Cal.) Transcript.*

Patent Office Publications in England.

The English patent office authorities have determined to discontinue the publication of the abridgments of specifications, in many senses, the *English Mechanic* thinks, the most valuable productions of the office. Having introduced a "cheap and nasty" style of printing specifications and drawings, they are anxious to save a few more pounds to add to their clear income of $500,000 per year. To remedy the difficulty pointed out by the judges, namely, the impossibility of deciphering the drawings now produced, full sized copies will now be supplied.

Laying Water Pipes.

When water pipes are laid at an inclination either above or below the horizon, a correction will have to be made in estimating the supply, by adding or deducting $\frac{1}{100}$ of an inch to or from the initial pressure for every foot of fall or rise in the length of the pipe.—*Molesworth.*

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXVII.

PATTERN MAKING.—GEAR WHEELS.

We now approach a class of work in which the fullest amount of care and attention on the part of the pattern maker, for the attainment of accuracy, is exceedingly desirable. Patterns for wheel work, clumsily constructed, may be positively worthless, or may at least give rise to great loss of time in the fitting shop, in correcting the defects in the castings taken from them. It is not our purpose to enter into the various methods of arriving at the proper form or curvature that is to be given to the teeth, as that is a subject quite extensive and a study in itself. What more particularly concerns us is the general construction of the patterns from designs furnished.

Gear wheels are of two kinds, spur and bevel, the former for transmitting motion when the shafts are parallel, and the latter to be used when the shafts are inclined to each other. When the teeth of a bevel wheel are inclined at an angle of 45° with the axis, that wheel is called a miter. Skew bevels are wheels suitable for shafts that are inclined to each other and are not in the same plane. Pinion is a distinctive term, applied to the smaller of a pair of gear wheels when there is a great disparity between them; or it may mean generally a small gear wheel.

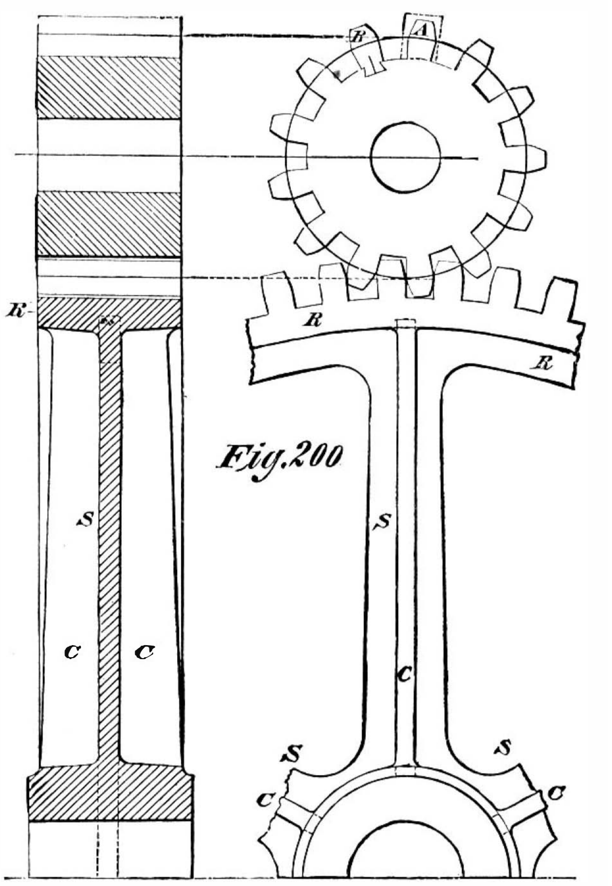


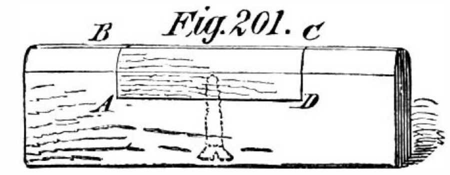
Fig. 200

Fig. 200 is a plan and section of the pattern of a spur wheel and pinion, such as is usually supplied to workmen. The plan exhibits the form of the teeth and pitch, with the size and number of arms. The sectional view shows the breadth of face, depth of hub, and ribs on the arms. In the construction of gear wheel and pinion patterns, the particular method to be adopted, as also the material to be used, will depend upon size and the service expected to be got out of the patterns. Mahogany, dry and straight grained, is an excellent material for wheel patterns; but for large work it is too costly. In some cases the teeth are worked in mahogany, and fixed to a pine body; in the majority of cases, however, pine is the only material used. The pinion may be carved out of one piece, or it may have the teeth attached to a hub; and if the latter, then the teeth may be held by dovetails, or they may be simply glued or nailed. If the pinion is so deep in proportion to its diameter as to be strong enough, and not more than 5 or 6 inches diameter over all, it may be cut from the solid; in this case, the grain of the wood must lie in the direction of the teeth. For turning the piece, we must use a chuck or face plate smaller than the pinion is at the bottom of the spaces, so as to be able to trace circles on both sides by the motion of the lathe; if such a face plate is not at our disposal, we may bore a hole in the piece to be turned, and fit to it an arbor of hard wood. Having turned the pattern, trace upon it very fine circles to indicate the pitch line, the line for the roots of the teeth, and (if required) circles for the centers used in tracing certain peculiar forms of teeth. All these circles are to be traced on both sides of the pattern, and draft is to be allowed by making the circle for the roots of the teeth a little smaller on one side than on the other, and also by turning the piece slightly taper. The pinion is now to be pitched out, on one side, very accurately; this is sometimes a matter of no small difficulty, for, having passed round with the compasses a few times, the points are liable to slide into previous impressions, giving rise to error. For this reason the pattern maker does not allow the points of his compasses to fall where he intends the center of the teeth to be, until he has obtained the correct division, which is known by the compass point, after having made the tour of the circle, falling exactly into the starting point. He now proceeds to lay down the centers of the teeth, and to delineate their size and form; then, by squaring across the face, the points of the teeth are transferred to the other side; the teeth are then outlined on that side and the intervening spaces cut away exactly to the lines.

For a large-sized pinion, the usual method is to build up a hub or body with quadrants breaking joint at each course or layer; the body is then turned, and the circumference pitched off to the required number of teeth. Blocks of hard or soft wood, planed nearly to the size of the teeth and hollowed on the side that goes next the body, are to be glued on and set to the lines made on the surface of the body when it was pitched off (see tooth marked A, Fig. 200). When the glue has properly set, the whole is replaced in the lathe, and turned off, the same as for a solid pinion; the lining-in will also be a repetition of the process above explained. Another method is to fix the teeth on dovetails, as at B, Fig. 200; but as this is very seldom adopted for spur pinions, it will be more in place to describe it when dealing with bevel gear.

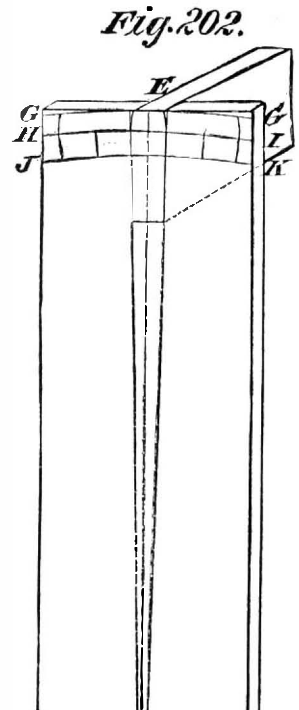
We now proceed to the construction of the wheel, which in our illustration has six spokes or arms, marked S; the rim, R, must of course be built up in segments; and when we have reached to the height of the top of the flat arms, we should turn the inside to the finished size, and cut in the arms, as shown in Fig. 200, the rest of the building can then be proceeded with. To avoid here useless repetition as to the details observed in building or in preparing the arms, the reader is referred to the SCIENTIFIC AMERICAN of January 20, 1877. Having turned the body of the wheel both inside and out, we proceed to attach, on each side of the arms, a hub, so as to form the whole hub as in Fig. 200; the ribs, C, are then fitted, and lastly we complete the body by filleting the corners. For the teeth there is but one method that is usually adopted, and that is to form them in a box as follows: Plane a piece of hard wood, as in Fig. 201, some five or six

Fig. 201.



inches longer than the teeth, and about three inches wider; the thickness is not to be less than that of the tooth at its thickest part. The ends of this piece must also be planed; from the edge, B C, gauge the line, A D, the required depth of tooth. Lay off, about in the center of the piece, the distance, B C, equal to breadth of face of the wheel, and make two saw cuts, B A and C D. Let this piece be now let into a piece of planed board, Fig. 202, which is an inch or so longer than the radius of the wheel at the tops of the teeth. This piece is to fit tightly into the mortise, which is made equally on each side of a center line on the board. Take now in a trammel the radius of the wheel at the top of the teeth, and mark off, from the outer edge of the hard wood box, the distance, E F, on the center line of the board. The point, F, represents the center of the wheel. Take the radius of the wheel at the pitch line, and also at the roots and points of the teeth; and with these distances describe the arcs, E G, H I, J K, and such other arcs as may be necessary, on which to take the centers for describing the correct form of the tooth. Complete the delineation of three teeth, or at least the center one, which will be upon the hard wood box; reverse now this box, and draw the outline of the tooth upon the other end of it; remove the piece from the mortise, and plane off to the shape of the tooth as drawn; remove the portion, B A D C, and the box is ready for shaping teeth in. Such teeth during the process are held by the screw shown.

Fig. 202.



Select for the teeth lumber very straight in the grain, and rip off a number of strips about two or two and a half feet long, of a width and thickness, when planed, slightly fuller than the required teeth, and hollow one edge to fit the curvature of the rim of the wheel. Saw the strips into pieces a trifle longer than the teeth, and plane the ends so that, when finished, the length of the pieces is exactly equal to the breadth of the rim; this latter process is most rapidly performed by placing some eight or ten side by side in a frame, and, if necessary, tightening them by a wedge and nipping in the vise (see Fig. 203). The frame must be equal in width to the length it is required to make the pieces, and care must be taken not to diminish this width, as is sometimes done. In planing a number of teeth, it perhaps is as well to blacklead the frame where it is apt to be planed; this will at least

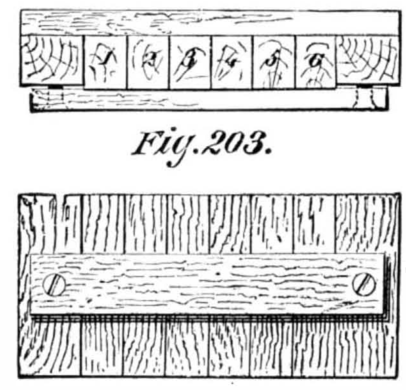
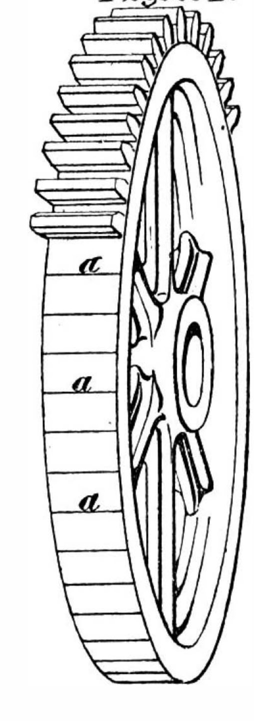


Fig. 203.

show when damage has been done. The blocks are now severally shaped to the proper contour in the box, Fig. 201, particular attention being paid not to shave away the box in shaping the teeth; for this reason it is well to have an extra plane, very finely set, to finish with. The rim of the wheel having been divided according to the number of teeth required, and lines squared across its face, at *a*, Fig. 204, the finished teeth are glued on exactly to the lines. Only a few spots of glue should be applied, so that little or none may exude and hide the line that we pose the teeth by; when the glue has perfectly set, the teeth should be additionally secured by nails. If the above processes are followed up with proper care, the teeth will all be found evenly set around the wheel; nevertheless, it is only right to verify their position with a pair of callipers while the glue is yet soft.

Fig. 204.



Very large wheels, or even those of moderate size when difficulties of transportation are anticipated, are made by bolting together a number of sections. A section usually consists of an arm and two equal portions of the rim, one on each side of it, so as to have a joint midway between each pair of arms. However, this may be one thing that must be observed, namely, to have the joints always in the center of spaces; therefore it is sometimes necessary to employ unequal segments or sections, in which case the pattern is made to the longer segment; and when these are cast, the flange is moved to suit the shorter one, and the superfluous teeth are stopped off in the sand. This saves cutting the pattern, which remains good for other wheels when required. The extremities of the arms, which are to be screwed to the hub, are provided with flanges for this purpose, the hub being flattened to accommodate them. A great deal of nicety is required in constructing wheels on this principle, as the spaces between the teeth at the joints must be neither wider nor narrower than at other parts.

Killed by Lightning.

Recently, during a severe lightning and thunder storm, at Newberne, N. C., three young persons, Isaac Richardson, aged 20, Eliza Collins, 20, and Laura Williams, 19, were struck by a heavy discharge of electricity, and instantly killed. Richardson was escorting the two girls, arm in arm, from church to their homes; and as they neared Queen street, a gentleman, who was but a few feet behind, saw them fall as the flash struck them. The coroner found the lifeless bodies lying side by side, with arms still locked. At the time of the accideut they were walking under a steel-handled umbrella, which was found lying upon the ground near the bodies (the cover partially burned), and which, undoubtedly, was what attracted the electric discharge.

Strange Electric Phenomena.

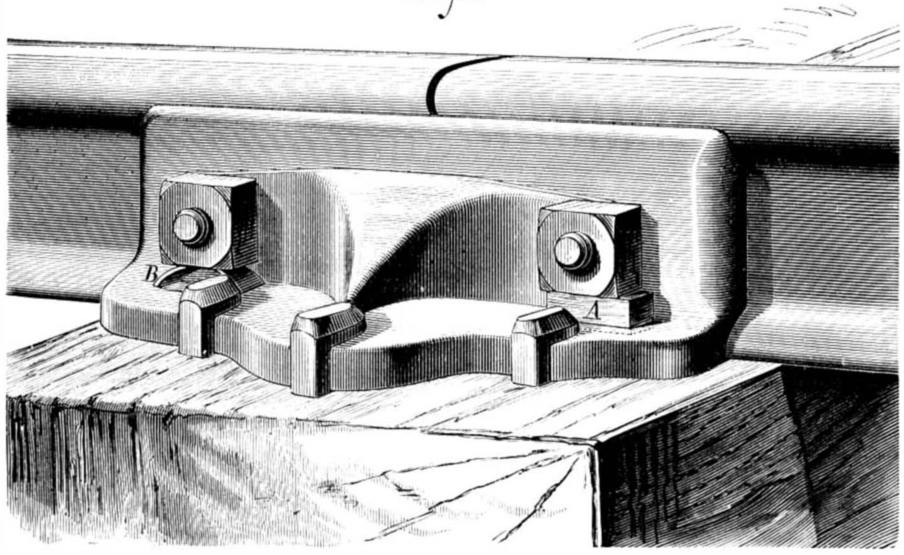
The city was interested, last evening, by the appearance on C street of a strange phenomenon. At first it had the appearance of sparks of fire coming up through the pools of water beside the street. These sparks seemed to explode on reaching the surface, in many instances producing reports loud enough to be heard across the street, and being accompanied by a little cloud of smoke, and emitting a decidedly sulphurous smell. It was noticed that the phenomena occurred only on one side, under the telegraph wires. The sparks seemed to be caused by drops of water falling from the wires of the telegraph, which exploded when striking the pools of water. This solution was seemingly confirmed by the fact that when the wires became dry the phenomena ceased. It still remains to be explained, however, why, under the circumstances, such results should follow the falling of the water drops from the wires.—*Virginia City Enterprise.*

IMPROVED RAILROAD JOINT AND NUT LOCK.

We illustrate herewith a novel railroad joint and nut lock. The object of the device is to support the ends of the rail, keeping them from spreading or turning over, and at the same time furnishing abundant material opposite the joint to compensate for separation of the rails. As the appliance is made to fit closely, two bolts are done away with. The inventor states that the joint would be safe without any bolts on the same section of rail. The nut lock provided is cheap and simple, and may be either a wooden or iron key, or a spring, placed as described further on.

The shape of the device is clearly shown in Fig. 1. As the sectional view, Fig. 2, indicates, it is especially well adapted to the old pear-head rail, a form which has gone almost entirely out of use from the fact of its being too low to admit of fish plates and bolts, as commonly employed. The inventor considers that there is no better shaped rail than this, both for durability and strength; and he claims that, in connection with the joint here described, the pear-head rail will be as smooth to ride over as any of the fished rails. The engraving shows that the pear-head rail, being nearly an inch lower than the ordinary T rail, the leverage will be much less. The inventor further adds that a mile and a half of track, provided with his joint, has been laid, and that the riding thereon is exceptionally smooth. It is not deemed necessary to minutely describe the form of the invention, as it is plainly apparent from the engravings. It is moulded and matched to the rail. It requires no spikes in the flange of the rail, which, with the ordinary fish joint, are very necessary to keep the rail from creeping. In this way the full strength of the flange is retained. The nuts are locked by driving under them a wooden or iron key, as shown at A, Fig. 1, the same fitting down into a channel in the brace, or by adapting a steel bent spring, as shown at B. This device is applicable to ordinary fish joints by having a small projection rolled on the outside plate to hold wooden plugs or keys.

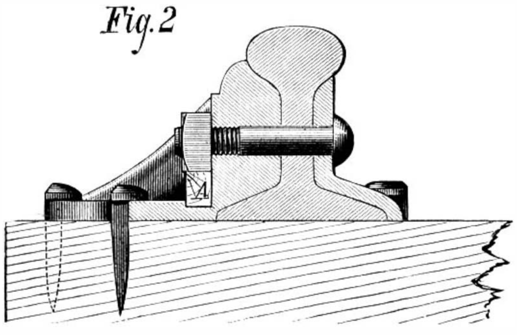
Fig. 1



NICHOLL'S RAILROAD JOINT AND NUT LOCK.

Patents for both brace and nut lock pending through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. T. J. Nicholl, chief engineer, Gilman, Clinton, and Springfield Railroad, Springfield, Ill.

Fig. 2

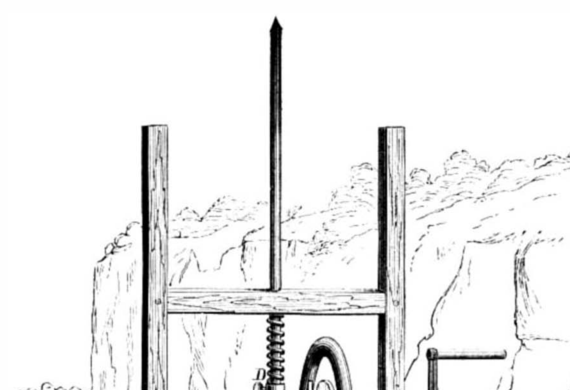


The Telephone.

New facts are discovered in the practical use of Professor Bell's speaking telephone much faster than theories can be framed to meet them. At present he uses only permanent magnets in operating the instrument; there is no battery used at all to give the current, it being obtained solely from ordinary and not very large horseshoe magnets wrapped with fine wire near each of the poles. Strangely enough, the magnets work equally well, no matter which pole of either magnet faces the other in the circuit. Instead of the usual arrangement of poles, + —, + —, these may be placed — +, + —, and yet serve the purpose of the telephone completely. Great electrical resistance, such as that caused by the interposition of 16 persons holding each others' hands as part of the circuit, interferes little with transmission. As the resistance is in such a case nearly twenty times that of the Atlantic cable, there seems to be reason for the hope that the sound of the human voice may be readily transmitted between Europe and America. The Bell telephone is strangely oblivious to some kinds of defective conduction and sensitive to others. Thus wet weather, which interferes with ordinary telegraphy, has no perceptible effect on the telephone; but imperfect joints uniting the lengths of wire are a grave impediment to the working of the new instrument. Three curious sounds are heard in the telephone when used with the ordinary wires between cities; these sounds are fainter than those which the instrument specially transmits, and make a sort of undertone of sound. The most distinct of the three is the ticking of Morse signals and the like. These can sometimes be distinguished as the signals of separate letters and words, but in general they are confusing by their number. They are produced by the vibrations of the telegraph poles from all the other wires that may be fastened to the poles that carry the telephone wire. There is a low crackling sound which is believed to be produced by the rubbing of imperfect or rusty joints of the telegraph wire. There is also a faint, continuous, bubbling sound, for which no satisfactory explanation has yet been offered. The Mechanics' Institute of San Francisco sent a gentleman to Professor Bell to induce the latter to apply the telephone in mines, so as to give prompt and complete communication throughout the mine and with the surface. The ordinary telegraph does not at present work well in the majority of mines, for various reasons. But to that, and many similar applications for the use of the telephone, though backed by most liberal offers, Professor Bell has invariably replied that he has not yet finished his experiments nor ascertained all the conditions necessary to the faithful service of the instrument. Nevertheless, he has one in constant use, connecting the workshop of some makers of electrical instruments with his own laboratory, and "chin-music" travels over the intervening half mile of wire without difficulty or mistake.

MERSHON'S IMPROVED ROCK DRILL.

In the accompanying engraving is represented a novel method of operating rock drills, enabling the same to be driven more rapidly and with greater facility than is possible with the usual sledge hammers. It also saves the labor of the man ordinarily required to hold the drill upright. The mechanism consists in a strong frame, through boxes in the cross beams of which the drill slides. One end of a short shaft is journaled into the frame, and the other in brackets. Upon the inner end of the shaft is a disk, A, in which there is an arc-shaped slot. In the slot is journaled a roller, which is concave in the direction of its length. B is an arm that projects from a ring which encircles the drill, and passes through the slot in disk, A. The brackets that support the inner end of the shaft are of such size as to come wholly within the slot, so as to allow of the rotary motion of the arm. A block, C, is secured to the lower cross timber to receive the ring of the arm, B, at the lower portion of its stroke. The drill point is enlarged and made V-shaped, so that the sharp edges of the V trim the sides of the hole. A spiral spring surrounds the drill bar, and is suspended directly under the upper crosspiece. This spring is compressed by the fixed collar, D on the bar when the latter is raised.



The disk shaft is turned by an ordinary crank, or it may be connected with any convenient motor. The mode of operation is as follows: As the disk is rotated, the arm, B, is carried upwards by the roller; and as the arm clamps the drill rod on being raised, it carries the latter with it, compressing the spring, and at the same time turning the rod through a part of a revolution. When the roller comes directly over the shaft, the arm is released, and the drill rod and arm fall together. As the ring of the arm strikes the block, C, the drill rod is entirely released, and is thus allowed to make a full blow upon the rock, the effect of which is increased by the expansion of the spring. Each time that the drill is raised, it is automatically turned, so that its cutting edge is constantly being shifted to new points in the rock.

Patented May 1, 1877, through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. A. J. Mershon, Warsaw, Ind.

California Timber.

The sugar pine of California occupies the same place that white pine or cork pine does here, and is about equal to it as finishing lumber. It is used almost exclusively for sash, doors, and inside blinds. For all uses where a soft, white, straight grain is required, there is no wood on the slope equal to it. The heart is durable for shingles, crossties, and the like. Shingles made from heart sugar pine are free from some of the objections attaching to those made from redwood.

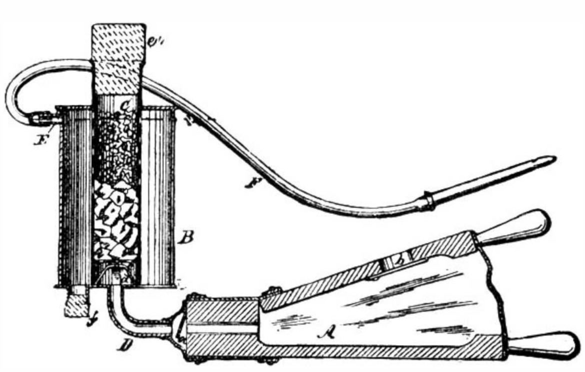
Yellow pine is used in the place of the sugar for some purposes; it has a soft, white and even grain, but works harder and is a firmer wood. Much of it resembles sugar pine so closely as to be barely distinguishable. Some of it is as handsome as many of the ornamental woods. For building lumber and fencing it is preferred to sugar pine.

Spruce, which is sometimes called red fir, is a strong timber adapted for joists and scantling, and all work requiring strength and durability. It stands exposure to the earth and weather very well and resembles Puget Sound lumber quite closely; it makes good plank for sidewalks, platforms, ship plank, car floors and frames, and similar work.

The fir is a white, close-grained wood, free from pitch or odor, useful for ceiling, scantling, and wainscoting, and makes good box lumber.—*Northwestern Lumberman.*

A NEW FUMIGATOR.

Mr. George T. Blanchard, of Plymouth, Me., has patented through the Scientific American Patent Agency, April 24,



1877, the improved fumigator herewith illustrated, which is mainly designed for use in killing lice and ticks on sheep and other animals, and also in destroying insects that infest shrubs and plants.

A is a bellows of ordinary construction, having the valves *a b*. B is a chamber containing a central perforated tube, C, in the bottom of which is placed a perforated grate, *c*, which is supported by the curved strips, *d*. A pipe, D, connects the lower end of the tube, C, and the bellows, A. The upper end of the tube, C, extends above the top of the chamber, B, and is stopped by a cork, *e*. An aperture is made in the bottom of the chamber, B, which is closed by a cork, *f*. A nipple, E, projects from the side of the chamber, B, for receiving the flexible tube, F, which terminates in the nozzle.

The manner of using the fumigator is as follows: A burning coal is placed on the grate, *c*, and the tube, C, is wholly or partly filled with fumigating material, such as tobacco or sulphur, and is stopped by the cork, *e*. The bellows is worked, and the smoke issues through the perforations of the tube, C, into the chamber, B, where it is cooled, and whence it passes, through the flexible tube and the nozzle, to attack the insects.

Ashes and dust that accumulate in the chamber, B, may be blown out through the aperture in the bottom by removing the cork, *f*, and working the bellows.

Foresite.

A new silicious mineral, found at San Cero, in Italy, has received the name of foresite in honor of the mineralogist, Rafael Fores. It occurs in granite, along with tourmaline, felspar, stilbite, and desmin, and crystallizes like the latter. Its composition is as follows: Silica, 49·96 per cent; alumina, 27·40; lime, 5·47; magnesia, 0·40; potash, 0·77; soda, 1·38; water, 15·07.

A SNAKE-EATING FROG.

Mr. C. F. Seiss, of Philadelphia, Pa., writes as follows: "It is a well known fact that many serpents subsist almost entirely upon frogs, but I never knew of frogs attempting to devour their common enemy, the snake, until I myself witnessed it. Last autumn I had in my vivarium a female shad frog (*rana halecina*, Kalm), a young bullfrog (*rana Catesbiana*, Shaw), and also two male marsh frogs (*rana palustris*, Le Conte). One morning I introduced to them a De Kay's brown snake (*Storeria Dekayi*, Holbrook). The bull and marsh frogs were much terrified at the appearance of the snake, and leaped wildly about, hiding at last under stones in corners as far removed from the snake as possible. Not so, however, with *halecina*. She did not, if I may use slang, 'scare worth a cent,' but looked upon the sudden appearance of the snake as a matter of course. The snake, happy at being released from the small dark box in which it had been confined, began moving about quite briskly. It at length crawled too near *halecina*, who with her tongue instantaneously seized it by the head, and began swallowing it with rapid gulps, until six inches of the snake had disappeared in her now distended abdomen. At this moment the snake had the appearance of an immense tongue, which the was frog slashing about most energetically. Not wishing to lose the snake, it being the most valuable of the two reptiles, I endeavored to force the frog to part with the snake, by tapping her smartly with my lead pencil. This had not, however, the desired effect, but I was forced to grasp the frog in one hand, and the snake in the other, and thus draw the snake from its unpleasant situation. The snake acted as if partially blind or bewildered after its removal, but otherwise seemed none the worse for its five minute trip around the frog's stomach. *Halecina* made two more attempts to swallow her fellow prisoner the snake; both times she was caught in the act and frustrated, and it is without doubt, she would at length have succeeded, had I not adopted precautionary measures. The above-mentioned snake was twelve inches in length, and the frog, from nose to vent, two and a half inches. Previously, this same frog had swallowed a live brown Triton (*desmognathus fusca*, Rafinesque), over three inches long. I will presume the frog mused thus: 'I will be compassionate toward you, poor Triton, and end your sorrowful longing for liberty'—and swallowed him!"

A BEAUTIFUL FERN.

The *Gleichenia dicarpa*, which we illustrate herewith, is an exquisite fern of the natural order *polypodaceæ*. It is, we believe, a native of New Zealand; and it is a highly ornamental addition to the shrubbery and the fern house. It is of a rich, dark green color, the spores being brownish yellow. It grows well and flourishes in a peaty or loamy soil. It can be easily propagated by divisions of the roots.

Botanists recognize as many as eight sub-orders of ferns, the *polypodaceæ* being known as the true ferns. This class includes the great majority of those with which we are familiar in the wild state or under cultivation. As many as 3,000 different species of ferns have been enumerated. In the earlier geological ages, ferns formed an important part of the vegetation, as may be seen by studying the coal formations; and they are found in our days in all parts of the world. One peculiarity of the genus is that many species flourish best when secluded from the air; and for this reason the Wardian case was designed especially for their cultivation, and has become one of the most popular and beautiful of household ornaments.

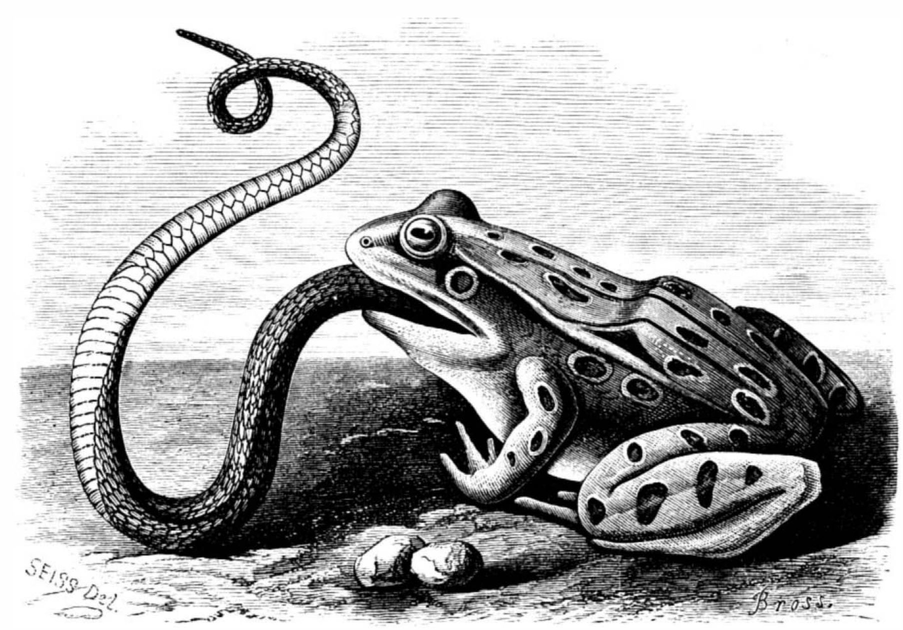
Purification and Uses of Petroleum.

M. Masson, druggist, of Lyons, France, has succeeded in removing the disagreeable odor of petroleum by the following process: Into a vessel containing 225 lbs. of petroleum are separately introduced, by means of a long funnel, 2 ozs. each of sulphuric and nitric acid, and 1·1 lbs. of stronger alcohol are carefully poured upon the surface of the petroleum. The alcohol gradually sinks to the bottom, and when coming into contact with the acids heat is developed and some effervescence takes place, but not in proportion to the quantity of the liquids. Ethereal products of a very agreeable odor are formed, and the substances thus treated acquire an analogous odor, at the same time becoming yellowish in color. The operation lasts about an hour, after which the liquids are thoroughly agitated for some minutes with water, and after resting for eight or ten hours the purified petroleum is drawn off. The lower stratum, which is a mixture of the acids, water, and alcohol, may be used for deodorizing the heavy oils of petroleum, by agitating them well for twenty minutes, and, after twelve hours' washing the oil twice with milk of lime, to remove the free acids. It will then have the same, but a weaker odor, as the light petroleum first treated, and answers well for lubricating purposes.

Petroleum thus purified may be used in pharmacy for many purposes. All the tinctures for external use may be prepared with it, like the tincture of arnica, alkanet and camphor; it may be used for dissolving ether and chloroform, like alcohol, and, combined with fats or glycerin, promises to be of great utility in the treatment of skin diseases, etc. The alcohol used in pharmacy might be replaced by this purified petroleum.—*Répertoire de Pharmacie.*

Woodpeckers.

N. O. says, regarding a statement that woodpeckers never make incisions in the bark of trees for the purpose of sucking the sap, that woodpeckers proper, as well as a species called sapsuckers, tap beech, cherry, wild cherry, sugar maple, and almost all smooth-barked trees. They bore holes ½ or ¾ inch apart, horizontally, round the tree or its limbs; these holes are an inch deep sometimes, as many as 50 having been seen in a row.



THE SNAKE-EATING FROG.

A Disastrous Launching.

A disaster which resulted in the killing of six men and the wounding of several others occurred during the launch of the iron steamship Saratoga, at Mr. John Roach's shipyard, in Chester, Pa. The men were engaged in knocking the blocks from under the keel of the vessel, and failed to hear the warning to come out, when the ship began to move. Before they could escape, they were caught among the timbers and terribly mangled as the vessel passed over them. Mr. Roach has launched some forty ships, and hitherto without accident.

GLEICHENIA DICARPA.

A Museum for Working Men.

Mr. Ruskin has opened near Sheffield, England, a museum for working men. It is the first school established under the St. George's Company for the working men and laborers of England, to whom the *Fors Clavigera* is inscribed; and as soon as he had selected the site Mr. Ruskin called some of the Sheffield men together and explained to them the reasons of his choice. He was well pleased with the workmen, spoke to them in the most familiar and friendly strain, and remarked that he had come to learn and not to teach. Having found they appreciated the boon he was about to confer upon them, he has sent to the museum many rare and interesting objects. On his paying a second visit to Sheffield, several working men who had embraced the doctrine of Robert Owen were anxious to obtain an interview with him, especially as he was reputed to be of an exceedingly amiable and affable disposition, and to hear his opinion as to the feasibility of establishing a co-operative village, consisting of houses, works, dining and lecture hall, library, etc., and surrounded with plenty of fresh air and pure water. Out of the funds of St. George's Company he has now purchased at Abbeydale, Sheffield, a beautiful estate of thirteen acres, at a cost of altogether $11,000, and has expressed his willingness to accept his co-operative friends as tenants until the annual interest they may contribute shall have cleared off the capital; that the estate is to be known as Equality Country, that twelve families have united in the undertaking, and that all their earnings will be thrown into a common stock, are matters of surprise to those who have taken a leading part in the movement. At most two families will live on the estate until it is known that the scheme is a success, the object of its promoters being simply to carry on the boot and shoe making trade on co-operating principles, in antagonism to the modern system of producing, by means of machinery, cheap and nasty goods; and if in this they succeed, they may gradually increase the number of their dwellings and form the whole into a co-operative village. The garden produce will be simply to meet their own requirements; but in whatever direction they may extend their present programme, Mr. Ruskin has not been asked to furnish them with the requisite means to carry out the movement.

Professor Bell's Talking Telephone.

A correspondent asks: "Do you think that the telephone will take the place of the telegraph now in use?" As this question is one which a great many are now asking, we would say that we do not. It may perhaps supersede the Morse system to some extent for private lines and the like, and, possibly, may be utilized somewhat in forwarding press reports; but for regular commercial telegraphing, it does not appear to us to possess, as it now stands, any advantages. In the first place, messages would require to be taken down in short hand by the receiving operator, and afterward copied in long hand; and we all know the liability to error, not to speak of the great delay of such a system. Then, again, while "Auld Lang Syne," "Home Sweet Home," or anything with which we are perfectly familiar, could be very easily recognized, it is questionable if regular messages could be "telegraphed" without serious errors occurring. It is very much like talking through the little toy "lovers' telegraph," or an ordinary speaking tube. If great care is taken to speak slowly and distinctly, and you have an idea of what is coming, you can generally make out enough to understand what a person is talking about. But it seems to us that nobody would care to trust important messages, sometimes involving life and death, or thousands of dollars, to being sent in this manner. We chronicled, issue before last, a ludicrous mistake made in just this way. A reporter telegraphed over the police wires to the editor of a Brooklyn paper that he was at the lunatic asylum, where he had gone on business, and could not get back in time for the afternoon edition. The sergeant told a policeman to step around to the newspaper office and inform the editor that Koselowski (the reporter) was at the lunatic asylum. The policeman misunderstood the message, and reported to the editor that Cardinal McCloskey was insane, and had been removed to the lunatic asylum. It is not too much to expect that just such mistakes would constantly occur were the telephone in use for commercial telegraphy. For the above reasons we do not think that telegraphers need have any fears about the telephone usurping, to any great extent, the place of the system handed down to them by Professor Morse.—*The Operator.*

On Dyeing with Aloes.

To prepare the coloring matter of aloes we introduce gradually 10 parts of this resin in 60 parts of nitric acid heated in a water bath. When the disengagement of gas is slackened, we evaporate the yellow solution at first in the sand bath, then in a water bath, and we redissolve the residue in water, which precipitates the major part of the matter; we wash it to carry off all the nitric acid, then we dry it. The yellow, bitter matter thus obtained is entirely soluble in water, alcohol, and ether; its yield is from 66 per cent of the aloes employed. Aloes dye wool without a mordant, in shades which go up to a deep brown. We obtain mode shades very varied with mixtures of orchil and aloes; we grind up, for example, 20 parts of orchil with 1 of aloes, and we dissolve them in soda. We obtain the same varied shades by the employment of aniline colors. A mixture of aloes and soda ash dissolves in water with a beautiful purple color, which gives in dyeing fast bluish grays, analogous to those which are obtained with fustic on an indigo blue ground. We dissolve 1½ parts of aloes in water, and we add 2 parts of soda ash; after 12 or 24 hours we dye. If before dyeing we neutralize the bath, and add to it afterwards chalk, we obtain green olive shades.—*M. Victor Preston, in Muster Zeitung.*

NEW YORK ACADEMY OF SCIENCES.

A regular monthly meeting of the section on "Geology and Mineralogy" was held at the School of Mines, on Monday evening, May 21, 1877, Dr. J. S. Newberry, President, in the chair. Dr. Martin offered a series of resolutions in regard to the scientific use of the public parks, praying that they may be guarded from encroachment and misuse, that they be made schools for taste and scientific instruction, and that they be stocked with plants and animals of scientific and economic value.

Dr. Newberry exhibited a photograph of the restoration of a mammoth from Siberia. It is 26 feet long, 16 feet high, and represents an animal eight times as large as an elephant. The president also showed a new fossil from the Catskills, which seems to connect our red sandstones with the old red sandstone made famous by Hugh Miller; also a plaster cast of the new crustacean found in the upper silurian and named *cosarcus.*

The first paper of the evening, by Mr. B. B. Chamberlin, was on

SOME CHOICE MINERALS AT THE CENTENNIAL,

and was illustrated by a large number of beautifully executed water-color drawings. Among the minerals referred to were the native copper and silver of Lake Superior. Drawings were shown of calcite crystals of a delicate wine color, also of stalactites and stalagmites from the lead mines of Iowa. Arizona sent a meteor weighing 1,400 lbs., and Mexico another. Among the beautiful things there were emeralds, rubies, and crystals of corundum from North Carolina. Mr. Chamberlin also spoke of the amazon stone from Pike's Peak, Cal., and exhibited beautiful drawings of this green mineral, some specimens of which have sold for $150. He described the diamond exhibit from South Africa as exceedingly interesting, embracing both white and colored stones. In the collection sent by the School of Mines, St. Petersburgh, was a topaz 5 inches in diameter, also emerald in rock, crocoite, and other beautiful and rare minerals. In other portions of the Russian exhibit, the magnificent display of polished stones and gems, lapis lazuli, malachite, labradorite, rhodonite, etc., made a splendid display.

THE EVOLUTION OF THE NORTH AMERICAN CONTINENT

was the subject of a paper by Dr. J. S. Newberry. The speaker said that the oldest rocks we know are themselves formed from sediment deposited by the disintegration of still older rocks of which we have no trace, and which may have likewise been the sediment from a still earlier continent. Of this older continent, we know not where it was or what it was; we only know that it was large enough to form a continent from its own ruins. Its history has been obliterated. Beginning with the old metamorphic rocks, known as the Laurentian and Huronian, which extend from Labrador to the Lakes of the Woods and as far north as the Arctic Ocean, we have the oldest known form of the American continent. Since that time it has been changing form by the formation of newer rocks. Owing to the cooling and contracting of the earth, there is a continual tendency to raise the high lands higher and depress the valleys lower; while at the same time other influences are at work, grinding off the elevations and filling up the depressions. In many places we dig or bore down to the old metamorphic shales and slates, surrounded by newer rocks. There are islands of these old slates in Texas, and the Black Hills were found by Messrs. Jenney and Newton to be an island of these old rocks very much disturbed, with the slates turned up on edge. They contain characteristic shells which connect them with the Potsdam of New York. The Pacific coast is a rock-bound shore that seems totally invulnerable; but the big rollers come in and pound away at the rocks perpetually, until the rocks are undermined and fall. Finally the rocks are pulverized and carried off to be deposited in the far distant sea. This sea has taken possession at different times of different parts of the continent. Wherever there was a depression, there has been a deposit of the remains of sea fish, spines, teeth, etc., on the bed of the sea. When the sea became shallow, another series of deposits, shells, etc., was made. Thus each period left a record of the physical conditions and the kind of life that existed in the sea at that time.

By the aid of the magic lantern, Mr. Russell threw upon the screen a series of pictures showing the shape of the continent in the Silurian, Devonian, carboniferous, tertiary, and other ages; also pictures of the crustaceans, fish, reptiles, birds, and mammals that existed at each of these periods, together with ingeniously restored imaginary landscapes. This series ended with the introduction of man, the crowning glory of all. The lecture was well received and attentively listened to throughout.

What Liquor is Doing.

R. F. Mushet writes to the English press that Liquordom is killing trade, and, after mentioning the amounts spent annually, he remarks: "Now I say to manufacturers that it is all very well to reduce wages, and to economize their processes of manufacture, but unless they unite manfully, and put down the liquor fiend, he will crush them all. Besides the nine hundred and forty millions actually paid in the past seven years, the effect of swallowing the Satanic solution itself has lost and cost the nation at least an equal sum. If the days' works lost through drink in the last seven years were reckoned up, the amount of wages thus sacrificed would appear incredible. If manufacturers were to unite, as one body, and refuse to employ any man or woman who frequented drink shops, and would set the example by themselves abstaining, prosperity would soon return; for a sober England could compete successfully against all other nations."

We are most forcibly reminded of the truth of all this by an item in the *Labor Tribune* of Pittsburgh, which gives an account of the number of drinking shops in Allegheny City; the editor proceeds to use the stirring words: "When will men rise above this serfdom to a soul-enslaving appetite? Reform is impossible while saloons abound. Good wages cannot be long preserved where men encourage such vices. The working classes will be compelled sooner or later to acknowledge that abstinence must be practised before there can be any permanent amelioration in their condition."—*Coal Trade Journal.*

Paper Calender Rolls.

Paper calender rolls are almost as hard as iron, but are used in preference to iron because, while they will preserve their roundness, truth, and smoothness, they possess a certain amount of elasticity, and are therefore less liable to damage from the strain due to any foreign substance passing through them. The method of fixing the paper to the rolls is as follows: Disks of thin common brown paper, of a diameter large enough to turn up to the required diameter of roll and with a hole in the center of each large enough for them to pass freely over the roller shaft, are first cut out; then a number of similar disks, with the central hole made about four or six inches larger, are made. In putting these disks upon roll shaft, four having the smaller holes are put on, and then one with the large hole, the object being to insure that the paper shall press together at and towards the outer diameter of the roll, and not bind so tightly towards the center; thus the outer part of the roll is sure to be the most compact, and therefore the most durable.

To avoid bending the roll shaft by reason of any unevenness in the thickness of one side of the sheet of paper from which the disks are cut, every other disk is turned halfway around when placed upon the shaft. When the shaft is filled with tthese disks, it is placed under a very powerful hydraulic press, giving a pressure of about 200 tons, which compresses the disks solid together without the aid of glue or other adhesive substance. The disks are allowed to stand until they are compressed sufficiently to give room for additional disks, which are added in the same manner as before, the whole being again compressed. This process is continued until the intended length of the roller is filled with compound paper, when the latter is fastened as follows: Upon each end of the roll shaft a recess is turned, and a flange, made in two halves, is bored, smaller than the recess referred to by the amount allowed for shrinkage. The outer diameter of the flange is then turned, larger than the recess cut in the iron disks or flanges forming the end of the roll by the amount allowed for shrinkage; which flange is made slightly smaller in diameter than the intended size of the paper roll. The two half flanges are put in place upon the recess in the shaft, and the end flange or disk is shrunk on over the diameter of the two half flanges, thus firmly locking the whole to the shaft through the medium of the recesses on the shaft. This locking device is placed on one end of the roll before the paper disks are placed in position; then, after the disks are compressed and while the roll is in the hydraulic press, the flanges or disks at the other end are shrunk on. This plan is the one generally adopted in this country, that employed in England being considered deficient in that it gives the paper opportunity to expand ⅜ inch in the locking process. The rolls are then turned up in the lathe with a front tool for iron, the speed being but little greater than that employed to turn iron of equal diameter. The finishing is done by an emery wheel, the same as for an iron roll.

Dyeing Straw.

The season approaches when dyers have to take in hand articles of straw, and especially hats. As a rule, straw goods should be well steeped, and then treated with alum, orchil, and extract of indigo, and yellowed with turmeric. The shades most in demand are black, brown, and gray. Black (for 25 hats): Logwood, 4 lbs. 6 ozs.; bruised galls, 17¼ ozs.; turmeric or fustic, 4¼ ozs. Boil for two hours, and then steep in a beck of black liquor (crude acetate of iron) at 4° or 5° B., and rinse in several waters, dry, and rub with a brush of dog's grass, to bring up the polish.

Gray.—This shade can be obtained only on very white straws. Steep in a bath of soda crystals to which a little lime water has been added, to causticise the alkali. The purpose of this washing is to remove all traces of sulphur from the straw. For 25 hats, take: Alum, 4 lbs. 6 ozs.; tartaric acid, 3½ ozs. Add ammoniacal cochineal and extract of indigo, according to the shade desired. By making the one or the other of these wares predominate, we obtain a reflection more bluish or reddish. A little sulphuric acid is added to the beck, to neutralize the alkalinity of the ammoniacal cochineal. The hats are boiled in the dye for about an hour, and rinsed in water slightly acidified.

Maroon (25 hats): Ground sanders, 1 lb. 10 ozs.; turmeric, ground, 2 lbs. 3 ozs.; bruised galls, 7 ozs.; rasped logwood, 24¼ ozs. Boil in a kettle so roomy that the hats may not be bruised. Rinse. Steep over night in black liquor at 3° B., and rinse in several waters. To produce a deeper black, return to the first beck, which is strengthened by an addition of sanders and logwood. Polish as for black.

Havana.—This shade, being a degradation of maroon, may be obtained by the same process, reducing the proportions by one half or one third, and omitting steeping in black liquor. The hats may be soaked for a night before dyeing in 4 lbs. 6 ozs. or 6 lbs. 9 ozs. of alum.—*Moniteur de Teinture.*

NEW BOOKS AND PUBLICATIONS.

FIRES: their Causes, Prevention, and Extinction, combining also a guide to Insurance Agents. By F. C. Moore. Published for the Continental Insurance Company of New York city.

Although this work is primarily a manual of instruction for insurance agents, and is especially intended for the employees of the above-named corporation, it embodies much that is new and valuable on the subject of fire prevention. There is of course no one class in the community who have a more direct interest in lessening the number of fires than the fire underwriters, and consequently it is to them we may look for thoroughly practical suggestions, based on the best experience and not combined with doubtful speculations. As a means of information of what is dangerous, as likely to cause fires in workshops, factories, and buildings of all kinds, how much the rate of insurance risks are enhanced by the presence of such perilous material, how to prevent fires, how to deal with them, and lastly, as a full exponent of the rights and duties of both insurer and insured, we can cordially commend this book. It contains much that we do not think has ever been published elsewhere, and it is written clearly and well.

STEAM INJECTORS: their Theory and Use. From the French of M. Leon Pochet. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

As the injector is now coming into use for other purposes than the feeding of boilers, there is a large demand for literature concerning its theory and action; and this M Pochet has done much to supply. The mathematics of the subject are exhausted in his little treatise.

ENGLISH SCIENCE LECTURES.—Messrs. Macmillan & Co., of Astor Place, New York city, are now issuing series of the lectures addressed to popular audiences which are delivered in London, Manchester, and other cities in England. We have now before us one on "the Earth's Chemistry," by J. Norman Lockyer, one on "Technical Chemistry," by Professor Roscoe, and one on "the Succession of Life on the Earth," by Professor W. C. Williamson. The names of the lecturers guarantee the accuracy and value of the information contained in the discourses; and we are glad to find that the language employed in them is singularly clear and precise, and in every way adapted to the purposes of popular instruction.

Inventions Patented in England by Americans.

From May 2 to May 7, 1877, inclusive.

CARRIAGE LIGHT.—A. H. Phillippi, Reading, Pa.
FRINGING MACHINE.—J. B. Lincoln, Providence, R. I.
LIQUORING SUGAR.—O. H. Krause, Jersey City, N. J.
PEN, ERASER, ETC.—S. C. Thompson, New York city.
PHOTO-RELIEF PLATE.—W. H. Mumler, Boston, Mass.
PLATE PRINTING PRESS.—R. Neale, Brooklyn, N. Y.
REED ORGAN.—L. K. Fuller, Brattleboro', Vt.
SHEET METAL CAN.—L. V. Sone, New York city.
VARNISH, ETC.—G Wolff, Philadelphia, Pa.
VENTILATOR.—T. W. Bracher, New York city.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Minnesota.

PATENT SEAT.—DAVID C. PRICE VS. JAMES E. KELLEY.

[In equity.—Before Nelson, J.—Decided February, 1877.]

The patents granted to David C. Price for improvements in portable show and circus seats are not infringed by the use of chair seats placed upon every alternate board of the ordinary circus seats.

OPINION OF THE COURT.

Nelson, J.:

The complainant obtained two patents, Nos. 125,329 and 134,486, dated respectively April 2 and December 31, 1872, as the original inventor of an "improvement in show and portable show seats." He also secured patent No. 163,537, to be issued to himself as the assignee of the original inventor, Wm. H. Shuey, and dated May 18, 1875, "for an improvement in circus seats." He brings suit against James E. Kelley, because of an infringement of his patents.

The complainant declares his invention, No. 125,329, has for its object "to provide an improved arrangement of seats for use in circus and other shows, the same being constructed with a view to the comfort of the spectator, while possessing the necessary qualities of security when erected, and compactness when packed for transportation." He claims as new an "improvement consisting of notched support, straps or bars, and boards and chairs, constructed and arranged as shown in a diagram;" also chairs provided with slots or recesses through which boards can pass, and "the seats be shoved along to the required position;" also "the combination, with the supports and boards, of the binding bars or straps and stakes to secure the supports."

The diagram of this invention shows the ordinary stringers used in circus and outdoor portable seats, elevated and adjusted on an inclined plane, the stringers being notched for the support of boards and elevated at the back by means of trestles. Every alternate board has a chair seat upon it, and the board immediately in front is used as a foot rest. The boards upon which are the chairs or seats, as well as the foot rests, are secured in place at each end by a zigzag-shaped strap passing from the top of each stringer over the boards to the bottom and terminating in an eye, through which a stake is driven into the ground.

In No. 134,486, every alternate board is suspended at each end from the under side of the stringer by a band of metal running the length, or nearly so, of each one, and by forming the shape of a clevis, upon which the ends of the board rest, secures it in position like a hanging shelf, and is called a foot rest. The complainant claims as new "the series of foot boards or rests, in combination with the supports (stringers) and braces" (trestles).

In No. 163,537, the invention is claimed as a "show seat consisting of the frame, the back formed of a single piece of bent wood, pivoted to the side of the frame, and jointed braces, the back being constructed to fold around and closely embrace the seat frame in order that the upper surfaces may be flush."

The defendant alleges want of novelty, denies that the patents are for original inventions, and denies that he has infringed either of the inventions and patented improvements.

It is admitted that there is no novelty in using stringers and trestles to form portable show seats, nor in making every alternate board on the stringers a foot rest; but the combination of all these in connection with a chair seat and folding-back, and straps to secure the ends of the seat boards in position, is urged by the complainant's counsel as new and patentable, and the infringement of this combination is charged.

An examination of the manufacture of the defendant shows that it has nothing in common with that of the complainant, except the notched stringers and the trestles, and the metal straps used to secure the seat boards, the space between the strap and the stringer at the notches being sufficiently open to allow the ends of each board to pass easily through.

The chair seat proper has nothing in common except a cushion. The Price or Shuey patent has an open back in the shape of a yoke, pivoted to the side of the seat, and with braces attached and jointed to permit its being folded about the seat. The Kelley seat is composed of two leaves upholstered and connected at one edge by a hinge joint, so as to hold the back when open and allow it to be folded upon the top of the seat. The hinged edges are rabbeted so that the back when open bears against the seat proper, and prevents the seat board from splitting. Price suspends every alternate board in the ordinary circus seat by a stirrup of metal fixed below the stringers for a foot rest. He is thus enabled to bring his seat boards nearer together, and accommodate more spectators with no inconvenience. The knees and feet of the person when seated, being below the seat boards, do not interfere with those seated in front.

Kelley uses notched stringers and raises his seat boards so that they have the appearance of a high bench, upon which he puts his chair seats, and then uses for a foot rest every alternate board on the top of the stringers, as in the old and ordinary circus seats. When the seat board is raised, the board in front used as a foot rest falls below the back of the seat immediately in front of it, and the persons seated do not interfere with those in front. The security and comfort of the spectators are attained by each, and the mechanism permits the seats to be packed in a small compass for transportation, and rapidly and easily adjusted, but the arrangement in each is different. The only device used by Kelley not found in the old and ordinary circus seat is the upholstered chair seat and back, and the metal strap or clamp fastened to the stringers which holds the seat board in position. Price describes this strap in his patents and claims it as new. The testimony of the mechanics and architects is, however, that this mode of securing boards or underlying axles by a clamp or clevis in a firm and fixed position is a common and ordinary device, and "is on general principle of holding stairs or steps in their place and securing windlasses," etc.

The complainant, therefore, cannot maintain his suit on account of the use of this device, and as defendant constructs substantially the ordinary circus seat, which is old and common, and upon every alternate board of which, when elevated, he puts a chair seat which is not an infringement, his bill of complaint must fall.

It is unnecessary then to examine the other issues raised by the pleadings. Decree will be entered dismissing the bill of complaint.

Davis O'Brien Wilson, for complainant
Palmer & Bell, for defendant.

United States Circuit Court—Eastern District of Pennsylvania.

PATENT TOBACCO STAMP.—LORILLARD & CO. VS. MCDOWELL & CO.

[In equity.—Before McKennan, C. J.—Decided February 24, 1877.]

Charles Seidler's reissued patent of October 24, 1876, construed to embrace the impressment of a hard or metallic label upon either the inner or outer face of a plug of tobacco.

An inventor is supposed to describe in his patent the best mode of practising his invention, but is not necessarily limited to the precise construction shown, so as to exclude a method differing from it only in a single detail, but producing the same result.

A reissued patent is not void simply because it contains an expanded claim. The inadvertence on the part of the inventor in not making such claim in his original patent is conclusively determined by the Commissioner of Patents in granting the reissue.

McKennan, Cir. J.:

This is a motion for an interlocutory injunction, to restrain infringement of the patent set up in the complainant's bill. An original patent was granted to Charles Seidler on the 12th of January, 1875, which was surrendered and reissued to him October 24, 1876. The invention is thus described:

I have discovered and successfully developed in practice a means of marking and distinguishing tobacco in plugs. I prepare labels, or distinguishing pieces of separate material, and impress them into the body of the plugs, one label into each plug, preferably putting the label under the outside wrapper, and giving it a character by raised letters or analogous devices, which is recognizable through the flexible covering. The material of which these labels are composed is preferably sheet iron tinned, cut into a circular form, and having points or prongs bent backward from their edges, and with raised or sunken letters or marks upon their upper face, to indicate the quality, origin, or trademark. Before the plug of tobacco is subjected to its final pressure, one of these labels is placed upon it in proper position, and, by powerful pressure, the prongs of the label are sunk into the tobacco, so that its face is about flush with the outer surface of the plug, and adheres firmly to it. An outer leaf of properly dampened tobacco is then wrapped around the plug, which is subjected to a powerful pressure, and the label is seen beneath this wrapper, and is rendered thereby difficult of removal.

The invention is therefore claimed under five heads, the first and third of which are:

1. A plug of tobacco having a hard label pressed into one of its faces, as specified.

3. A plug of tobacco having letters or other decorative and distinguishing marks produced on a hard metallic surface, and pressed as specified.

These claims the respondents are alleged to have infringed, and construing them, as I think they must be construed, to indicate the impressment of a hard or metallic label upon either the inner or outer face of a plug of tobacco, the fact of infringement is clearly made out, both by the affidavits read in support of the motion, and by an inspection of the tobacco manufactured and sold by the respondents.

This construction of the patent has been very earnestly contested, upon the ground that the specification describes only the mode of applying the label to the plug underneath the outer covering, and that the words "as specified," limit the scope of the claims to that particular mode, but the patentee must be understood as merely describing what he regards as the best mode of practising his invention, as the law requires him to do, and not as excluding a method different from it only in a single detail, which produces the same result, and is distinctly within its object. He claims to have discovered a new method of identifying tobacco, which consists in the attachment of a hard label to each plug by pressing it into the points or prongs which project from the under surface of the label, and thus the fundamental object of his invention is fully effectuated. When this is done the outside wrapper is applied; but the label is thus placed underneath the wrapper, not as auxiliary in any way to the specific office of the label, but avowedly only to render it more difficult of removal.

It is obvious then that to dispense with this additional safeguard, and to apply the label outside of the wrapper, does not differentiate the devices, nor does it vary the method of attaching them to the plug in any essential degree.

Of the objections to the validity of the patent but little need be said at this stage of the case.

The first of these is to the novelty of the invention, or rather that it is a double use of an old device. But it is not shown to have been used for any purpose analogous to that contemplated by the patentee, or even remotely suggestive of such use.

It was the result of considerable thought, and of careful and repeated experiments, and supplied a perfect means of distinguishing the quality and origin of plug tobacco, which had not before been furnished to either the manufacturer or consumer. Nor does the denial of its patentability seem to me to have any firmer foothold.

Simple as it is, it nevertheless involved reflection and experiment to bring it to practical maturity, and its evident utility, indicated by its prompt displacement of other identifying devices, and its very extensive use, even by the respondents, strongly attests its patentable merit.

The remaining objection, that the reissue is void, as not being for the same invention described in the original patent, is clearly untenable. The drawings in both are the same, and the specifications of both are substantially the same. They both describe, as the invention, a hard or metallic label applied to a plug of tobacco before it is subjected to its final pressure, with characters impressed upon it indicating its quality, origin, or trademark; while in the original patent the claim is limited to tobacco, to which the label is applied underneath the wrapper. To remedy this restriction, inadvertently imposed, as the Commissioner of Patents has conclusively found, the reissue was properly granted with an expanded claim, to secure to the patentee the full benefit of the invention described, but not claimed in the original.

The motion for a preliminary injunction must, therefore, be allowed.

George Harding, for plaintiff.
Leonard Meyers, for defendant.

Supreme Court of the United States.

CLOTH MARKER FOR SEWING MACHINE.—HENRY W. FULLER AND ISAAC W. BARNUM APPELLANTS, VS. ENOCH S. YENTZER AND WALTER SCATES.

[Appeal from the Circuit Court of the United States for the Northern District of Illinois.]

A patent will not be sustained if the claim is for a result, a principle, an idea, or any other mere abstraction.

Where a new combination of old elements, producing new and useful results, is patented, it is the established rule that the invention, if any, within the meaning of the patent act, consists in the means or apparatus by which the result is obtained, and not merely in the mode of operation independent of the mechanical devices employed.

Where the claim immediately follows the description of the invention, it may be construed in connection with the explanations given in the description, and if the claim contains words referring back to the specification it cannot properly be construed in any other way.

It being understood that a result is not patentable, claims which read "forming one, two, or more creases in cloth, by means of, etc.," and "marking a line on the surface of cloth or other material sewed in a sewing machine, by means of, etc.," construed to be for the described apparatus for producing the results named.

Where the invention is embodied in a machine, the question of infringement is best determined by a comparison of the machine or apparatus constructed or used by the respondent with the mechanism described in the specification of complainants' patent.

Combinations consisting of old elements are not the same when none of the devices employed in one can be substituted for those in the other, so as to render the apparatus operative to effect the described result without reconstruction and invention.

A patent may be granted for a new combination of old elements or ingredients if it produces a new and useful result; but in such case the invention consists merely in the new combination, and the patent t[illegible] is not infringed by a substantially different combination, even though it includes the exact same elements or in redients.

The rights of a patentee for a mere combination of old ingredients are not infringed unless it appears that the alleged infringer made, used, or sold the entire combination.

The substitution of a known equivalent for one of the ingredients of a patented invention is not a good defence for an infringer; but if the ingredient was a new one, or performed a substantially different function, or was not known at the date of the patent as a proper substitute for the one omitted, there is no infringement.

Decree confirmed, dismissing the complaint.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED DRAFT REGULATOR.

Thomas Baker, Albany, N. Y.—The object of this invention is to enable the fireman to control his fire, so that the heat, after the fire is fully burning, may be prevented from passing off with the products of combustion to so great an extent as it otherwise would. The invention consists in the combination of the open-bottomed case, the damper, bar, and chain, the weight and chain, the pulleys and shaft, and the chain, guard, and point with each other and with the flue of a furnace. By pulling upon the chain the damper can be raised to any desired extent, and can be secured in place, when adjusted, by passing a link of the said chain over a pin attached to the forward end of the guard. By counting the links of the chain drawn from the forward end of the guard, the fireman can adjust the damper in any desired position without leaving the front of the furnace. A steam gage is attached to the front of the boiler, so that the fireman can always see what the steam pressure is, and can regulate the damper as required.

IMPROVED DEVICE FOR CONVERTING MOTION.

Edwin Long and Louis E. Lyon, Iowa City, Iowa.—This invention relates to an improved device for converting a reciprocating into a rotary motion, and is more particularly applicable to treadles for driving light running machinery in which a number of revolutions for the flywheel are desired for each movement of the treadle. The improvement consists in a snatch block loosely connected with a reciprocating lever or bar, and having a hole or throat through the same through which one side of a band passes; which band is stretched about a driving and a tension pulley, and which snatch block has such shape of opening on throat as to seize the band when moved in one direction and to release the band, when moved in the other, back to its former position preparatory to taking a new hold.

IMPROVED ANCHOR.

Fisher A. Buck, Eastport, Me.—This invention is a novel modification of the mushroom anchor, in which the arms that branch out radially therefrom are curved upward at the ends, and provided with an inclined and tapering fluke, of circular shape, that is riveted or otherwise securely fastened to the ends of the arms. The circular fluke may be made of suitable width, so as to impart to the anchor a greater holding surface and power of resistance. The main advantage of the circular fluke consists in the fact that it will prevent the fouling of the anchor.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED AEROSTAT.

William S. Hull, Jackson, Miss.—This aerostat is designed to be used either in miniature form as a toy (being driven by a torsional rubber spring in this case) or upon a larger scale with steam, or other suitable motive power, as a flying machine. The improvement consists in the construction and arrangement of two propellers at opposite ends of a tubular frame containing the driving mechanism, the said propellers being arranged to rotate in opposite directions, and constructed each of a series of right-angled triangular blades or fans, having one side at right angles to the rotating shaft and their larger acute angles deflected away from the shaft and supported upon independent projecting arms or bars.

IMPROVED ORE WASHER.

Dexter A. Hendrick, Calumet, Mich.—This invention relates to an improved "vanning" process mineral dresser, which process proceeds upon the principle of separating the rich ore from the lighter earthy matter by reason of their different specific gravities when the pulverized material is agitated with water; the rich ore gravitating to the bottom, while the lighter earthy matter is thrown off at the top. The machine consists in a receiving pan which by a tilting motion imparts to its contents a rotary motion without revolving upon its own axis, which pan is provided with means for regulating its degree of inclination or tilt, and is supported upon or stepped in a jigger lever which is alternately lifted and allowed to drop by means of a cam or wiper wheel, so as to further agitate the contents of the pan; a revolving rake being employed in connection with the pan, which rake is always upon the high side of said pan.

IMPROVED TEETHING NIPPLE.

Charles E. Rogers, La Crosse, Wis.—This invention relates to means by which the teething of children may be facilitated, and consists in an instrumentality of peculiar form, the same being provided with a handle to adapt it to be manipulated by the child, and a nipple of such shape and length that the gums may be brought to bear upon it, while it cannot be forced too far into the mouth or throat so as to do harm.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DEVICE FOR SETTING, JOINTING, AND GAGING SAW TEETH.

Levi H. Bigelow, Fremont Centre, Mich.—In order that saws may perform their function properly their teeth occasionally require to be set, to give them a uniform inclination or angle, also to be jointed, to make them uniform in length; and when clearers are used, they require to be cut down or made shorter than the fleam or cutting teeth, between which they are located. The object of this invention is to provide a cheap, simply constructed, but efficient device, for use in performing these operations.

IMPROVED BOX SCRAPER.

John P. Tierney, Sacramento, Cal.—The knife box is made hopper-shaped. The knife or cutter fits against the inner surface of the box, so that its edge may project through the slot in the bottom; said knife is easily adjustable. A roller is added which prevents the instrument from being clogged with shavings.

IMPROVED WHEEL TIRE.

Isaac N. Pyle, Decatur, Ind.—This construction is such that the outer tire may hug the inner tire snugly when shrunk upon it, and may draw said inner tire more firmly down upon the fellies, making the entire wheel firm and strong.

IMPROVED SASH HOLDER.

Luther Jones and James Stroud, New York city.—This consists in the arrangement of two rollers at right angles to each other, in a suitable frame for attachment to the upper corners of the window sashes of cars to relieve them of friction caused by the swelling of the sash or casings when damp, or by the warping of the sash or window frame.

IMPROVED METHOD OF ATTACHING HANDLES TO CROSSCUT SAWS.

Charles A. Sands, Burlington, Kan.—This invention consists of a saw with a detachable spring guard, that serves to stiffen the back of the same, and also to cover the teeth of the same after use. It consists, further, of adjustable handles applied to face plates clamped to the saw ends.

IMPROVED METAL WAGON BODY.

Simon Peter Graham, London, Ontario, Canada.—The body of the carriage is made of sheet metal, and constructed with a flange around the bottom, which rests upon the wooden sill, and is secured to it by screw bolts. The top of the body is also flanged and attached to a wooden piece which forms the support for the seat proper. The sides and back of the body are united by a lap seam or joint which performs the function of a brace. The body is cheaper and stronger than those heretofore constructed.

IMPROVED WAGON END GATE.

Stephen D. Davis, Malvern, Iowa.—This end gate forms a box-like extension of the wagon body, and is so attached to it that it may be adjusted vertically as well as horizontally. It may be readily detached from the wagon body, and is so constructed as to support the ends of the sides of the latter.

IMPROVED LATCH FOR DOORS, ETC.

Augustus C. Woolman, Bellefontaine, O.—This latch has the form of a quarter section of a sphere, and is pivoted in a socket attached to the gate. It also has a handle which hangs vertical, so that the latch maintains a horizontal position, except when the gate is being opened or closed. A beveled catch plate is attached to the post, so that when the gate is closed the catch will strike the same and be turned on its pivot till it passes the catch, when it at once resumes the horizontal position and engages with the catch.

IMPROVED SKYLIGHT.

Joseph Henry, Chicago, Ill.—This invention is an improvement upon that for which the same party received letters patent dated March 27, 1877. It relates to constructing in one piece the head of the bar or rafter, upon which the glass rests, and in supporting the head by means of flat bolts provided with shoulders for that purpose. The invention also relates to a double gutter joint for use between the rafters, the same being constructed with a bent flange that is inserted between the panes or plates of glass.

IMPROVED MACHINE FOR GRINDING SHAVINGS.

Isaac Tompkins and Abram G. Tompkins, Brooklyn, N. Y.—This invention consists of an interior grinding cylinder that revolves within an inclosing cylinder, having a cutting surface and exit perforations, the inclosing cylinder forming a space around the inner cylinder that diminishes gradually in width. The small pieces into which the shavings are cut pass through the perforations of the outer cutting cylinder to an exterior casing, from which they are conducted to a suitable receptacle.

IMPROVED OSCILLATING CUTTER HEAD FOR FINISHING SPOKES.

Joseph R. Locke, Amesbury, Mass.—This machine is so constructed that the cutter heads may be oscillated to bring their cutters into proper position for finishing spokes.

IMPROVED BOARD LATH.

Andrew A. Smith, Boulder, Col.—The object is to furnish a lath so constructed that it will not be necessary to break joints in putting it on, which will strengthen the building, and will require less studding and less labor to put it on than ordinary laths. The invention consists in a board lath formed by slotting boards of the proper thickness with sets of slots, alternating or breaking joints with each other.

IMPROVED PLATFORM WAGON.

Ebenezer H. Booth, West Colesville, N. Y.—This improvement in the construction of platform wagons enables the draft to be applied directly to the axle, so that the wagon box can be set level. Its holds the body or box against swaying, and may be used either with or without a reach.

IMPROVED SAWING MACHINE.

George J. Kautz, Emporium, Pa.—This is an improved sawing machine, designed for use in a sawmill for cutting off slabs, edgings, and other lumber into lengths for wood, laths, pickets, etc. It is so constructed as to feed the lumber forward to the saw, and feed the saw forward to the lumber automatically. It may be adjusted to cut off the lumber in longer or shorter lengths, as required.

IMPROVED SETTING, JOINTING, AND GAUGING THE TEETH OF SAWS.

Levi H. Bigelow, Fremont Center, Mich.—By this device the cutting or flew teeth of a saw can be set at a uniform angle and jointed to make them of uniform length, and the clearers or clearer teeth can be gauged to a uniform length (but less than that of the cutting teeth, between which they are located). The device is extremely cheap, simple in construction, compact in form, and apparently adapted to operate efficiently.

IMPROVED METHOD OF MAKING WOODEN BOXES.

William Huey, Cambridge, Md.—This invention relates to certain improvements in the construction of wooden boxes, which improvements are designed more particularly for that class of wooden boxes which are stiff and rigid in shape, such as are employed for holding hats, caps, boots, shoes, thread, cotton, cigars, and all fancy articles, but which improvements are applicable to and designed to be also used in the construction of fruit baskets, crates, etc. The improvement consists in the manner of forming the bend or joint at the corners, whereby a single piece of board is made to form the several sides of the box without the trouble of measuring and fitting, and without the use of nails, screws, or dovetails for this purpose. The manner of forming the joint is to cut, by means of revolving cutterheads, preferably transverse channels across the board, and then after steaming the board to bend the same around. A peculiar form of channel which permits the successful bending of the board without breaking constitutes the main feature of novelty, which channel has straight angular sides that form a miter when the board is bent, with a curved groove at the bottom of the angular groove which affords bending room to prevent cracking.

IMPROVED STOP HINGE FOR CARRIAGE DOORS.

Charles W. Butler, New York city.—This is an improved hinge for carriage doors, trunks, etc., which stops the doors, covers, and other objects when the latter have been opened to about right angles. The invention consists in two bars hinged to each other at their inner ends, and at their outer ends hinged to the outer edges of the slotted plates or wings of a hinge.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

N. A. R. will find directions for browning gun barrels on p. 11, vol. 32. This also answers G. D. M., who can clean brass shells by the process described on p. 102, vol. 25.—M. L. is informed that a recipe for root beer is given on p. 138, vol. 31.—A. D. B. is informed that there is no simple rule for the proportions of a screw propeller. He should read the subject up in the special treatises devoted to it.—O. B. S. does not give sufficient data as to his boiler.—L. T. F. and many others will find rules for calculating the horse power of engines on p. 33, vol. 33.—H. will find directions for whitening ivory on p. 10, vol. 32.—M. W. will find directions for making hard plaster of Paris on p. 43, vol. 34. —T. J. McN. should read our article on lightning rods on p. 144, vol. 31.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—M. A. A. will find something on cancelling postage stamps on pp. 83, 135, 266, vol. 36.—M. F. F. will find directions for removing freckles on p. 347, vol. 32.—E. R. C. will find directions for mounting chromos on p. 154, vol. 27.—E. J. L. will find a description of a galvanic battery suitable for medical purposes on p. 196, vol. 27.—W. H. C., J. J. Q., C. A. S., J. D. H., I. P., W. S., I. K. B., W. L., G. N. T., N. T., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. A. asks: 1. How thick must a tube of cast steel be to hold 1,000 lbs. pressure per square inch? A. These questions are too indefinite. The thickness of the tube will depend upon its size. 2. Through ¼ inch hole, how many gallons water would be forced out per minute with a pressure of 1,000 lbs. per square inch? A. The discharge through the orifice will depend upon its shape and location.

(2) A. J. C. asks: How can I make a pattern by which to cast a cam wheel having upon its outer edge three equal eccentrics? Motion is given by two levers, one above and the other below, the levers having upon each one a roller which presses upon the outer face of the wheel, thus giving three strokes of the levers for each revolution of the wheel. A. Make the outline of the cam such that all lines drawn through the center will be equal.

(3) B. I. L. asks: How many lenses, and of what sizes and foci, are required to make a camera obscura for copying pictures? A. It requires but one, and it is not material about its size and focus. One 2 inches in diameter and of 18 inches focus will answer very well.

(4) J. B. H. asks: 1. On p. 186, vol. 36, in reply to J. N. A., you say that a horse power to 1·5 lbs. coal is among the best results. Will you state what class of boiler will accomplish this result? A. The figure represents exceptional results with marine engines having very efficient boilers, and giving a horse power with the consumption of 14 or 15 lbs. of steam an hour. 2. I suppose that the heat given up by the condensation of any given amount of steam would, if all used, evaporate an equal amount of water into steam. Is this true? And, if true in theory, about how much result in evaporation can be gotten from the condensation of a given quantity of steam? A. You will find this matter discussed in nearly any modern treatise on the steam engine.

(5) H. H. F. asks: Is the use of alum in bread and cakes, at the rate of a teaspoonful to a loaf of moderate size, injurious? A. Yes. The presence of alum in bread, in any proportion, is very objectionable.

(6) E. L. W. asks: 1. Can you inform me how metal stencil plates are prepared? A. Stencil plates are usually made of hard brass. The letters and characters, if small, are usually stamped out with suitable dies; but when large, the work has to be done by hand cutting. 2. Are they treated with hydrochloric acid? A. Not that we know of.

(7) J. D. E. asks: What are the curves and positions of the lenses of the Huyghenian eyepiece? A. There are two plano-convex lenses with their plane sides towards the eye. Their aperture is ⅓ their focal length. The field lens is of 2 or 3 times longer focus than the eye lens. Their distance apart is one half of the sum of their focal lengths: that is, if the focus of one is 1 inch, of the other 2 inches, the distance apart is 1½ inches. A diaphragm a little smaller than the aperture of the eye lens is placed between the lenses at the focus of the eye lens. For a medium power, the focus of one may be 1 inch, of the other ⅓ inch, etc.

(8) W. J. G. asks: How many lenses and of what sizes and foci are required for a photographic camera to take pictures 4 x 6 inches? A. It requires an achromatic combination of flint and crown glass. The diameter is not material, say 1 inch, with a focal length of about 8 inches. The smaller the lens, the sharper the picture.

(9) F. W. G. says: In a very severe thunderstorm last summer, a large brick house here was struck by lightning. An "American District" telegraph wire was connected with one of their boxes in the house. Parties at the house claim that the wire brought the lightning to the house. I say that the house would have been struck anyway, and that the wire was a protection. Who is right? A. It is most probable that the wire had nothing to do with the matter. A discharge which would damage the house would, in all probability, have fused the wire.

(10) P. M. S. asks: Can you give me some information about rosin oil? A. When rosin is distilled, it yields about 74 per cent of liquid distillates. The first portions are mobile, yellow, and strong smelling, and are known as essence of resin (colophonone). Later in the distillation the viscid fluorescent rosin oil (pinolin) passes over. This body is used in paints, for the manufacture of printer's ink, in making soap, and as a cheap lubricant.

(11) W. E. B. says, in answer to G. S. W., who asked if there is any rule for dividing a circle into 3, 4, or more equal parts by parallel lines: He will not probably find any general rule for this purpose; but I find by calculation that the chord of an arc of 149° 16′ 30″ cuts off a segment whose area is about $\frac{1}{50000}$ in excess of one third the area of the circle, and the chord of an arc of 132° 21′ cuts off a segment whose area is about $\frac{1}{20000}$ in excess of one fourth the area of the circle. These values are probably sufficiently accurate for all practical problems.

(12) A. E. F.—A good recipe for silver writing fluid is the following: Mix 1 oz. finest block tin in shavings with 2 ozs. mercury till they become perfectly amalgamated. Then shake up in a stoppered bottle with enough gum water to give proper consistence. The writing, when dry, will have the appearance of silver.

(13) H. S. asks: How is manganese obtained from the ore? A. Metallic manganese may be obtained from pyrolusite—the peroxide of manganese—by smelting at the highest heat of the blast furnace. It is, when free from carbon and silicon, a soft, easily tarnishable metal, resembling iron somewhat in appearance; and it has a specific gravity of about 7·2. It sells in small quantities for about $1 per lb. Manganese has six oxides, of which the dioxide is the most important. This occurs in Nature (in a nearly pure form) in the mineral pyrolusite, which, broken into lumps or powder, is commercially known as black oxide of manganese or simply manganese, the latter name being incorrect. The black oxide is worth from $10 to $20 a ton in New York. See p. 226, vol. 35.

(14) L. G. asks: 1. What is the greatest force, as expressed in horse power, which has as yet been obtained by means of electricity, and please tell me what is the name of the inventor? A. Professor Page, as long ago as 1850, constructed electro-magnetic engines of between 4 and 5 horse power. 2. As this power is very feeble, could I, by means of several engines working separately and giving the maximum power each is capable of, and working together on the same driving beam, obtain as great a power as desired, costing less and with less weight than from a steam engine of same force? A. No system of magnetic engines has yet been found as economical as the steam engine.

(15) J. E. S.—Your relay for submarine telegraphy might be used on lines of moderate length; but for very long lines the mirror instrument is the best.

(16) F. S. says: 1. I wish to construct a telephone. Can I be prevented from making and using the instrument by patent or other cause? A. You can make one for experiment, but could be prevented from using it after its successful working. 2. What number and length of wire should be used in the coils? A. Altogether about 190 feet of No. 24 copper wire will answer for short circuits. 3. How and of what material should the sounding plate be made? A. It can be made of thin iron. A very good description of the apparatus is to be found in Prescott's "Electricity and the Electric Telegraph." 4. Do you think a good mechanic could construct one that would work well from these directions? A. Yes

(17) J. F. says: For gumming envelopes I use mucilage composed of 2 ozs. dextrin, 1 oz. acetic acid, 1 oz. alcohol, 5 ozs. water. I am not satisfied with it. The adhesiveness is not sufficient. It is more adhesive without the alcohol. A. A strong aqueous solution of reasonably pure dextrin (British gum) forms a most adhesive and cheap mucilage. Alcohol, or rather diluted wine spirit, is usually employed as the solvent where the mucilage is to be used for gumming envelopes, postage stamps, etc., in order to facilitate the drying, and acetic acid is added to increase the mobility of the fluid. The strong aqueous solution is more adhesive than that prepared with alcohol, for the reason that it contains a greater proportion of the gum. To prepare this, add an excess of powdered dextrin to boiling water, stir for a moment or two, allow to cool and settle, and strain the liquid through a fine cloth. The addition of a little powdered sugar increases the glossiness of the dried gum, without interfering greatly with its adhesiveness. The sugar should be dissolved in the water before the dextrin is added.

(18) F. B. says: On p. 187, vol. 36, C. V. W. says that $\frac{\frac{1}{2}\,\text{chord}^2 + \text{height}^2}{2\ \text{heights}}$ = radius of the circle. Can this be true? I have tried it several times with a graduated beam compass, but cannot make it so. A. The rule is correct. Probably, you have made some mistake in applying it.

(19) J. H. F. says: I bought a small engine, nominally of 4½ horse power. The dimensions are as follows: Steam chest 4 x 5 inches, cylinder 8½ x 4¼ inches, stroke 7 inches, upright boiler is about 6 feet high, with water space 4 feet 5 inches, and 2 feet in diameter. I have made several attempts to run a corn mill, and have tried 12, 16, and 18 inch burrs; it will pull them if they are fed sparingly, but if fed in the ordinary manner they stop the engine. If running fast, pulling the mill, the piston rod or the rod running from eccentric to slide valve bends and quivers from top to bottom. This rod has no knuckle joint, but is made thin in one place to give it the right motion. I notice that running at good speed with 60 lbs. of steam a man can stop it by simply bearing his weight against the pulley. Please tell me what power the dimensions indicate, and give me your opinion in regard to the unsatisfactory manner in which it works. A. From your account the engine does not seem to be very well constructed. We advise you to test it with a friction brake, and see how much power it can exert steadily, and how much steam is required.

(20) F. L. says: 1. How should I treat a leak in a flue of an upright boiler? When I let the water out, by the blow-off cock, I can hear the air escape out of the flue. When I have a fire under the boiler the flue does not leak at all; but as soon as the fire is out the leak begins again. A. Such a leak can doubtless be made tight by caulking, if a slight expansion is sufficient to stop it. 2. What is the best way to refit a pair of safety valve seats, the valves on which do not set very closely, and stick somewhat, after being opened by a high head of steam? A. You can grind them in with oil and brickdust or emery. 3. To have two safety valves on the boiler, is it proper to have both valves set at the same weight, or should one be a little heavier than the other, say one for 60 lbs. and the other for 70 lbs.? A. If each is large enough to relieve the boiler, they might be set as you suggest. 4. What is the cause of knocking in steam pipes? A. It is caused by water in the pipe, or condensation and sudden changes of temperature. 5. Would it not be a good plan to have hand holes in the outside shell of the boiler at the level of the crown sheet, so as to be able to clean the crown and flues with a hose? A. This arrangement is sometimes adopted.

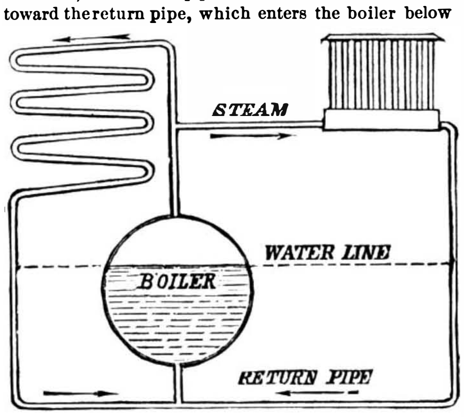
Will the rubber waterproof garments that ladies wear on damp days do to make a balloon? A. It might be made to answer very well if there was a demand for it. 2. How is this rubber material made? A. If you wish to experiment, it would be better to obtain samples from manufacturers than to attempt to make it.

(21) J. K. W. asks: What is the trouble with a double acting pump, which, in pumping from the cistern with the long suction pipe, if run very slowly (about 20 revolutions per minute) will work; but when the speed is increased to 100 revolutions, it seems to drop the water and the speed increases to 500 or 600 revolutions per minute, and it does not pump. A. The trouble is probably caused by the collection of air in the pipe. If so, it can be remedied by the use of a cock or valve.

How can I burn naphtha in a boiler furnace? A. We believe that there are special devices in the market for this purpose. Insert a notice in our Business and Personal column.

(22) J. E. asks: Can you inform me of any varnish for insulating No. 36 copper wire. I have used shellac dissolved in alcohol, but it would not answer. A. You cannot hope to thoroughly insulate helices of such fine wire by merely varnishing it. The wire must be covered with silk, cotton, or some other similar insulator. On cotton or silk covered wire, a strong solution of shellac gives very good results, and is very commonly employed. Fused paraffin wax is sometimes used, and is one of the best of insulators.

(23) C. G. L. says: You advise the use of a trap to return the water of condensation from the radiators to the steam-heating boilers. A trap of any kind is worse than useless, if the apparatus is for heating only, and all the radiators are above the water line of the boiler. It is only necessary that the pipes be of suitable size, and that all pipes and radiators shall incline toward the return pipe, which enters the boiler below



the water line. The water must stand at the same level in the boiler and return pipes, returning as fast as the steam condensed. I have known a boiler to be run for several months without the addition of any water: and in well constructed apparatus, the loss would be but a few gallons per month. The cracking and thumping often complained of is probably caused by water remaining in the pipes. This can frequently be remedied by raising any depressions in the pipe, where the water is trapped, or by taking the water from such depressions to the return pipe by a drip.

(24) J. N. says: 1. I wish to make a boiler which when finished will be exactly 30 inches high by 14 inches diameter. I intend making it of ⅛ inch wrought iron, and the boiler heads of ½ inch cast iron. Will the cast iron heads stand enough pressure to run a small engine, size 3 x 1⅝ inches, to do light work? A. We advise you to make the heads of wrought iron. 2. How much steam can I carry? A. You can carry about 30 lbs. per square inch.

What is the best way to clean the rust off iron and polish it afterward? A. If the work is very rusty, you can use oil and brickdust or emery, and finish with a file.

(25) J. P. G. says: 1. I would like to know the difference between phosphorus and amorphous phosphorus? A. Red or amorphous phosphorus is only a modified form—an allotropic condition—of the ordinary vitreous variety. Their chemical nature is identical, though they differ greatly in their physical properties. This difference is believed to be due to an alteration in the molecular grouping. This property is known as allotropism, a word which means simply "different states." The phenomenon of allotropism is not confined to phosphorus alone, but is more or less a property of all the elements. Carbon in one condition gives us the brilliant, transparent, and nearly incombustible, diamond; in another, the black, opaque, easily inflammable charcoal or coke; while in another we have the metal-like graphite. The red phosphorus is usually obtained by heating vitreous phosphorus for some time to, or nearly to, its point of vaporization in an atmosphere of carbonic acid or hydrogen. It is more passive or inert than white phosphorus; it is heavier, of a brick-red color, and is not phosphorescent. It does not oxidize at ordinary temperatures, and requires a much greater degree of heat for its fusion than the waxy or vitreous variety, into which it may be directly converted by heating to 500° Fah. 2. Which is used on the common matches? A. Both active and passive phosphorus are used in the preparation of matches; but the latter, although more costly, is coming into more general use in parlor or safety matches and the like, in which it is mixed with chlorate of potash to cause it to ignite readily by fric

tion. When once ignited, it burns as readily as the vitreous variety.

(26) W. P. C. asks: Can you tell me of any substance soluble in water, for which sulphuric acid (diluted) has a stronger affinity than for iron, lead, tin, and zinc? A. Your questions are rather indefinite. All of the alkalies—soda, potassa, ammonia, etc.—also some of the alkaline earths, as lime, baryta or strontia, are more or less soluble in water and have stronger affinities for sulphuric acid than iron. 2. Also any substances soluble in water for which sulphuric acid has less affinity than for copper? A. If we understand you, most of the metallic sulphates are soluble in water, and are not decomposed by strong oil of vitriol. If you mean metallic bodies, there are none that we know of that dissolve in water without decomposing it and combining with one of its elements to form bases. Platinum, silver, gold, lead, mercury, etc., are not attacked by sulphuric acid in the cold, the former not even by the hot acid. 3. Can you tell me where I can find a table showing the relative affinities of the principal metals, acids, and alkalies? A. You will find such tables in most good works on chemistry.

(27) M. E. says: You once published a recipe for milk paint which contains considerable lime. I have used it on my walls and find it very satisfactory, but knowing nothing of the effect that lime has on different coloring, I have been unable to obtain the colors I wished. Will you tell me how to produce a light buff and a brown? A. Use oxide of iron or yellow ocher mixed with a little umber for the brown. A mixture of Spanish brown with a little chrome yellow gives a good yellow. Use Vandyke brown for a strong tone.

(28) W. H. R. asks: How can I make and use a quick bleaching liquor, for bleaching cotton goods which have become yellow from long service? A. Make a strong solution of chloride of lime (hypochlorite of lime—bleaching powder) in water, allow to settle, and draw off the clear liquid. Rinse the goods in clean water containing about 5 per cent of sulphuric acid, and then pass them slowly through the bleaching solution. They should then be well rinsed in water containing a little carbonate of soda. If the cloth is much colored it may be necessary to allow it to remain for a short time in the bath. This is the usual method of bleaching in laundries.

(29) H. M. S. says: I shook some pieces of litmus in a bottle partly filled with water, until the latter became of a deep blue color. Corking it up tight, I placed it on a shelf with other chemicals, among which were several acids. About a fortnight afterwards I observed that it had turned to a yellowish brown color, quite transparent compared to what it was before. Upon uncorking it and exposing to the air, it turned gradually to a deep red or carmine on top, and this extended upon shaking until the whole liquid was so; and it became opaque again, though of a different color. Can you explain this? A. Litmus is very often adulterated with lime, plaster, Prussian blue, etc. The action you noted may have been due to these other adulterants, or to some acid impurity contained in the water used for making the solution.

(30) F. S. & S. ask: What is the best cement for filling white metal signs with? A. Try the following: Melt together in a clean iron pot 2 parts each of best asphaltum and gutta percha; stir well together, and then add 1 part of gum shellac in fine powder. It may be used hot, and mixed with smalt, vermilion, or other pigment, if desired.

(31) B. P. asks: Please give a recipe for making paste to stick bills which are exposed to the weather? A. Take flour 25 lbs., alum in powder ½ lb., boiling water sufficient quantity. Paste will not very long resist the action of wet weather, but may be made to do so by giving the bill, after sticking with it, a wash of soap water, sugar of lead solution, or a solution of crude lac in naphtha.

(32) F. S. C. asks: What will restore faded black walnut doors? They have been covered with shellac, but the color of the wood is gone. A. It will be necessary to first remove the shellac. Much of it may be removed with a little ammonia water and alcohol; but it is best to scrape off the last portions, and sandpaper the wood. If the wood is genuine walnut, a little oil will then bring out the color, and it may be finished with a good coat of copal varnish. If the doors are of imitation walnut, make a solution of 2½ ozs. Vandyke brown in a boiling solution of 1½ ozs. washing soda in 1 quart water, and add to it about ¼ oz. of powdered bichromate of potassa. Stir well together, and when cool strain through a cloth for use. This will give you an excellent imitation of dark walnut; and when dry, it takes a good coat of varnish.

(33) A. F. H. asks: How can I make a new white coating stick effectually on an old ceiling? A. It is necessary to take all the old white coat off complete, to thoroughly wet the brown coat left on, and then finish with a new white coat.

(34) W. A. H. says: I wear a small compass attached to my watch chain; and in casually looking at it I noticed that it deviated about 90° from north. I also noticed that, when I stood alongside of our safe, the compass pointed directly to the safe. I walked to the stove, and my compass again swerved; but instead of pointing directly to the stove, it pointed diametrically from it. The safe and stove are not near enough to each other to exert any combined influence. The only difference between the situations is that one lump of iron was hot and the other cold. Please give your explanation of this remarkable effect of caloric over the magnetic needle. A. The data given are not explicit enough to enable us to give a satisfactory explanation; but it will probably be found that the pole of the needle which points towards the safe varies as the former is near the top or bottom of the latter; possibly, also, the same will be the case as regards the stove. The safe or stove, or both, may have become slightly magnetic from the inductive action of the earth.

(35) W. S. says, as to the welding of the point of a spindle to the plate on which it rested, while running: We had a parallel case in our mill some years ago. The burrs were 4 feet diameter, spindle was 10 feet long, 4 inches diameter, of cast iron, with a taper steel point inserted in the spindle. The point was about 1½ inches in diameter, flat; it ran on a steel plate, above which was a collar, about 1 inch thick, fastened securely in the oil pot, which was square and always full of oil. The motion was observed to be getting slower, and something was unusual about the running of the burrs. The engine was stopped to examine, and it was found that the end of the steel point was perfectly welded to the plate and collar in which it worked. Before it could be got out, it had to be heated to a red heat in a blacksmith's fire and driven out by punching a hole through the steel plate. The tapering end, however, was loose, and allowed the spindle to revolve when the point stopped. The pot was full of oil in which the point was running. Had we not seen this, we could hardly have credited it. If the supply of oil were insufficient, and the heating had been caused by want of it, the wonder would not be so great; but when the oil was in the pot to a depth of 2 inches, it is difficult to account for the phenomenon.

(36) I. B. C. asks: 1. In making a core for an electromagnet is soft iron the best? A. Yes. 2. Which makes the best armature, soft iron or steel? A. Soft iron.

(37) J. M. H. and several others write as follows: Your answer to query of W. D. S. in regard to carrying the bar of iron is incorrect. The true answer being 2 feet 3 inches instead of 3 feet, as published in No. 8, p. 299, vol. 36. I presume the error was due to an oversight. A. As our correspondent correctly surmises, the answer was due to an oversight, or perhaps something of the same character, as Mr. Richard Grant White calls "heterophemy," since the conditions to which our answer applies are those in which a weight is shifted on the bar for proper distribution, the bar being supported at the ends, and its own weight disregarded. The numerous corrections that have been sent to us show the interest with which this column is regarded; and as our only desire is to furnish correct and useful information, we are always grateful to our readers for calling attention to any corrections that may be necessary.

(38) F. G. W. asks: In making a small engine, cylinder 1½ inches in diameter and of 3 inches stroke, would gas stop cocks be sufficient as cut-offs, or must I have a slide valve? A. If the cocks were nicely fitted, they might answer very well.

(39) M. O. S. asks: Do you consider a rotary engine as powerful with the same amount of steam as a cylinder engine? If not, what is the difference? A. We understand you to ask whether the rotary engine will give out as much power with the consumption of a definite amount of steam as a reciprocating engine. In special cases it may; but on the average, we think not.

(40) S. B. W. asks: What does a first-class land engineer get a year? When do you think that the time will come when they will stop putting on so much cheap help to run engines, and have every engineer examined? A. In large establishments, such as public buildings and hotels, where the engineer has considerable machinery, pipe connections, etc., to look after, the compensation is proportionately large. We imagine that, including all classes of establishments, the pay of the engineer varies from $30 to $300 a month, perhaps, in exceptional cases, being higher. Laws regulating the appointment of engineers may be good in theory; in their practical application, however, they are not always successful.

(41) S. & K. say: 1. We are pumping oil from one tank into another. S. says his pump is sucking the oil from the tank. K. claims that the oil comes to the pump by the atmospheric pressure upon the oil in the tank. Is there any such thing as suction in the true meaning of the word? A. What is called suction is due to atmospheric pressure. See p. 352, vol. 31. 2. Can you pump as well out of a tank which stands on a level with the pump as you would out of a tank standing some distance higher? A. When the tank stands above the level of the pump, the pressure forcing the oil into the pump is increased by the weight of the column of oil.

(42) F. W. asks: 1. Will a boiler 4 feet long, 1 foot in diameter, with five 2 inch flues through it, put in an arch horizontally, make steam sufficient to run an engine, 2¼ x 5 inches, at 300 revolutions per minute? A. The boiler will scarcely be large enough. 2. What power will such an engine give with steam at 75 lbs. to the square inch? A. See p. 33, vol. 33.

(43) H. J. D. says: I inclose a specimen of scale from my boiler. I have used potatoes, petroleum, tannate of soda, and sal soda. The sal soda seems to do as much good as anything. Is there any danger to the iron from sal soda in large quantities? A. With frequent blowing, you can use considerable amounts of soda safely. 2. Do you consider such scale, in places nearly ¼ inch thick, dangerous? A. Scale should not be allowed to collect to the thickness mentioned. 3. Could I keep the boiler clear by using soft water, say 4 or 5 months in the year? A. If you can use soft water occasionally, it will be likely to loosen the scale. From an inspection of the sample, we think you can prevent the greater part from entering the boiler by using a feed-water heater with sediment collector.

(44) J. N. P. says: I fitted up two barometer tubes. One stands about ¾ of an inch higher than the other. Would boiling the mercury before filling up the tube drive all the air out? A friend says it would not, but that I must boil it in the tube after filling. Can I do that successfully without bursting or warping the tube? A. It is desirable, to insure a good vacuum, to boil the mercury in the tube, and in a vacuum. If you have no experience in such matters, it will be much better for you to have the tubes filled by a philosophical instrument maker.

(45) T. J. M. asks: In floating down a river, will a flat-bottomed boat go at the same speed as the current if no power is used to push it or increase its motion? A. Yes.

(46) A. S. T. says: We have laid a pipe underground from a spring, and have brought it above the surface in one place for the purpose of tapping. Will the water continue to be discharged in an unbroken stream, that is, over the crook? A. Air may collect at the highest point, and should be removed by opening a valve or cock.

(47) P. W. asks: If a weight be suspended by a wire in water, one inch below the surface, weighs 1,000 lbs., would it weigh the same if lowered in the water half a mile deeper? Of course the weight of the suspending wire is to be deducted. A. The weight of a body immersed in water is reduced by the weight of the water which it displaces. As water is slightly compressible, the body will weigh a little less at a considerable depth than near the surface.

(48) E. W. P. says: We have an artesian well which does not overflow. The water is elevated by steam pump, the suction pipe of which passes down inside of the well tubing, leaving a small space between the two pipes. If the well tubing was attached to the pump and made airtight, leaving out the inner suction pipe, would the pump work? Would it not be on the same principle as trying to draw water from a barrel without an air vent? A. Exactly.

(49) S. D. Y. asks: If I make a model of a boat to a scale of 1 inch to the foot, will its buoyancy be 1,728 times less than that of the boat? A. Yes, if you mean by buoyancy the volume of water displaced, and if you use in the model materials of the same specific gravity as those that are in the boat.

(50) H. M. says: I am about making a water velocipede, but do not know of what size and weight the wheel should be. How deep should the wheel be in the water? The length of platform is 3½ feet, length of floats 8 feet, width of platform 2 feet 8 inches, height of seat 1 foot 4 inches, floats are to be 10 inches in diameter, platform 3 inches above the floats, with cork fenders on each side of platform to save it from upsetting, and make it safer. How long should the crank or treadle and the posts on stands for the wheel be? A. As we have had no practical experience with these devices, we are not sure that we can aid you much. Your proportions seem to be judiciously chosen. The crank, treadle, etc., may be arranged with the same dimensions as in ordinary velocipedes, suited to the proportions of the rider. If any of our readers have experimented with these water velocipedes, we would be glad to know the results.

(51) A. B. says: I am building a steamboat, the diameter of my paddle wheel is 8 feet, and is 6 feet 8 inches across. I use an 8 to 10 horse power engine. Boat draws from 8 to 12 inches water. How many buckets should I have, so as to have the least amount of slippage? A. Make it so as to have 3 or 4 buckets in the water, with ordinary draft.

(52) E. O. M. asks: 1. Which is the best way to learn the exact amount of priming when a boiler is tested? If the method is expensive, and requires the skill of an expert, what is a tolerably good way which is inexpensive and adapted to the capacity of an ordinary boiler tender? A. Some form of calorimeter should be employed; and we know of none that can be used successfully by an inexperienced person. 2. What is the peculiarity about a boiler which inclines it to entrain sediment without also entraining water? This peculiarity is claimed for some boilers. A. You should inquire of the patentees. 3. Robert Wilson in his work on steam boilers under the heading of "Incrustation," says that the light carbonates, when entrained, are liable to blow off the cylinder cover, break the piston, or stop the engine. Did you ever hear of such damage, and what are the particulars? A. If any of our readers can furnish information on this subject we would be glad to hear from them. No such occurrence has ever been brought to our notice. 4. Is it possible for any boiler to entrain all the scale-forming impurities of salt water? A. We think not. 5. What can be done to relieve the cylinder of the engine from its trials when so much solid matter is thrown into it? A. Use large relief valves.

(53) C. H. H. asks: How are electric bells constructed so that they may be made to ring for five or ten minutes? A. Attach one end of the line circuit to a spring against which the armature rests when it is not attracted; also, connect the armature to one end of the magnet coil. The other end of the coil is to be connected to the battery, and the circuit completed; this will cause an attraction of the armature; and after traveling together for a very short distance, the latter leaves the spring and breaks circuit. The armature, being now no longer attracted, returns to its normal position and completes the circuit again, when another attraction results and the vibration is continued as long as desired.

(54) B. N. G. says: 1. I want to build a boiler for an engine 2 x 2 inches, to run a boat 15 feet long with a screw 18 inches in diameter, of 3 feet pitch. I intend to build the boiler by placing the heads on the end of the shell, bolted on with several of the tubes with nuts on the ends. Do I need shoulders on the inside of tubes? How large should the shell be? A. No. 2. How large an oscillating engine should I want to run a boat 15 feet long, of 4 feet beam, and how large a boiler would it take? A. You can make the engine 2 x 3. Make the boiler 20 to 22 inches in diameter, and 3 feet high. 3. Should an oscillating engine be larger than a slide valve engine, of the same power? A. An oscillating engine, if properly constructed, will not take any more than the other, under the same conditions. 4. Shall I need a license to run my boat on the Merrimac? A. According to the United States law a license is required. Whether the law is strictly enforced in your locality, we do not know.

(55) H. M. C. asks: If the sides of a triangle, A B $=a$, A C $=b$, B C $=c$, are known quantities, how can I find the area A B C of the triangle, in terms of a, b, and c? Perpendicular, A D, is supposed to be unknown. A. The following is the formula, the demonstration of which may be found in any good treatise on plane trigonometry: $S=\frac{a+b+c}{2}$. Then

$$\text{Area} = \sqrt{S \times (S-a) \times (S-b) \times (S-c)}.$$

(56) G. J. R. says: I have been thinking of building a small steamer; I do not think the water will average over two feet deep. I have an engine of 2 inch bore with a 3 inch stroke. Please tell me its capacity? Will this engine do to drive a boat 26 feet long and about 5 feet wide, to carry 8 or 10 persons? A. The engine is, we think, too small for such a boat as you propose.

(57) E. C. W. asks: 1. Which is the better, cypress or cedar, for light boat building? A. Cedar is generally considered preferable. 2. How ought boats to be treated, after finishing, to protect from the water and weather? A. The joints can be made tight with putty or white lead, and the boat should be well painted.

(58) M. F. says: I am the owner of a tract of land in the Carson valley, that lies some 25 feet above the level of the Carson river. It is very productive, but I am at a loss to know how to get much of it under cultivation, as it must have irrigation, and ditching would cost me more than I am able to expend. Can I force water upon the land from the river by means of a force pump, say, through a 3 inch pipe? If so, what size or power of pump should I have? How much fall of water should I have back of the pump, and would it do to set the pump in an excavation in order to give it a fall? A. If you can use a windmill, your plan of artificial irrigation may be successful; and by addressing a manufacturer, you can obtain particulars as to machinery required.

(59) C. C. C. asks: How can I line sheet iron tanks with Portland cement? A. We do not think you can succeed in causing the cement to adhere permanently to the sheet iron unless the lining is given a great thickness. The cement could be moulded into thin bricks and built in with cement mortar. Portland cement can be obtained of any dealer in building materials.

(60) Mr. J. H. Tjörswaag, of Flekkefjord, Norway, says: As an example of how fast the appearance of a landscape can change even under higher latitudes, I can mention that last year in the early days of June the snow covered the ground at Masi, in the northernmost part of Norway under 70° north latitude, and in the middle of July the potatoes were all in full bloom. It is but fair to add that the sun does not go below the horizon from the 15th of May till the 27th of July at the above-mentioned place.

A couple of years ago I built a new barn with barnyard all of wood. Partly for the sake of appearance, but chiefly to make the barnyard more easy to clean, I gave the walls and ceiling two coats of oil paint. Now as long as mild or warm weather prevails, it is all well enough; but as soon as cold weather sets in, the evaporation from the animals (only four or five cows) settles under the ceiling, collects in drops, and (when heavy enough) falls on the floor, on to the animals, or runs down the walls, making everything wet and dirty. Can I ventilate the room (25x14x7½ feet) in an efficient manner, and at the same time retain sufficient warmth for the animals, and how? The temperature here during winter varies from 18° to 45° Fah. A. The space is rather small for that number of cows, and a little ventilation would benefit them. A small opening at the floor upon one side and at the ceiling upon the other would answer the purpose. The size of these openings might be graduated by sliding shutters.

(61) E. R. asks: 1. If I have an air-compressing pump which will hold ½ cubic foot of common air, how many times must I force the piston up and down until I have respectively pressures of 15, 30, 50, 75, 100, and 125 lbs. per inch over the atmospheric pressure in an air tank of the same dimensions as the pump? A. It will make considerable difference whether you cool the air as it is compressed, or not. You will find formulas by which you can make the necessary calculations, in question (26) on p. 235, vol. 35. 2. If the valve that connects the pump with the tank be 2 inches in diameter, will it take a greater force to move the piston down when the communication between the tank and pump is open, and does the compressed air in the tank press with a greater force on the valve than if the valve were only 1 inch in diameter? A. By using the larger valve, the friction of the air will be reduced.

(62) F. G. T. asks: 1. What size of boiler will it take for a small engine ¾ by 1¼ inches? A. You can make a boiler 3 inches in diameter, and 5 inches high. 2. Would it do to make it out of tin? If so, what pressure would it stand? A. It can be constructed of tin for a pressure not exceeding 10 lbs. per square inch. 3. Could I keep up steam with burners and coal oil? If so, how should they be placed, under the boiler or in a flue? A. The lamp should have a burner that would answer without a chimney, or by having a central flue in the boiler, that would take the place of a chimney. 4. What tools would it require to make a small engine out of ready made castings? A. The tools required to fit up the engine will be a vise, some files, taps and dies, hammers, chisels, and wrenches.

(63) R. K. asks: Will you please tell me what is the difference of heat in the sun's rays on a perpendicular round stick 4 inches thick by 2 feet high, and one of the same size placed to incline 6 inches to the south? A. We presume you refer to the different areas exposed at right angles to the direction of the rays, in the two cases. You can easily plot or calculate this for any assumed direction of the rays.

(64) F. W. S. says: I wish to build a vase which shall hold about forty gallons of water, to be placed where I can have pipes running about five feet below the vase. Will it be possible to construct it in such a manner that, by the use of pipes, the water of its own weight may be made to form a fountain from one to two feet high? A. You can arrange it on the principle of Hero's fountain, which is illustrated in many elementary treatises on natural philosophy.

(65) J. B. says: 1. We have to use salt water in a boiler. Is it injurious? A. Salt water forms scale in a boiler, which is injurious. 2. How is a condenser made? A. A condenser is a vessel in which the steam is condensed either by contact with or by being exposed to the cooling influence of water. 3. What is the hottest water which a common force pump will throw in a boiler? A. Pumps made for hot water will act when the temperature is quite high. With others, the temperature of the water should not ordinarily exceed 100°. 4. Is salt water more injurious to a boiler than sulphurous or lime water? A. There are some spring waters that are more injurious to boilers than salt water from the ocean.

(66) W. G. says: I have a steam pump of the following dimensions: 22 inch steam cylinder, 10 inch plunger, 4 feet stroke, 9 inch suction pipe, and 9 inch discharge pipe. The discharge pipe runs 250 feet north on a rise of 40°. It makes a quarter turn, and runs 94 feet east, horizontally, and then another quarter turn and runs 290 feet north on a rise of 40° to the point of delivery. The pump works as smoothly and with as little jar as possible; but there is a heavy jar in the discharge pipe which moves the whole column when the pump runs over 18 strokes per minute. When it runs less than 18 strokes, there is no jar. Will you please tell me the cause and the remedy? A. According to data sent, the vertical height of column of water is nearly 350 feet. The jar is probably due to the stopping and starting at the end of each stroke, and might be reduced by the use of a larger air vessel.

(67) J. V., of Canterbury, England, says: I have a traction engine, with one cylinder 8 inches in diameter and 12 inches stroke, which I work at 100 lbs. pressure. What difference will there be in the power if I put on an 8x16 inches cylinder, all other things being equal? What difference will there be in the power of a 9x12 inches and a 9¼x16 inches engines, all other things being equal, at 100 lbs. pressure? A. Calling the power of the 8x12 inches 1, that of the 8x16 will be 1·33, that of the 9x12 will be 1·27, that of the 9¼x16 will be 1·78.

(68) J. H. E. says: The following is taken from a book high in authority on mechanical subjects, speaking of an ordinary steam engine: "If, on the introduction of steam to the cylinder, it has a pressure of say 4 atmospheres, it follows that it will act upon the piston with all this force to cause it to descend; since, however, the lower part of the cylinder is at this time in communication with the external atmosphere, there is a resistance = 1 atmosphere opposed to its movement, therefore the actual effective pressure on top of piston = 3 atmospheres." I wish to inquire if the pressure (4 atmospheres) is that which is indicated by the steam gauge, and what becomes of the pressure of the air in the boiler after the air is worked out? I know that an engine will run with less than 15 lbs. pressure by the gauge. A. In the statement quoted by you the reference is apparently to absolute pressure, or pressure above a vacuum. The steam gauge, being pressed internally by the steam and externally by the air, indicates the difference of these pressures, or the pressure above the atmosphere.

(69) W. S. says: 1. Given the boiler or reservoir of a fire extinguisher, tested to 150 per square inch, 24 inches long, of 9 inches diameter, and about ¼ inch thick, laid horizontally and fired with charcoal, required the size of engine it will run, and the best working pressure? A. The reservoir could be made to answer as a boiler; but it would not be advisable to carry a pressure of more than 60 or 75 lbs. 2. I wish to cast the cylinder of brass. If I take a piece of iron, turn it off smooth, and polish it, could I use it for the core to cast the cylinder around, and could I drive the iron out? A. You will not be able to make a very good cylinder in the manner you propose. There is no difficulty in making a sand core quite as smooth as the one that you suggest.

(70) I. C. C. asks: How can I make a good filter, capable of filtering three or four pails of water a day? I have made my box 14x14 inches at top, and 14x2 at bottom, with a height of 3 feet; and I filled it with alternate layers of charcoal, coarse gravel, and sand. For a week or 10 days it will work well, and then the amount filtered lessens. A. It would probably answer your purpose to use sand only, spread out over a large horizontal surface, and when choked by the accumulated sediment, to remove about one inch in depth of the sand and renew it. After a more extended interval the whole might be renewed.

(71) T. P. B. asks: What is fire? A. Fire is, commonly speaking, gaseous matter in a state of intense heat, due ordinarily to combustion, or a direct and energetic combination with atmospheric oxygen. Scientifically it might be described as matter under the influence of intense atomic or inter-molecular vibration. Consult some good work on chemistry or chemical philosophy.

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

C. W. R.—It contains carbonate of lime and alumina.—Miner, New Mexico.—It consists of red oxide of iron and clay.—G. F.—They are all crystals of quartz (pure silicic acid). They are quite common, and of little value.—M. A.—It does not contain silver, but antimony and lead.—M. A. A.—The sand you send consists principally of quartz crystals and iron, and manganese garnets.

M. H. H. says: 1. An acquaintance claims that, in a sugar cane mill, one of the crushing surfaces should be the surface of a small cylinder, for as it presents a smaller surface to the cane, it will do the same work easier. Is it so? 2. What are the advantages and disadvantages of horizontal and perpendicular rollers? —T. W. D. asks: Which steamboat, running in fresh water, is the fastest, and what is her speed?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Saving Life in Case of Fire. By J. S.
On Nickel Plating. By D. G.
On High Interest. By J. H. S.
On Reclaiming the Desert of Sahara. By R. T. E.
On a Tidal Motor. By A. S.
On the Trisection and Multisection of Angles. By W. T.
On Pernicious Literature. By C. W. B.
On Labor-Saving Machinery. By T. R. V.

Also inquiries and answers from the following:
F. M. B.—C. G. L.—D. B.—G. W. K.—M. A.—W. D.—J. W. L.—J. E. H.—M. J. C.—S. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells lampblack by wholesale, and what is its price? Who sells apparatus for the production of sulphate of potash? Whose is the best metallic piston packing? Who makes cotton and wool carding machinery? Whose is the best gas meter? Where can the best fireworks be obtained?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,952, 9,953.—CASSIMERES.—H. A. Kimball, Pascoag, R. I.
9,954.—TOWEL BORDERS.—R. T. Webb, Randallstown, Ireland.
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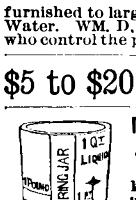

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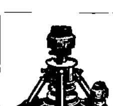

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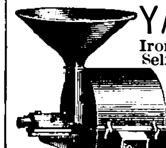

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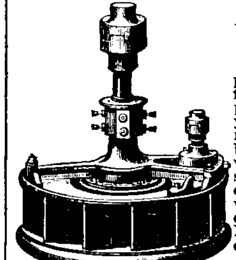

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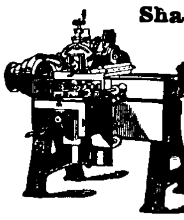

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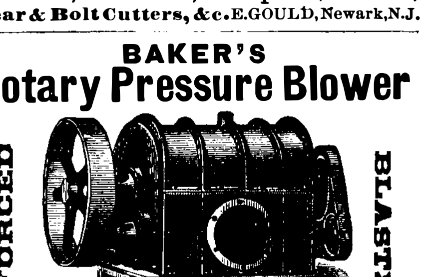

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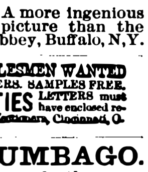

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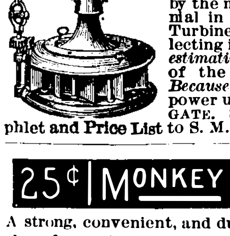

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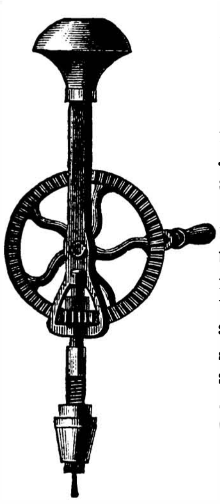

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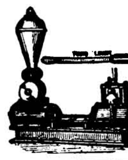

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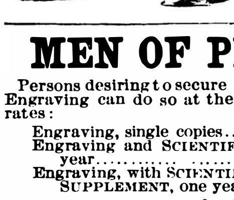

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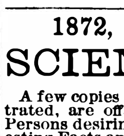

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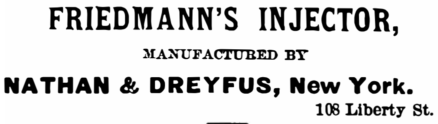

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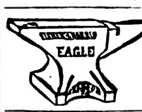

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