English Locomotive Cabs.

Writing to Engineering (London) Mr. Clement E. Stretton severely criticises the English practice of depriving locomotive engineers of all shelter from the weather while engaged in the performance of their duties. He says:

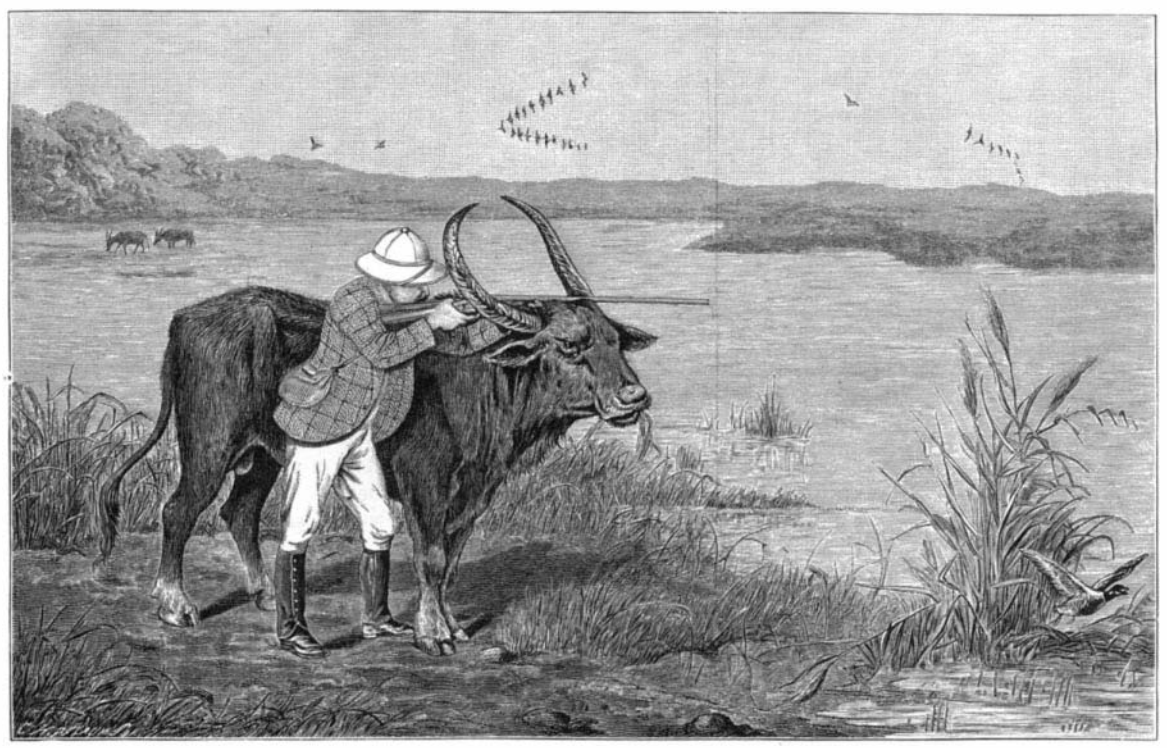
The recent collision at Binegar, which was caused by the driver and fireman trying to obtain shelter upon a bitterly cold night when running tender first, should be the means of obtaining far more protection for engine drivers than they at present have. Unfortunately several locomotive engineers appear to still hold the old opinion that "to provide a comfortable cab would render the men careless," and also add to the cost of the engine. The wishes and requests of the engine drivers and firemen to be provided with better cabs, and also that those engines which regularly are working tender first should be provided with weather boards upon the tenders, seem to receive very little attention, for nothing has at present been done to provide better protection to drivers generally.

Probably no greater difference in "cabs" can be seen than in the various engines working over the metropolitan lines, where the engines of one company will be found to have a complete "cab" and shelter provided for running in either direction, but the engines of another company have no covering whatever over the men. There is no possible reason why various engines, performing the same service, should be so differently constructed, nor is there any reason why the American engine driver should be able to perform his duties in comfort and yet that the same protection should be refused to the English driver.

Fig. 6.—PROJECT FOR AN ELECTRIC SUSPENDED RAILWAY FOR BERLIN.

SPORTING OXEN AND BUFFALOES.

A correspondent of the Graphic, London, writes from India: Some years ago a friend of mine, known in the district as J. J., was manager and part owner of a Behar indigo factory. Being short of factory oxen, he purchased from some natives a number of buffaloes to work in the plow. Among this draught was a full grown bull which was of such a savage and morose disposition that the natives could do nothing with him — he would charge them again and again, and could only be approached by jamming the herd in a mass round him in the "Bail-Khana," or bullock house. J. J. was rather a good hand at breaking in "Cutcha" horses; the fancy took him to try and tame the bull buffalo. So he told his "jemadah" to have the animal securely fastened in the shade of a large pepul tree which grew in the compound in front of his bungalow veranda. Then he forbade any of the servants to go near, and took the entire charge of the "bisa" himself. For a long time he fed him very sparingly, and whenever he was passing the pepul tree he would go near and talk to the bull in a full deep voice; sometimes using very flowery Hindostani, in which he made frequent allusions of a defamatory character to bull buffaloes in general and the direct ancestors of this one in particular. These remarks were often emphasized by recourse to a rather heavy bamboo "lathi" which was kept handy. The animal would charge J. J. in the most savage manner, but as he was securely fastened to the tree, and his trainer took good care to keep some little distance beyond the end of his tether, these onslaughts were of little avail. Moreover, they were always met by a sharp crack on the nose by the aforesaid bamboo. Soon the "bisa" began to awaken to the folly of this mode of procedure, and contented himself with merely shaking and tossing his head. Then J.J. took up the attack, walking round and round the tree, shouting loudly and calling Mr. "Bisa" all kinds of names! After this some canes of the succulent sugar plant were introduced, and the poor beast, being in a very low condition, soon learned to take them out of his master's hand, though showing some shyness at first. In course of time he would allow himself to be patted, and eventually became so tame and fond of his master as to leave the herd and come up to the veranda when called, and receive scraps from the table as his reward. Of course he had to do his daily task on the cultivation, but showing himself still uncertain with the native plowmen, the planter devised the plan of utilizing him as an ambush for wild duck shooting, these birds being quite accustomed to the herds of village buffalo which graze along the margins of the jhils and lagoons. After some practice this bull became very steady under fire and enabled his master to make some big bags.



A SPORTING BUFFALO.

A correspondent of the N. Y. Sun says: "I made a good deal of money in the early days of California, when we used to stalk wild geese with oxen. Stalking geese with oxen may sound a little queer, but that's the way we used to hunt 'em in the early days. A good stalking ox, I want to tell you, was a valuable bit of property forty years ago in California, and we used to talk about him and discuss his points just about the same as sportsmen nowadays discuss the points of their bird dogs. A good stalking ox could earn his owner anywhere from $50 to $100 a day if the owner himself was any good, and enjoyed the sport as much as the hunter did.

"I went to California in 1851, and promptly dropped every cent I had in a gold mine venture. In all the counties bordering on the bay, and in fact all along the coast, wild geese occupied the wide and open plains by the hundreds of thousands. I have seen more than a thousand acres of these big fowl pasturing in a solid block, and that many cattle feeding couldn't have cleared the grass away as completely as those geese did. I heard that the killing of these geese for market had grown to be a great industry, and that some men were getting rich at it. Ranchers were also offering a bounty for the geese, as cattle raising was becoming an important business, and the geese preempted so much of the pasture area that the loss was serious to the cattle men. I scraped enough money together to buy a gun, and abandoned gold mining for goose hunting.

"When hunting for wild geese on those plains first began, the hunters were able to crawl up on them as they fed and get within easy gunshot. But the geese soon got on to the sportsmen, and by and by no one could get within half a mile of a flock. Hiding in grass blinds was tried and worked well for a time, but the cunning geese sized the blinds up at last and wouldn't come anywhere near a bunch of grass. So something had to be done. Some one had noticed that cattle feeding on the plains could crop the grass almost on the heels of a host of geese, and the fowls took no notice of them. He had an ox that was even tempered and accommodating, and one day he turned it loose and let it feed along toward where a tremendous flock of geese were pasturing. Now and then he'd hurry the ox up a little, walking close to it on the side away from the geese. By and by the ox got close enough to the geese to satisfy his owner, who stood still until the ox had passed on out of the way. Then he emptied one barrel of his gun into the flock on the ground and gave it the other as the birds rose. He picked up sixty-two geese. The ox was somewhat surprised, but didn't object to repeating the operation next day, when it was equally successful. Geese were worth a dollar apiece. That was the origin of stalking wild geese with oxen. In less than a month there wasn't a goose hunter along the coast who didn't have a goose-stalking ox."

The Toothpick Industry.

Insignificant articles like the toothpick represent the investment of millions of capital, the employment of skilled labor, utilization of the latest inventions, the consumption of vast quantities of wood, and the operation of a long line of complex activities. These small articles play an important part in the economies of all civilized nations. To stop at once the manufacture of toys and all not really needful articles in these nations would be to put a stop to a large part of the working and producing forces that constitute the origin of civilization. Some European nations live mainly by their work on articles that are really only mere toys and playthings. In the United States we are rapidly adding to our productions all the wares that find favor abroad, while we have originated scores of novelties in the amusement line that are being sold and imitated abroad. There is in humanity a chord that responds to the touch of frivolity, adds the American Wood Worker, and that chord has enabled the inventors of ingenious nothings to coin fortunes out of their trifles.

THE eastern hemisphere, on which dwell 92 per cent of the population of the world, has 170,792 miles of railroad, or 46 per cent of all railroads.

Shop Photography.

James F. Hobart tells, in the Iron Age, how to select the necessary apparatus, the material, and how to do the work of photographing machinery and other goods.

Photography has become so necessary to the manufacturer that he can no more do without it than he can dispense with the draughtsmen who design his tools and machinery or the salesmen who turn the manufactured products into cash. Notwithstanding that photography is so valuable, the manufacturer has not employed it to the extent he might, and by all but a few concerns photographing is done in a loose, haphazard manner, sometimes by one and sometimes by another "photographer to the trade," who may chance to be available at the time pictures are needed. As a result, there is not even a ghost of a system in the preparation of pictures or in the sizes used. Neither are they got out always at the time and in quantities to suit the man who pays for them. Another thing is the ownership of the negatives. The photographer claims them, and as he has got them, and possession is said to be nine points of the law, he generally keeps them and makes the manufacturer await his pleasure. Indeed, it has been stated that the only way to get a negative away from a photographer is "with a club," and there seems to be a good deal of truth in the statement.

Once equipped with the required apparatus, the necessary material and "know how," photographs can be turned out at will, and usually in a small fraction of the time required by professional photographers to deliver the same amount of work. This is not because the shop operator can do work quicker than the professional, but because he has only one man's work to look after, instead of having to cater to twenty or thirty customers at once, when, perhaps, all of them want their work first, and "day before yesterday" at that.

The apparatus and material that should be purchased to begin with need not cost more than $100, although as the operator gets into the business he will become acquainted with many "conveniences and luxuries" which he will want, and which will bring the cost to a somewhat higher figure. To begin with, purchase a camera, tripod and lens, one or two double dry plate holders and a focusing cloth. These comprise the articles necessary for exposing the plates. For developing the negatives there must be provided three trays, at least 10 × 12 inches, a glass graduate for measuring the developer and two or three bottles in which to keep the developing solutions.

For making pictures from the negatives there will be needed two "printing frames," three trays, and another bottle or two. For the trays, those used for the negative developing can be used, but it is better to get one large tray, at least 15 × 19 inches, for toning prints, to be kept for that purpose exclusively. When it comes to mounting the prints on cardboard, there will be needed only a soft bristle paste brush, although some of the luxuries of the art will probably soon be obtained, consisting of glass forms for trimming the prints and a burnisher for finishing up the pictures after they are mounted. This operation (burnishing) is a very important one, but a burnisher is expensive, costing about $25, and in all large towns there are dealers in photographic material who will burnish prints at a small cost.

The camera should not be less than 10 × 12 inches in size, and a picture of that area will be large enough to show up any ordinary machine. A good 10 × 12 camera can be purchased for $25. It should have a rising front and swing back. The rising front enables the operator to throw the image a little more toward the top or the bottom of the plate, thus making a change in height without moving the camera itself. The swing back is to keep the perpendicular lines of the machine vertical on the picture. It is often desirable to tilt the camera up or down a little, or even considerably, in order to get the whole of a tall machine on the plate, or, perhaps, to show the top as well as two sides. This can be done, but the plate which is to form the negative is tilted so that the picture of the object appears wedge shaped.

Perhaps one of the best illustrations of the use of the swing back that can be made is to set up a plain board, say 16 feet long. Erect this board on one end, then set up the camera in front of it and tilt the machine so that the top of the board is visible on the ground glass. A close inspection of the image will show that the top is very much narrower than the bottom, making a wedge-shaped picture, which is far from being a correct representation of the object itself. In order to correct this error, the swing back must be used, and so changed that the ground glass will stand perpendicular. Then, no matter how much the camera itself may be out of level, the picture will be perfectly symmetrical in all its parts, provided the lens is rectilinear, as it should be. The glasses must be so proportioned that pictures of all objects are not distorted by being reduced more or less to a circular form, as is the case with some of the cheap view lenses in the market. A very good test for a lens is to draw a large square on a piece of paper or board, then set up the camera so that the image of the figure almost covers the ground glass. Then, with a nice straight edge, test the lines on the ground glass. If they are perfectly straight, the lens is rectilinear. If the lines are not straight and the figure as perfect a square as the one in the drawing, then the lens must be discarded for a better one.

A good lens for photographing machinery can be purchased for $35. It will cover an 8 × 10 plate in good shape. Two kinds of lenses are made, one kind being known as "wide angle," that is, it will put into the picture anything coming within an angle of 90° to 100°. The ordinary lens will not take in more than 50° or 60°, and this kind is much better for making pictures of machinery, because the perspective of a machine is not made so prominent with a narrow as with a wide angle lens. In cases where the room in which a picture has to be taken is limited, as when photographing a large machine in a small room, the wide angle lens is a necessity. If expense is no object and the shop is to purchase a first-class photographic outfit, then both a wide angle and an ordinary lens should by all means be included in the list and both made to fit the same flange on the camera. For the $100 limit we must be content with a single lens, and that is one covering not more than 60°.

The developing trays are next to be selected, and if there is a handy pattern maker in the shop, he can save that item of expense by making some neat pine frames of the size required for the trays, and then setting a pane of glass in a rabbet made for that purpose inside each frame. The glass must be set with shellac or asphaltum varnish, and the entire frame should also be given several coats of the same substance. This method makes trays with transparent bottoms, and they are nice ones to work with. Some concerns use wooden trays with wooden bottoms as well. They are good when large sizes are necessary.

The cost of the articles necessary is about as follows:

Camera and tripod	$25.00
Lens	35.00
Three 9×11 trays, at $1.65	4.95
Two 8×10 plate holders	8.00
Focusing cloth	50
8-ounce glass graduate	50
Two 8×10 printing frames	1.00
One large tray, 15×19, for toning	4.00
One 2-quart fluted glass funnel	70
One 3-inch brush for pasting prints	50
One 3-inch camel's hair brush for dusting plates	50
One box (one doz.) dry plates, 8×10	2.40
1 ounce pyrogallic acid	45
1 pound carbonate of soda (sal soda)	10
1 pound sulphite of soda	45
5 pounds hyposulphite of soda	35
1 pound ground alum	10
1 ounce sulphuric acid	12
15 grains chloride of gold	60
1 pound chloride of sodium (common table salt)	4
8 ounces nitrate of silver in crystals	6.00
One package round filter paper, 13-inch	55
100 negative envelopes	75
One dozen sheets albumen paper	1.00
One dozen sheets, 8×10, ferro-prussiate paper	45
One quire non-actinic orange paper	50
100 card mounts, 10×12	2.75
One quart parlor paste	50
Total	$97.76

This estimate comes within the $100, and by the time the first picture has been made the balance of $2.24 will be found in demand for little things of convenience in the dark room.

Unsolicited Testimonials.

We have received a large number of unsolicited testimonials for our "Scientific American Cyclopedia of Receipts, Notes and Queries," of which the following form a part. Professor Edward S. Holden, of the Lick Observatory, says: "It is a mine of useful information set forth in a simple manner, and it will be found of value to all who have to do with practical matters—as who has not, nowadays?" Mr George F. Kunz, the gem expert, says: "'The Scientific American Cyclopedia of Receipts' cannot fail to be highly valuable to artisans of all kinds, such as jewelers, silversmiths, microscopists, and many others who are desirous of obtaining recipes for making, repairing and adjusting a great variety of articles with which they are constantly coming in contact." Professor W. F. Watson, of Furman University, says: "It exceeds my expectations. I believe it to be the most comprehensive and reliable work of its kind that has ever been published." Robert Bond, M.D., says: "It pleases me to say that no other book I have would I exchange for it could I not duplicate it. I have used several of the formulas and have had absolutely no failures when I use pure materials. Being a chemist, of course I know how to select. In fact, some of your formulas are marvelous." The Rev. C. C. Brown says: "Your 'Cyclopedia of Receipts' is a wonderful book. I reinked the ribbon that I am now using by following the directions given in the book; I have also made a splendid hektograph and a supply of ink." Mr. M. E. Lee says: "I am so captivated with your 'Cyclopedia of Receipts, Notes and Queries,' that I desire another for a new year's present to a friend of mine and inclose $5, for which please send me," etc. Mr. A. E. Dye says: "Cyclopedia received. Am delighted with it. Just what I have felt the keenest want of for years." Mr. Charles E. Cole says: "I think it is the finest thing of the kind I ever saw. May its sale never stop until every family in the civilized countries of the world has got a copy."

The De Mare Incandescent Gas Burner.

Public attention is being given in Paris to a system of incandescent gas lighting to which the name of the inventor, M. De Mare, has been given. The arrangement consists of an atmospheric burner-fitting designed to be easily attached to an ordinary burner point. This fitting is of extremely ingenious design and construction; being probably the smallest and most compact air and gas mixing apparatus ever successfully used for this purpose. It is professedly designed upon the principle of the Giffard injector. The mixed gas and air issue at the top of the fitting through a slit, which causes the flame to spread in the regular batswing shape. Across the flame is suspended, by means of a brass yoke, a length of twisted platinum wires, carrying a row of what appear to be asbestos fibers. In the heat of the atmospheric flame these fibers become highly incandescent, and yield a brilliant light. The effect is certainly striking; and as neither chimney nor globe is required to enable the light to burn satisfactorily, and the incandescing material is not woven into any textile form, the simplicity and cheapness of the arrangement are obvious. For street lighting, clusters of these burners are used in Paris with good effect. Before lighting, the fibers, being flexible, will stand any reasonable amount of handling; and it is said that one string will last for 1,500 hours of lighting, and be serviceable to the last shred. The consumption of gas in the De Mare burners is limited to 2⅜ cubic feet per hour; and the illuminating power is stated to be 25 candles.

Photographs of Lightning.

Mr. J. N. Jennings, of Philadelphia, and of the Philadelphia Photographic Society, gave an interesting exhibition of views of lightning before the Society of Amateur Photographers, in this city, on the 14th inst., which proved, in his estimation, that the artists' conception of lightning, as depicted by them, was wholly wrong. He had illustrations of the earliest ideas of lightning gathered from the records of the ancients; lightning as the Western Indians sketched it; a comparison of the discharge of electricity over the surface of a dry plate, between the two terminals of a Holtz electrical machine, with the appearance of iron filings on a piece of glass or paper as arranged between the two poles of a magnet when the latter is placed under the paper, and a comparison of a heavy discharge spark from such machine with an ordinary lightning flash. A photograph of a silver dollar laid on the surface of a dry plate and illuminated by the faint discharge of electricity about it was very novel.

Other pictures represented the curious tree-like appearance of lightning, and the dark branches or black branches seen to emanate from the side of the stroke. Mr. Jennings stated that when the picture was made he observed, at the time of the flash, these branches had the appearance of a deep orange color, which accounts for the phenomenon of their taking black on the sensitive plate. A peculiar phase of a single flash, separating into two branches going in the same direction downward, the path of one being further off than the other, on account of the lateral action of the wind, was shown. There were views of veritable thunderbolts, where two separate flashes run into each other. Also views of flashes shooting upward from the earth. He showed a comparison between a sheet of glass cracked by heat with the form of a lightning flash, and closed the series by showing a view of a flash taken from the rear end of a railway train in motion, which had the appearance of a broad ribbon of light—very remarkable. He proved that it could not have been due to the local movement of the camera, but gave as a possible explanation that it might have been produced because of a single stroke separating it into two parallel branches near together, one nearly back of the other, which would make the light from each merge on the plate and give the effect of a broad ribbon of light.

The views were very instructive, in showing the many phases of lightning and in correcting false ideas on the subject. Photographers generally should be prepared to catch views of lightning, in order that it may be studied photographically as effectively as astronomy is now done.

The Deseret Museum.

In our description of the Deseret Museum, Salt Lake City, in the SCIENTIFIC AMERICAN of April 20, the size of the main lecture hall was erroneously given as 16 by 32 instead of 66 by 32 feet, as it should have read. The museum was represented by its president, Dr. James E. Talmage, at the Dublin meeting of the Museums Association in June of last year.

Columbia College Library.

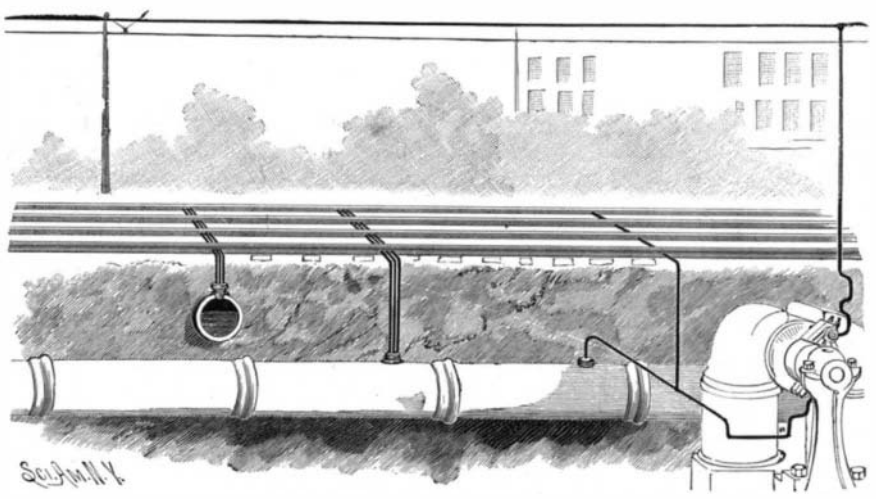
President Seth Low, of Columbia College, New York City, has given one million dollars to build the new library building, which will be erected on the new site of the college at One Hundred and Sixteenth Street, New York. Mr. Low wishes the library building to be a memorial to his father, the late A. A. Low, "a merchant who taught his son to value the things for which Columbia College stands." The new library will be erected in the center of a terrace occupying the highest point of land of the new site and will be the center of the imposing group of buildings. Access to the facade of the new building will be gained by a flight of steps 325 feet wide, which lead to a subordinate flight 140 feet wide, which, in turn, lead to the main terrace on which the library building will be erected. The classic building will be in the form of a Greek cross, and will be surmounted by a dome at the intersection of the arms. The summit of the dome will be 136 feet above the upper terrace. Bronze doors will give entrance to the portico, from which the richly ornamented vestibule will be reached. Marble doorways will lead thence to the president's room and the office, on the left and right respectively, while directly ahead the vestibule will open into the main reading room, which will occupy the whole space beneath the dome, which will be 70 feet in diameter. From the four piers of limestone at the corners will rise four richly coffered vaults, which correspond to the four arms of the building. These vaults will be 17 feet deep and will end in semicircular windows, 44 feet wide and 22 feet high. A marble and bronze colonnade, 29 feet high, will connect the piers and support a gallery adorned with statues of heroic size beneath the great windows and at the level of the second story. The colonnade gives access to an ambulatory surrounding the reading room, and thence to the halls and special libraries occupying the four wings of the building, also to the four stone staircases leading to the upper stories. The northern arm of the library is set apart for the law library, the western for the administration, the eastern for the Avery architectural library, while the southern is occupied by the vestibule and adjoining chambers before mentioned.

The second story contains the trustees' room, the president's private room, special libraries, etc. The third story will be devoted to lecture rooms, of which there will be ten, and to rooms for officers of the college. The main depository for books will be situated in the basement of the building, which is entirely above ground. The design of the library has been prepared by Messrs McKim, Mead & White. It will be constructed of buff Indiana limestone.

The library of Columbia College is one of the most remarkable collections in the country, the number of volumes in 1893 exceeding 160,000. Though primarily intended for the use of the students, a generous hospitality is extended to scholars or to any one who is making special investigations.

PROTECTING THE PIPES NEAR ELECTRIC RAILWAYS FROM ELECTROLYTIC ACTION.

Since the general introduction of trolley roads in the streets of towns and cities, numerous cases have occurred of damage to water, gas, and other pipes from the fact that the ground has become charged with electricity, and an electrolytic action thus set up by the escaping current, quickly destroying the pipes within its influence. To obviate this difficulty the improvement represented in the accompanying illustration has been patented by Mr. Richard Watkins, of No. 1909 M Street, Sacramento, California. The current is supplied by the generator to the trolley line in the usual way, and the generator is also connected with the rails and with the pipes in the street, these pipes being connected with the rails at frequent intervals and at points where the connection may be most easily made. The conductors should be large, so that the current will flow easily, and they are brazed or otherwise firmly secured to the rails to make good contact, while connection with the pipe is preferably made by means of a plug screwed into the pipe, but without the use of lead, solder being applied to make sure of a tight joint. By thus utilizing the street pipes for return conductors the current passes freely back to the generator and there is no chance for electrolytic action.



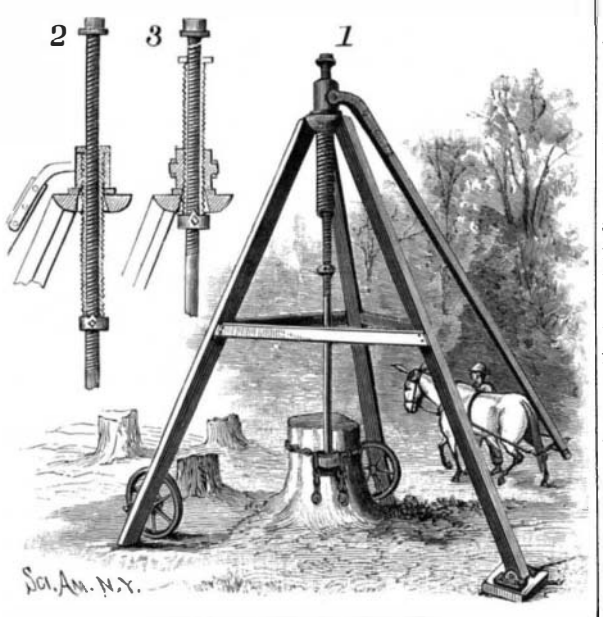
WATKINS' METHOD OF PREVENTING ELECTROLYSIS OF STREET PIPES.

Solid Stream Forms.

Mr. D. W. Taylor, United States Naval Constructor, the gold medalist, read a paper recently before the Institution of Naval Architects, in amplification of that read a year ago on "Solid Stream Forms, and the Depth of Water Necessary to Avoid Abnormal Resistance of Ships." There was plenty of experience, he said, to establish the fact that in water only three times the draught of a ship the progress of that ship was materially retarded, but he was unable to discover any authentic case of retardation where the depth of water was six times the draught amidships. Very broad ships required a slightly greater draught than ships of ordinary proportion, while the greater the speed, the more need for great depth. This was because shoal water produced but little effect upon any but the wave resistance, and at slow speed the wave resistance was very small. It, however, increased with the speed. In the case of a very fast ship, the wave resistance might well be 10 per cent of the total resistance at 10 knots, and be 60 per cent or more of the total at 21 or 22 knots. An increase of one-fifth in the wave resistance would mean but 2 per cent at 10 knots, while an increase of one-fifth in the wave resistance at the high speed would mean an increase of 12 per cent in the retarding influences; and this, of course, means an increase of engine power.

A SIMPLE AND EFFECTIVE STUMP PULLER.

The tripod frame of this stump puller has two of its legs provided with wheels, to facilitate moving it about, and to the third leg is swiveled a shoe, the head block at the top being preferably of metal, and having a conical opening, a half round washer resting on the block above the opening. The improvement has been patented by Mr. James D. Wilson, of Montague, Mich. Secured in any suitable way to the stump is a lifting shaft at whose upper end is a cap, the shaft having an exterior thread, preferably of two and a quarter inch pitch, and an adjustable clutch on the shaft, below the head block, is adapted for locking engagement with the lower end of a hollow shaft through which the lifting shaft passes. The interior of the hollow shaft has a thread engaging that of the lifting shaft, and the hollow shaft has a flange at its upper end and an exterior thread, preferably of four and a half inch pitch, the hollow and the lifting shafts being shown in their normal position in Fig. 1. A nut resting on the washer receives the exterior thread of the hollow shaft, the shape of the washer and of the head block permitting the lifting shaft to be somewhat inclined without becoming cramped. Arms projecting from the nut are secured to a lever or sweep to which a draught animal is attached, the lifting shaft moving up at a speed corresponding to the pitch of its screw thread, as the sweep is carried around, but when the clutch on the lifting shaft engages with the hollow shaft the latter is also carried up with the main shaft, at a correspondingly greater speed, owing to its coarser pitch, the stump then being raised four and a half inches at each revolution of the sweep. In Fig. 2 the lifting shaft is shown drawn up to a connection with the auxiliary shaft, and in Fig. 3 the two shafts are shown elevated together. As will be seen, the stump is first started and slowly drawn up by the main shaft, and is afterward raised more rapidly by the coarser thread on the auxiliary shaft.



WILSON'S STUMP PULLER.

Improved Boat-lowering Devices Needed.

Commander Tupper, of the Royal Navy, in a recent number of the Nautical Magazine, makes the following suggestions:

What are the means of hoisting out boats? Simply by the use of curved davits secured to the ship's side and capable of swinging outboard, as may be required, if the vessel is on an even keel; if the vessel is not on an even keel, it is with considerable difficulty, and much shoving with spars, etc., on the davit heads, that the davits on the side with "heel from" can be turned out, and of course this difficulty increases with the angle of heel. Again, assuming that the davits have been placed in the outboard position, then comes the difficulty of lowering the boats and disengaging them without bilging the boat against the ship's side or capsizing her in the act of disengaging; with the lee boats this difficulty is minimized, but with the weather boats it is always a very serious matter. It therefore amounts to this, that in cases of collision and grounding, when the boats are most wanted quickly, it is more than probable that only half the complement of boats can be got out at all.

How can these defects be remedied? I. By improving the form of davits. II. By fitting the davits with jackstays from the commencement of the curved part to the water line, fitting runners on these jackstays and securing them to the lower blocks of the boat's falls, which should disengage from the slings directly the boat becomes waterborne.

As to I. Improvements in the form of davit. I may mention: (a) That in the Royal Navy some davits are fitted with a horizontal toothrack into which a worm works; that is, cogs are fitted round the stem of the davit and a spiral screw fitted on the gunwale; this screw is revolved by a handle, and working in the cogs causes the davit to revolve in any required direction. It is a most convenient arrangement and would enable davits to be turned outboard on the side with heel from, when other means could not be effectively used. (b) I have seen a form of davit in use in the American navy which has rather taken my fancy; the davits are straight bars of iron or steel; their lower ends are T shaped and rest in eye bolts close to the waterline, their upper ends carry the upper purchase blocks of the boat's falls in such a manner that the boat is slung from the stem and stern posts, and swings in between the two davits, the tumblehome of the ship's side giving sufficient angle for the keel of the boat to rest on the gunwale of the ship, and be secured there or transported from there to amidships on a trolley if more convenient. Now with this form of davit you could always get a boat out by forcing the davits away from the ship's side by screw or hydraulic jacks, and when the boat is hanging over the water you can lower davits and boat together, keeping the boat close up to the davit head until there is no chance of her being stove against the ship's side when the falls are lowered.

(c) Another and a very good form is a curved davit pivoted and hinged on the gunwale itself, having a permanent screw jack fitted to it. In this case, when the boat is hoisted and the screws are close home, the boat rests in the curves of the davits well inside the gunwale, and when the screws are out to the full extent the boat is suspended over the water well clear of the ship's side.

In both (a) and (c) jackstays could easily be fitted; in (b) they are not necessary, but could be fitted to the davits themselves from the heads to water line. All these forms are, to my mind, much superior to the usual boat's davit.

But in addition to more efficient davits surely every well found mail steamer should carry a large kind of unsinkable boat, something after the style of the old troop boat carried in some of our troop ships, which could be launched from whichever happened to be the leeside, and also capable of automatically disengaging itself and floating if the ship sank before there was time to launch the boat.

Again, it seems practicable so to construct the bridges and promenade decks that they should automatically disengage to form three, four, or more rafts which would be left floating when the vessel has subsided. Shrouds, backstays, etc., interfered considerably with the chances of floating such rafts formerly; but now that we no longer require more than one mast, which could be fitted as a tripod mast, and that the funnel guys are quite easily slipped, I do not see that anything need interfere with these rafts floating. If the passengers accommodated themselves on them, they might at any rate have a chance of being rescued. Small depots of water and provisions could always be kept filled, which might enable the occupants to preserve their lives for three or four days, when they would almost certainly be found, even in midocean.