Beyond the Elbe lock stretches the inner harbor, which is about 1,557 feet long by 656 feet wide, at the widest place, and then narrows down to the regular width of the canal; that is, 229 feet.

But let us return to the lock. The two basins are contiguous and parallel, and each basin is provided with three sets of gates that are to be closed every four hours. The foundation of the Elbe lock was built mostly dry. The walls consist of brick and square blocks of stone, the latter showing in some parts, while other parts of the visible portions of the walls are covered with cement. The projecting corners, sills, recesses for the gates, and other trimmings are made of stone. In the Brunsbuttel lock there are altogether 103,332 square yards of masonry. The walls are provided with supply channels to be used in filling the locks, the water for this purpose being taken from the inner harbor. These channels can be closed watertight. Pontoons will be used for closing the basins watertight in case repairs are being made. In this lock, as in the lock at Holtenau, there are the necessary hydraulic motors and other machinery, all operated from a central machine station. The illustrations, for which we are indebted to the Illustrirte Zeitung, show the interiors of the locks.

About Engravings.

Not every one who reads the newspapers and looks at the engravings in print knows how they are made or what process is used in producing the different effects. The Newspaper Union undertakes to tell how the variety of kinds are produced:

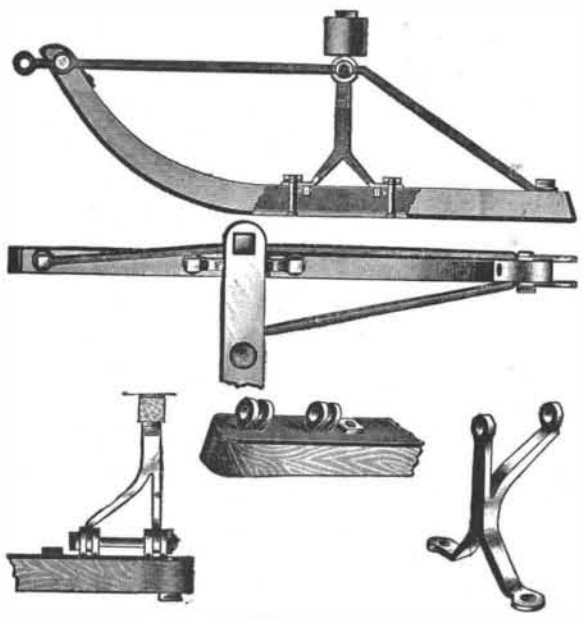
A half-tone is made direct from a photograph, and is the closest possible counterfeit of the original that can be produced. It is not suitable for newspaper work, but works well on any supersized and calendered stock. An electro from this necessitates a separate operation, and the price of an electro does not include the making of the half-tone.

A zinc etching is made only after the subject is first plainly shown in black ink upon white paper. Pen and ink drawings of original drawing subjects are indispensable, and may be made either from a photograph or other illustration. This drawing is photographed upon zinc, the superfluous metal eaten away by acids, and an electro is made from the skeleton which is left. Price of the drawing and zinc etching is not included in the price of electro. Zinc etchings are suitable for newspaper work, and are inexpensive.

Woodcuts are made only by drawing upon wood, and cutting out superfluous portions. They are necessary only for the finest work, not so good generally as half-tones, are slow to make, and expensive.

AN IMPROVED SLEIGH KNEE.

The illustration represents an improvement in sleigh construction for which a patent has recently been granted to Mr. L. L. Chaffin, of Monticello, Minn. The attachment of the knee to the runner is shown in one of the views, and the knee itself, shown separately, is forked at its upper end, spaced groups of bearings rigid with the beam receiving the upper forked arms of the knee between themselves, where they are held by a pivotal bolt. A continuous brace, having an eye through which the pivotal bolt is passed, is fastened



CHAFFIN'S SLEIGH KNEE.

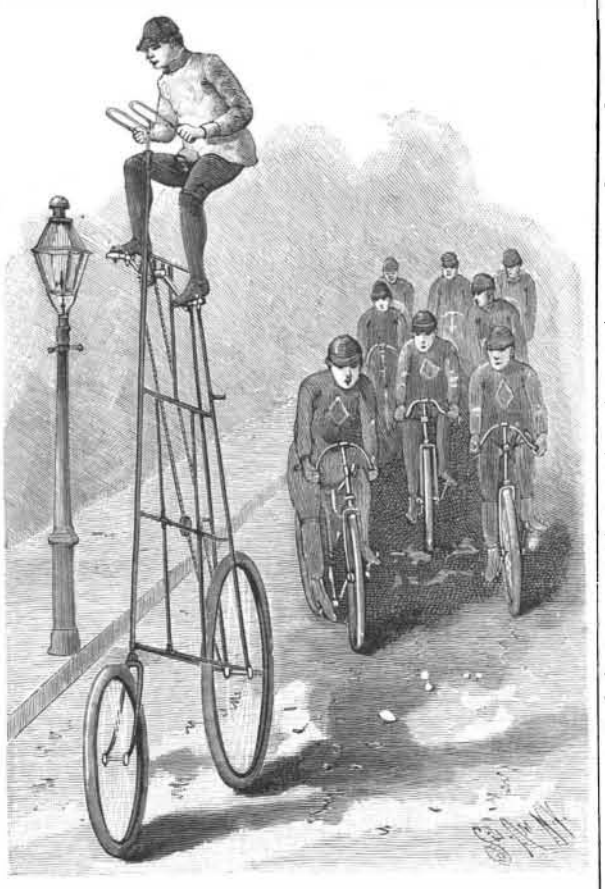
at its front and rear ends to the runner, and another brace extends diagonally from the front end of the runner to the inner end of the bolt.

The Shepherd's Telephone.

The use of the telephone on Australian sheep ranches is becoming common. Its employment is mentioned on the Clark ranch in Montana, where all the sheep and shepherds are watched and handled telephonically, by means of six stations all communicating with a central point, from which come weather signals, orders, etc.

A CURIOUS BICYCLE.

One of the most curious sights that has lately been seen in the streets of New York is what has felicitously been called the Eiffel Tower Bicycle. This machine is constructed on the same principle as an ordinary safety, but it has a frame superstructure which carries the rider at a distance of some ten feet from terra firma. This machine is frequently seen on the avenues of the city, and the rider easily overtops the ordinary lamp post along the route of travel. He seems to have



THE EIFFEL TOWER BICYCLE.

perfect control over the machine, which he can drive at quite a good rate of speed, taking sharp corners with perfect ease and apparent safety. This bicycle is mounted from behind in the usual way, but it has to be held by attendants while mounting. The owner sometimes places the machine against a wall and mounts from a standstill, but, of course, in the city this is not always practicable.

There is considerable difficulty in driving the bicycle up hill, owing partially to the weight, the length of the sprocket chain and the balance of the machine. The sprocket chain extends from the upper sprocket wheel to the rear wheel, and the lateral swing or play of the chain is prevented by a guide roller mounted just above the back wheel. The front wheel measures 28 inches, the rear wheel 36 inches, and the extreme height is said to be 13 feet. The machine was constructed in England, but the American Dunlop tire was applied after it arrived in this country. The adventurous spirit who has been seen riding this remarkable wheel is usually accompanied by a number of companions who serve as a sort of bodyguard and prevent vehicles and pedestrians from obstructing the way.

Natural Soda in California.

California is one of the few localities in the United States where natural soda is found. The geographical occurrence of this substance in the United States is principally confined to the arid regions of the Great Basin, especially to the soda lakes near Ragtown, Nev.; Mono Lake, Mono County, and Owens Lake, Inyo County, Cal.; and Albert Lake, Or., and to many dry deposits and incrustations in the same region. A full chemical discussion of the nature of natural sodas and their technology, together with numerous analyses of the waters of the soda lakes and dry deposits, are given by Dr. T. M. Chalard in Bulletin No. 60 of the United States Geological Survey. The lakes, as shown by Messrs. King, Hague (fortieth parallel, II.) and Russell (Eighth Annual Report and Monograph XI., United States Geological Survey) are, for the most part, the residues left by the evaporation of larger bodies of crates, the shore lines of which can be traced at considerable distances, sometimes several hundred feet above the present beaches, showing that the old lakes covered wide expanses of the present desert.

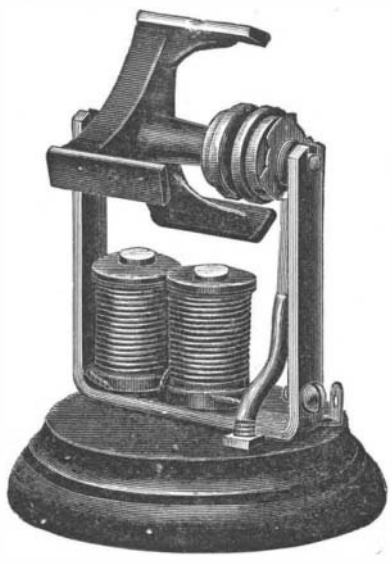
The concentration by evaporation of the waters of the former lakes has increased the proportion of their mineral salts, and sometimes this concentration reaches the crystallizing point, when the sodium carbonate appears as a white incrustation on the surface and shores of the lake. The origin of this salt is explained by the geology of the region where it occurs, which is given in the reports above referred to. Mono and Owens Lakes, in this State, are outside the great hydrographic basin of Lake Lahontain. Professor Russell describes the geography and geology of Mono Lake in the Eighth Annual Report of the United States Geological Survey. Its hydrographic basin has no outlet, but streams and springs feed the lake, and the only escape for the water is by evaporation. The ancient shore lines can be traced far up on the sides of the Sierra Nevada, which formed the western shore of the ancient lake. There are springs in the bottom of the lake and near its shores. They are especially abundant near the base of the mountains—the seat of former orographic movements—and a belt of hot springs extends along the range for hundreds of miles. Just south of the lake is a series of volcanic cones known as Mono craters, so that the locality is one of former volcanic activity. The high saline contents of this and other lakes is due to the gradual concentration of its own water supply.—Min. and Sci. Press.

Guard Rails.

The Roadmaster and Foreman says: "We were very much interested in the New England Roadmasters' Association's report on guard rails. The conclusions of the committee were about in accordance with the usual practice on the best roads of the country. The length of guard rail recommended is not less than 12 feet. But we rather like the length of 16 feet. The purpose of the guard rail being to so guide the wheels that they will not take the wrong side of the frog, or pass over it with unnecessary jar, it is plain the guard rail need only be long enough to produce this result. Any additional length is mere waste. For all practical purposes 16 feet is sufficient. With this length we could have a curved portion of four feet at each end and a straight portion of eight feet in the middle. A curvature of two inches at the end is sufficient. No greater mistake can be made than in having the curve at ends of guard rails too stiff. When the curve is short and stiff, the approaching wheel strikes the guard rail at such an angle as to impede its progress, and cause a very decided jerk. As evidence of this note a guard rail that has a very stiff curve. Not only does it cause a jerk when the wheel strikes the guard rail, but the wheel is veered out of its proper position, and before it rights itself a succession of jerks follow that are injurious to the track and rolling stock. It is therefore very important that the curve be as slight and gradual as possible, so that the sides of the wheel flange will strike the guard rail and glide along without any jerk, or without being retarded until it reaches the straight portion of the rail and passes over the frog without any jerk or jar. Everything should be so arranged that the wheels will pass over the frog squarely, and the only way this can be accomplished is to have nothing impede the progress of one of the wheels. The more gradual the curve, the more nearly this can be secured, as there is no facing surface for the edge of the flange to strike. Careful attention to these little details in the arrangement of the guard rail will save time, trouble and expense."

SIMPLE ELECTRIC MOTOR.

The electric motor shown in the annexed illustration is capable of use for driving mechanical signs, toys, and other devices requiring a very small amount of



SIMPLE ELECTRIC MOTOR.

power; but it finds its principal use as an instructive toy.

It is provided with a bichromate battery capable of developing sufficient current for running the motor at a high rate of speed. The armature can readily be detached so as to permit of using the field magnet for experimental purposes.

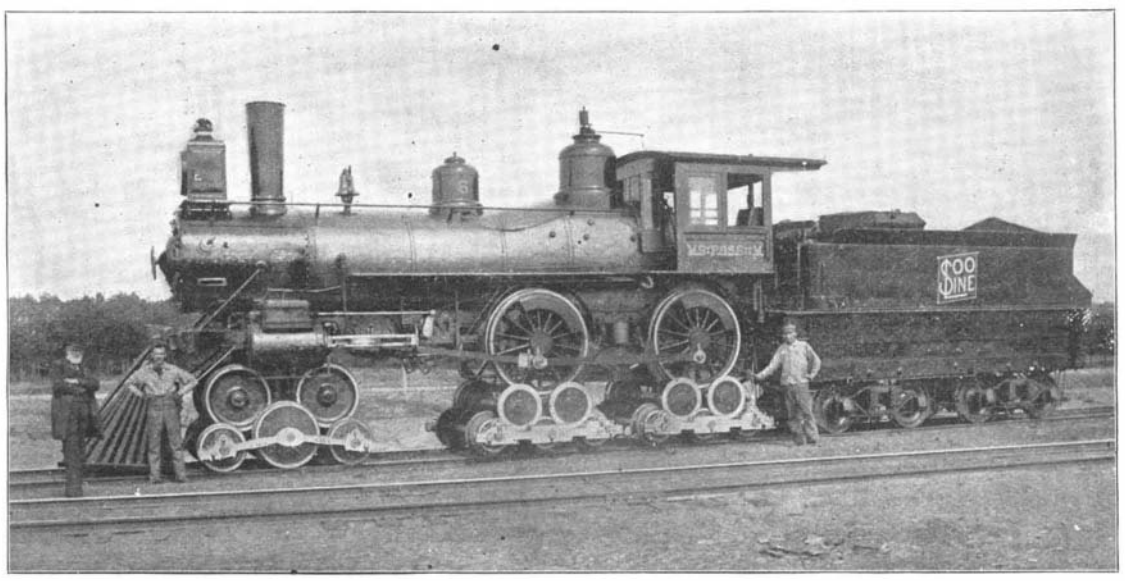
The entire apparatus, including battery and a few charges of bichromate of potash, is furnished for $1, a common tumbler being used for the battery cell. This motor is manufactured by the Wood Novelty Concern, of 46 Cortlandt Street, New York.

Hazing a Custom to Abolish.

The Western Druggist makes this pertinent inquiry: "Is the spirit of savagery creeping into our American universities? Hazing, in all conscience," the writer goes on to say, "is bad enough, and barbaric enough; but what must be the mental condition of 'students' who would run the risk of committing murder for the sake of indulging in a 'practical joke'? Not enough that chlorine gas was discharged with fatal effect into a hall filled with students of Cornell University; not enough that this crime found its imitators in the university at Lawrence, Kan., where bromine was similarly used (charged, in both instances, to the students of the pharmacy departments); now the list of these heinous jokes has been extended by the action of undiscovered individuals who burned a lot of cayenne pepper in the rooms occupied by the lady students of Northwestern University at Evanston, Ill., causing untold suffering to the students there assembled in meeting, and even prostrating a number who had inhaled a larger proportion of the penetrating, irritant fumes. The authorities are derelict in the execution of their duties if they do not discover the perpetrators of these crimes and make such an example of them as to deter in the future all evil-intentioned imitators."

THE HOLMAN LOCOMOTIVE.

So much has recently appeared in the columns of the daily press and also of the European technical press in connection with the so-called "Holman" locomotive, and its trial by the Minneapolis, St. Paul and Sault Ste. Marie Railroad Company, that definite information concerning same will no doubt be appreciated by the railway world and others interested. As will be seen by the accompanying illustration, reproduced from a photograph taken in the yards of the "Soo" Railway, the "Holman locomotive" in question is not a locomotive at all. On the contrary, it is one of the railroad company's regular 17x24 inch, eight wheeled Baldwin locomotives, placed on experimental trucks, for the purpose of demonstrating the possibility of decreasing the piston speed for a given rate of progress. The railway company is not interested in any manner in this device, the engine simply being leased to Mr. Holman for the above mentioned purpose. The engine up to date has not been in service except for a few days in the yards of the company at Minneapolis, although it is expected that a road trial will shortly be made. Without expressing any opinion as to the merits of the device, it would seem that even for the purpose of demonstrating the theory it would have been better to have dispensed with the front set of Holman trucks and obtained the necessary height for the front end of the locomotive by blocking on the top of the ordinary engine truck. This would have avoided much of the complication which at present attaches to this experimental device, and rendered it much less liable to accident. When the actual trial occurs, we will endeavor to supply our readers with a full account of the performance of the engine.—The Railway Review.



THE HOLMAN LOCOMOTIVE.

Standard Screws for Watches.

A general meeting of the Institution of Mechanical Engineers was held in London, October 24, the president, Professor Alexander B. W. Kennedy, occupying the chair. One of the papers read and discussed was "The Manufacture of Standard Screws for Machine-made Watches," by Mr. Charles J. Hewitt, of Prescot.

Mr. Hewitt's paper, remarks Nature, was of an interesting nature. He is the works manager and chief mechanic of the Lancashire Watch Factory, an establishment recently started at Prescot for the manufacture of watches on a large scale in one works. The factory system of watch production has been, as is well known, carried to a very successful issue in the United States, where the Elgin and Waltham Watch Companies annually make large numbers of excellent timepieces wholly by machinery. As in all cases where highly skilled hand labor, performing intricate operations, is superseded by mechanical appliances, the machines used are of a highly organized and costly nature. In the case of the minute parts required in watch making, this feature is very strikingly emphasized. Perhaps some of our readers may remember the exquisite little machine tools exhibited by the Waltham Watch Company at the Inventions Exhibition, in the year 1885. These were a revelation to most English watchmakers, accustomed to the small factories and perfectly rude appliances of the British industry, in which the highest skill of the operators, due to special training from earliest youth, compensated for the lack of ingenuity displayed in the construction of the tools used. In the case of watches, as with so many other mechanical productions, the brain capital expended in the employment of construction of machines bears fruitful interest in the shape of less skilled labor required in their use. The same thing may be observed throughout the whole range of mechanical industry. The file, the hammer, and the chisel are the primitive tools of the engineer, requiring simple inventive power in their inception, but great skill in their use. The planing machine, by which the same end is obtained mechanically, of producing a flat surface, as was got originally by chipping and filing, required knowledge and skill for its production, but a comparatively small amount of those qualities for its operation. The same thing is true, even to a greater extent, in the case of the still more modern machine tool, the milling machine, which is often attended by boys, possessing no mechanical knowledge whatever, during its production of finished forms such as would have required a highly skilled workman in former days.

The beautiful machines referred to by the author in his paper, examples of which were shown at the meetings, carry the same principle many steps farther. As was remarked, the machine shown for making watch screws may be said to stand in the same relation to ordinary engineers' machine tools as costly gems to common building stones.

Mr. Hewitt commenced his description by dwelling upon the difficulties experienced by watchmakers in old times, when there was no general standard for dimensions and pitch of screws, or form of thread. Such was necessarily the case with hand work, but a machine can be depended upon to turn out many thousands of parts exactly similar, so that a screw could be put into a watch made years previously. The advantage, naturally, is most apparent in the case of repairs and renewals. The standard of screws adopted by the Lancashire Watch Company, at their Prescot Works, is that recommended by the committee of the British Association, and described in the report of 1882. It is a V-thread of 47½ degrees, rounded top and bottom through $\frac{2}{11}$ of the height, and the pitch is directly related to the diameter of the formula $D=6P^{5}$. In arranging the standard the first business was to make master taps, which were produced on a small screw cutting lathe specially designed for the work, and having a corrected screw, accurate within very close limits. Taps being thus produced, screw dies were made to the exact standard. When cut the thread requires hardening, and this causes some amount of distortion, which is corrected by grinding the threads with a soft steel lap charged with diamond dust, the operation being performed in the same lathe that cuts the thread. The die used is simply a tapped hole in the center of a small thin disk of steel, it being an object to have as little metal as possible surrounding the hole, so as to reduce the distortion produced by hardening. Although the die is not split, the pressure exerted by the die holder is sufficient to produce a slight modification in the diameter of the screw, and in this way the alteration caused by hardening is corrected. During the discussion this fact was questioned, but Mr. Hewitt says that the statement is absolutely correct. The machine itself is of an intricate design, as may be imagined when it is stated that perfect screws are turned out automatically from the plain rod or wire. There are four hollow spindles through which this wire is fed forward to the operating tools, which are four in number, and are carried on a revolving turret. There is also a further tool for making the slit in the screw head for the turn screw. It would be useless to attempt to describe the mechanism of this very ingenious lathe without the aid of elaborate drawings. Indeed, during the discussion several engineers, well skilled in mechanical appliances, confessed themselves unable to follow the train of mechanism, even with the aid of working drawings displayed on the walls of the theater. It is enough to say that the machine will go on without any attention so long as the wire to form the screw lasts, when it stops of itself.

The Goodwin Sands.

Midway between the North and South Forelands, and right in the fairway track of the most crowded marine highway in the world—the road that leads to London—says the Nautical Magazine, lies that famous shoal, the Goodwin Sands.

There are few larger shoals off the coasts of the United Kingdom. Their extreme length, northeast and southwest, is 17,980 yards, or very nearly ten miles and a quarter, and their greatest breadth 7,669 yards, or a trifle more than four and a quarter miles. The area of the reef which is exposed at dead low tide is a little more than two-thirds of its entire surface, that is to say, two leagues and a quarter in length and about a league in width. Few more erroneous notions exist than the popular idea that the Goodwins are a quicksand. The nature of the particles is, indeed, as firm as the beach of the seashore, and when the yellow ridge has been long enough uncovered to become dry it may be walked upon with security and comfort. No doubt the quicksand theory originated with the discovery that wrecks which become stranded upon the Goodwins gradually settle away out of sight. But it is the nature of all sand when it gets wet to grow of an absorptive character, with a tendency to suck down any object resting upon the surface. Then again, the insidious process of silting caused by the ceaseless flow of the current has much to do with the seemingly mysterious disappearance of vessels upon this shoal.

The character of the various strata of which the Goodwin Sands is composed was revealed by a very interesting experiment made at the instance of the Brethren of the Trinity House by Sir J. H. Pelly, in the year 1849. The purpose of the undertaking was to determine the geological formation of the sands, and to ascertain on what bed they rested. In order to carry out this scheme an iron cylinder of two feet and a half in diameter was constructed in ten lengths, and sunk by the application of atmospheric pressure until it had gone down a depth of seventy-nine feet, when it was stopped short by coming to the solid chalk. The results of this boring are very interesting, as establishing the exact nature of the famous shoal. For the first ten feet nothing came up but pure, bright sand. From this depth up to forty-six feet sand continued to be bored through, turning gradually to the color and substance of blue clay, with a strong sulphureted smell. At fifty feet fine shingle, intermingled with broken shells and chalk nodules, was found to exist. Six feet deeper came another stratum of clear sand, then in successive layers for the next twelve feet, clear broken shells, decayed wood, sea coal, fine stones and shells; dark, rank-smelling sand, more shells, and black nodules of clay. At seventy feet was again found clear, bright sand, containing many small pebbles, and permeated with chalky water, and this continued to the solid chalk at bottom.

Ornamenting Glass.

The following is an example of the means of carrying out the inventor's process: A coat of acid resist is laid upon the glass; from the parts forming the background to the design the "resist" is removed with a stencil; soda and hydrofluoric acid are then poured upon the surface. Hydrofluoric acid is next applied; the resist is then removed and the glass is cleaned. The glass is next coated with stain, and by means of a stencil the ornament is freed from the stain, which remains as a protection for the background. The stain is then burnt into the glass. The glass is then taken from the kiln, cleaned, and the required outline traced upon the glass, the background being filled with acid resist. The solution of soda and hydrofluoric acid is again poured on so as to leave a white "mat" on the whole ornament, leaving the outline, which is protected by the resist, clear. The shading-in is then done according to the ordinary process of the trade.

A SOCIETY has been recently established in Chicago entitled "Association of Practical Electricians." The object of this organization, of which Mr. George E. Sanford is president, is the education and advancement of men engaged in electrical work.