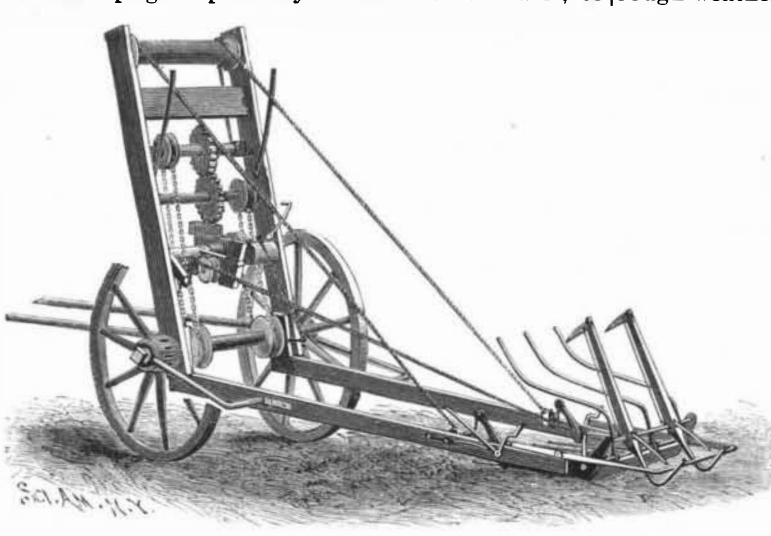
A HAY LOADER FOR FIELD WORK.

This loader, when drawn over the cocks of hay, is designed to gather up the desired quantities and automatically raise the rake to deliver the hay into a wagon to which the loader may be attached, a trip mechanism opening the rake for the delivery of its contents, and the rake being then automatically lowered to receive another load. The improvement has been patented by Mr. Fletcher M. Bird, of Wenatchee, Washington. The body frame of the loader consists of two uprights pivotally attached to the axle, to



BIRD'S HAY LOADER.

which is likewise pivoted a loading frame consisting of two parallel side bars. On the body frame is a drum shaft carrying two cables which extend upward over a friction roller, and are secured to the side bars of the loading frame. On the drum shaft is a gear meshing with a gear on a shaft below it, which carries near one end a pulley, connected by a belt or chain with a pulley on the axle, while another pulley on the axle is also connected by a belt or chain with a pulley on the drum shaft, both of these belts being so loose that they will be inoperative in the absence of a tightener. A cam shaft, carrying a block-like cam and weighted arms and tightener pulleys, acts as such tightener to control the movement of the drum shaft, whereby it is revolved in one direction or the other to elevate the loading frame and return it to loading position after the load has been dropped. The rake frame, pivoted in the loading frame, has lower stationary teeth, and in the back of the frame is journaled a shaft carrying movable teeth, a crank arm connected with a shifting lever being attached to the shaft. As the rake receives its load, the movable teeth are pressed upward until the complement of hay has been received, when the shifting lever is disconnected from its keeper, and the drum shaft elevates the loading frame and the rake, a trip yoke engaging lock levers, whereby fingers enter the hay to keep it from slipping. When the point of delivery is reached, the lock levers release the yoke and the fingers are raised out of the hay to permit it to drop into the wagon, after which the loading frame is again automatically lowered to the ground.

NEW BRITISH WAR BOATS OF GREAT POWER AND SPEED.

The British government is making renewed efforts to increase its naval forces and maintain its long-boasted supremacy on the seas. New war ships are being built, and especial attention is being given to the increase of the number of comparatively small but very powerful and swift torpedo boats—torpedo catchers they are called. Among the latest examples of new vessels in this line is the Havock, of which we here give, from the *Graphic*, London, an illustration.

The Havock was lately completed by Messrs. Yarrow for Her Majesty's navy, and on a recent trial yielded remarkable speed results. On the three hours' run in rough weather—the wind blowing 30 miles per hour—a speed of over 26 knots was reached. On the measured mile the mean of four runs was 26·78 knots. The fastest mile run was at the rate of 27·565 knots, and the mean of the best two runs was over 27 knots. This is believed to be the fastest craft afloat. The indicated horse power was 3,400, and the engine revolutions 362 per minute.

The boats have twin screws, and generally resemble the first class torpedo boats built by this firm. The length is 180 feet and the width 18 feet 6 inches. There is the usual hood or turtle-back forward, although some modifications have been introduced with a view to getting a drier deck when the vessel is steaming into a head sea. The propellers are three-bladed. The engines are of the usual tri-compound type adopted by the firm, having cylinders 18 inches, 26 inches, and 39½ inches in diameter by 18 inches stroke. The boilers, two in number, as stated, are of the locomotive type, and have copper fireboxes with copper tubes. The total grate surface is about 100 square feet and the total heating surface about 5,000 square feet. The deadweight load on board was 35 tons.

A further trial was subsequently had for eight hours at an economical speed, with a view to ascertain the distance the Havock would steam with the fuel supply she can carry on board, upon which depends her radius of action. It was found that at a speed of 11·2 knots the consumption was under a quarter of a ton an hour, and at 10 knots 3½ hundred weight an hour; and as the bunkers have a capacity of 60 tons, it follows that the distance the Havoc can steam without coaling is about 3,500 knots.

These vessels, with their high speed and considerable armament, would be likely to play an important part in a naval engagement.

Thirty-six of these boats have already been ordered, and six more, it is thought, will soon be ordered. The cost is about $200,000 each.

It is to be hoped Congress will not be backward in providing for the construction of a sufficient number of similar vessels to assist in the defense of our harbors.

THE IMPROVED "MONITOR" INCUBATOR.

An incubator which has stood the test of many years' experience, and proved highly successful in a practical and economical way for the artificial hatching of chicks and ducklings, is shown in the accompanying illustrations. It is manufactured by A. F. Williams, 61 Race Street, Bristol, Conn., and was awarded two medals and two diplomas at the World's Columbian Exposition. The case has double top, bottom, side and back, affording a dead air space all around, and it has two doors, the inside one being of glass, the whole being so put together as to prevent warping and shrinking, to last a long time without getting out of repair, and preserve an absolutely uniform temperature in the egg chamber.

The heat is regulated by a rubber rod, 1, that lies over the eggs in a trough, 2, the end of the rod farthest from boiler having an adjusting thumb screw, 3, and a block, 4, and spring forcing the expansion on the other end of the rod. On the other end is a double lever, 7, pinned to a frame, 5, through which the end of the thermostat is pinned. On the bottom or lower lever is another frame which the lever is pinned through, all very evenly balanced, so that the slightest change of the thermostat will force the double levers to throw the bottom in or out. The brass connection, 8, pinned to bottom of lever, is connected to lamp burner, lever and damper, 9. This lever is so sensitive that even a hair will turn it, and the damper is set

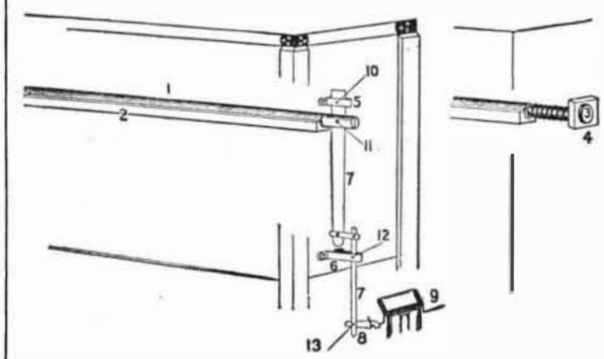
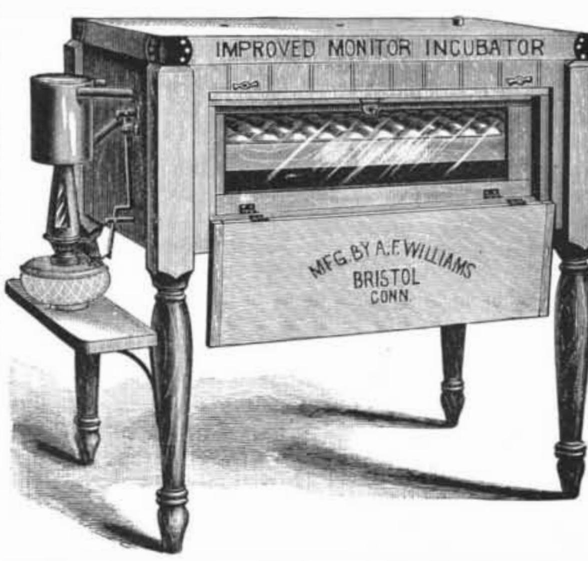


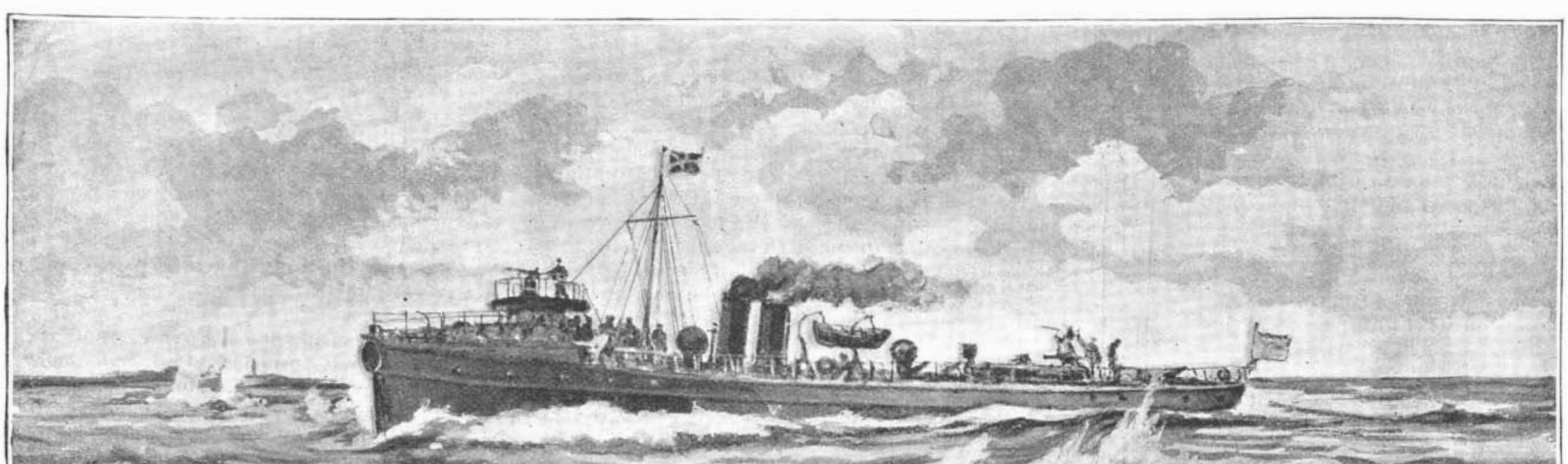
DIAGRAM SHOWING PARTS OF INCUBATOR.



A SIXTY-EGG INCUBATOR EXHIBITED AT THE FAIR.

close to the cone of lamp burner, but so that smoking is impossible.

It is said that on a recent trial of a 150-egg incubator it was locked up in a room alone for forty-eight hours and the temperature varied only one-half of a degree in that time. The air entering the incubator is warmed before reaching the egg chamber, and there is no direct draught upon the eggs. The air chambers and the evaporating pans are so arranged that the amount of moisture in the air is always under perfect control, the degree of humidity being registered by a hygrometer. The eggs are quickly turned without taking out the egg drawer, and the whole operation of the incubator is extremely simple.



THE NEW BRITISH TORPEDO BOAT HAVOCK—THE FASTEST WAR VESSEL AFLOAT.

The Speech of Animals.*

That animals have a means of communication among themselves through certain vocal sounds is a well established fact; that these vocal sounds are of sufficient range to express other than mere physical ideas, and thus to assume the importance of a language, is probable, although as yet unproved. It is toward the final settlement of this question that I wish to add my mite, and, while there is much that might be said, in the present instance I will confine my observations to a field but little explored—the attempts of animals to communicate with man.

For the last three years I have had a tame fox squirrel of which I have made a great pet. Polly has occupied a cage in the laboratory where she has been, for the most part, shut off from the sights and sounds of the outside world. Although at times the laboratory has had other tenants in the shape of squirrels, rabbits and guinea pigs, she has formed no particular attachment for any of them, but when I am about she is usually close to me, either on my shoulder or following me about like a dog.

Unconsciously at first and later with a definite purpose, I have talked to her much as one would talk to a young child. About a year ago she began to reply to my conversation. At first it was only in response to my questions as to food, etc., but later her "*talk*" has assumed larger proportions, until now she will, of her own accord, assume the initiative.

Her vocabulary appears to be quite extensive, and while, for the most part, it pertains to matters of food and personal comfort, there are times when it seems as though she were trying to tell me of other things.

When I first go out where she is in the morning she immediately asks for food, and until that want is supplied she keeps up a constant muttering. Later when her hunger is appeased she will ask to be let out of the cage. Often when playing about the room she will climb onto my shoulder and "*talk*" to me for awhile in a low tone and then scamper off. Unless she is sleepy, she will always reply to any remark made to her.

Her speech is not the chattering ordinarily observed in squirrels, but a low guttural tone that reminds one both of the low notes of a frog and the cluck of a chicken. Some of the notes I have been able to repeat, and invariably she becomes alert and replies to them. Unfortunately the effort to reproduce her tones produces an uncomfortable effect on my throat, and I have been obliged to desist from further experiments in that direction. The sounds that she makes are quick and in low tone; so the attempt to isolate words is very difficult, yet there is as much range of inflection as in German.

Another reason why I believe she is endeavoring to communicate with me is that she has used the same sounds toward other squirrels confined in the same cage, and that, while she will answer any one who addresses her, she voluntarily will only talk at length to me. That she understands what is said to her is beyond question, and, furthermore, she will distinguish between a remark made to her and one made to some one else.

I have had many pets that would answer in monosyllables to a question asked them or indicate by actions their desires, but this is the first instance that has come under my observation in which an animal has attempted more than that.

When Polly first commenced "*talking*," I regarded it merely as idle chattering, but further observation shows that it is not such and that the sounds she makes have a definite meaning. Moreover, the sounds she makes in "*talking*" are not the shrill notes of anger or alarm, but low, clear sounds that are unmistakably articulate.

In my fondness for my pet, have I overestimated the value of the sounds she makes, or am I right in assigning to them the characters of speech? Why should an animal not attempt to communicate with man? The higher animals are possessed of a well formed larynx and vocal chords. Why, then, should we deny or ever question the possibility of articulate speech? And, if they can converse among themselves, why may they not attempt to communicate with man?

Any one who has owned a well bred dog can relate numerous instances in which his dog has clearly understood what was said to it, and the readiness with which a dog learns a new command shows an intelligence of a high order. Although a dog's vocabulary is of limited range, it has certain definite sounds that possess an unmistakable meaning. There is the short, sharp bark that expresses a want, the low, nervous bark that means discomfort, the sharp, quick bark of joy, the low whine of distress, the growl of distrust, the deep growl of anger, the loud bark of warning and the whimper of fright. When to these is added the various movements of the body, cowering in fear, crouching in anger, the stiff bracing of the body in defense, leaping in joy, and many special actions, as licking the hand of the master or pulling at his clothes, we find that a dog can express his likes and dislikes, his wants and his feelings, as clearly as though he were human. Any one who, in a time of sorrow or depression, has had his dog come to him and lay its head in his lap and has looked down into those great brown eyes so full of sympathy and love, can never doubt that the dog understood all, and in its own way was trying to comfort.

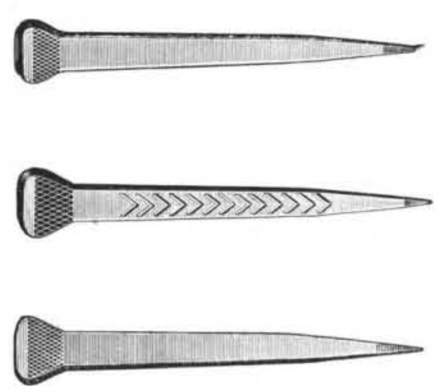
A friend's cat has an unmistakable sound for yes and no. The former is a low meyouw, while the latter is a short, sharp m'yoww. If Tom wants to go out, that fact is made manifest by a quick meyouw'. If, perchance, any one should be in the chair Tom regards as his especial property, no regard for propriety restrains him from indicating that fact and unceremoniously ordering the intruder out. His me'youw' on such an occasion cannot be mistaken. Instances of this sort are not uncommon and ordinarily fail to attract attention, but is there not here a field that will well repay a careful investigation?

Until my pet squirrel commenced her performances I regarded these things as a matter of course, but her chattering has raised with me the question, Is it not possible that our animal friends are endeavoring in their own way to talk to us as we talk to them?

*By Howard N. Lyon, M.D., Chicago, in *Science*.

THE CAPEWELL HORSE NAILS.

The Capewell Horse Nail Company, with factories at Hartford, Conn., and London, England, has experienced a steady and rapid development of its business in all sections of the country, notwithstanding the dull times which have been so prevalent. The company has lately built a fine new factory at Hartford. This nail is made from the best Swedish iron rods, improved in tenacity and uniformity of temper by the Capewell process, forming a nail of great strength.



THE CAPEWELL HORSE NAILS.

These nails are made in two styles of head, styled the "regular" and the "city" head, as shown in the illustration, and in both cases, as more plainly shown in the small cut, there is a distinct angle, and not a curve, where the head joins the blade.

The nail has a gentle convexity on its flat surface, and on the opposite surface a distinct bevel at the point, the point of the nail being reasonably sharp and the edges of the tapering portion near the point sharp and keen. This nail has been in use about twelve years, and has proved itself eminently adapted for both heavy and light work. The corrugated nail is a recent introduction which finds much favor, the slight ridges on its surface forming no obstruction to the passage of the nail through the hoof, but forming a secure hold without the necessity of clinching. The American factory of the Capewell Horse Nail Company is at No. 41 Governor Street, Hartford, Conn.

A Revolution in Telegraphy.

The *Boston Commercial Bulletin* says the days for the use of the primary battery for telegraphy in this country are numbered. It will not be long before the batteries that are now used in the various stations of the New England States will be relegated to antiquity. At the main Boston office, where 14,000 cells were employed for sending messages the first of the year, occupying one-fifth to one-sixth the space, there are now motor dynamos which take up but a small room in the basement. The advantages of the motor dynamo or transformers, as they are generally called, are many.

The saving alone over the old system is said to be between 40 and 45 per cent. This remains to be demonstrated, however. Then, again, the new practice has the great advantage of cleanliness and steadiness.

With the use of the cells the voltage varied from 26 to 36 points from the standard of 180 volts supposed to be delivered. With the motor dynamo as a generator of current, there is hardly any variation; at the most, two or three volts. The motor dynamo transforms or reduces the ordinary direct incandescent light current into one of small volume for the telegraph business.

In the Western Union Company's Boston office the current is taken in a commutator on one side of the machine and sent out from a commutator on the opposite side, the transformation being effected by two different windings on the armature.

The Boston plant has at present nineteen of these transformers in use and will put in addition probably ten more. Of the machines now in use five are of three horse power each, three are one horse power, two are one-half horse power, two are one-quarter horse power, and seven are one-sixth horse power. The potential of these machines varies anywhere from 25 up to 260 volts.

The farthest point to which a message has to be sent from Boston is Buffalo, N. Y., and this can be accomplished by throwing one large machine of 260 volts into service or several connected in tandem or in series. The small machines which are wound for from fifty to seventy volts are thrown into what is known as the loop from New York to Portland, thus necessitating the sending of but one message.

Aerial Ropeways.

At the San Andreas de la Sierra Mines, in Durango, Mexico, there is an aerial ropeway, built by the Vulcan Iron Works, of San Francisco, Cal., which is one of the boldest structures of its kind attempted thus far. The line is 15,517 ft. long, not being so remarkable in that respect, but the inclination is over 4,000 ft. in that distance, and two single spans are over 1,600 ft. between supports. This ropeway was put in to carry wood and charcoal to the mill. A great saving is made by this system, as the material had to be packed over a very circuitous route on mule-back. The country over which the line travels is exceedingly rough, and it crosses gorges 600 ft. deep. At one place the grade is at an angle of 48°.

The Vulcan system of ropeway consists mainly of an endless wire rope supported at convenient intervals on grooved sheaves, which are elevated on supporting structures, the height and construction of which will vary with the character of the ground; and passing around large grip wheels at ends of line. Carriers of suitable shape to hold the material to be transported—such as ore, wood, sugar cane, or any other similar material in sacks or in bulk—are fastened to the rope at intervals dependent on the amount to be transported. The ideal ropeway is one with sufficient grade to run by gravity, the loaded buckets pulling the empty ones back to the base of supplies. In any case, however, the power required to operate a very long ropeway is very small, for the friction is low. The surplus power generated on gravity lines is taken up by friction brakes at the terminals, which are automatic in their action.

Fireproof Floors.

In a paper recently read before the Civil Engineers' Club of Cleveland, Mr. Wm. Sabin describes the forms of fireproof flooring most commonly adopted in America. The oldest method was to place floor beams about 5 feet apart and turn a 4-inch brick arch between them, the beams being tied together to resist the thrust of the arches. The space above the arches was leveled up with concrete, in which were bedded strips of wood for the flooring. The plastering was applied directly to the bottom of the arches and over the flanges of the supporting beams. When exposed to a fire, however, it soon cracked off, and a special tile skewback is now used. Such a floor weighs about 70 pounds per square foot, exclusive of the weight of the floor beams. Its cost in America is about $1.44 per square foot. A similar floor in which the brick arch is replaced by one of corrugated iron has also been tried, but as the metal is exposed to the heat, it has no advantages. Its weight is 70 pounds and its cost $1.39 per square foot. The next improvement was the use of flat arches of terra cotta. In this case the beams were placed 6 feet to 7 feet apart, the tiles being 10 inches deep, and the weight of the floor was reduced to 40 pounds per square foot and its cost to $1.34. A further reduction of weight was effected by the use of porous terra cotta, obtained by mixing sawdust with the clay. The weight of floor was thus brought down to 35 pounds per square foot, while its cost was $1.36. In a test made at Denver an arch of porous terra cotta 4 feet wide and having a span of 5 feet bore a load of 15,145 pounds with a deflection of 0·65 inch, and it took 11 blows of a weight of 134 pounds falling from a height of 6 feet to 8 feet to entirely destroy the arch. Both systems of terra cotta floor have successfully withstood severe fires. In a method of construction now being largely adopted, the span of the floor is increased to 12 feet and it is supported by 12-inch I-beams. Between these beams is strained a galvanized wire net, said to be capable of carrying 1,000 pounds per square foot. A center board is fixed below this net, and the space between it and the top of the floor filled with a very light concrete, made with crushed coke, cork, cement and a little sand. This floor is 8 inches deep, the bottom flanges of the I-beams being protected by carrying the cement around them. Its weight is only 18 pounds per square foot, and it has been tested with a load of 580 pounds per square foot, the deflection being only one-half inch. Its cost is about $1.05 per square foot. In connection with the above prices, it should, perhaps, be mentioned that I-beams are very costly in the States.