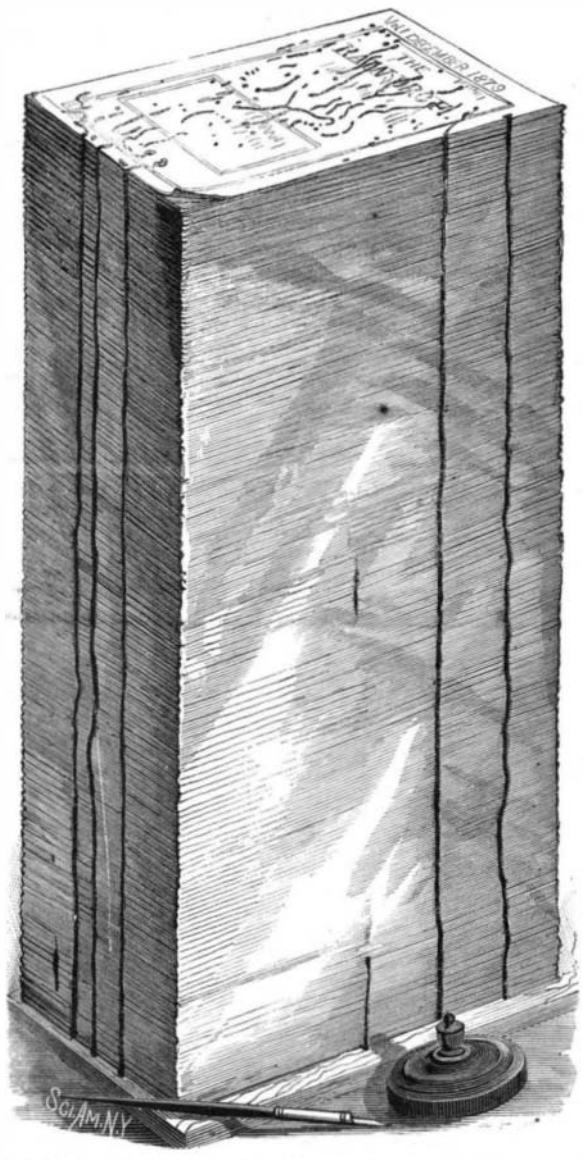
ered domes may be used with profit to any convenient number, but, on account of size, the inventor prefers to put only three in the friction still. In its present form the still is capable of producing thirty pints of distilled water in twenty-four hours, sufficient, he thinks, for any small boat's crew. Salt will not, we are informed, appear deposited if the machine is used properly, or unless all in the boiler or in the domes is vaporized to dryness.

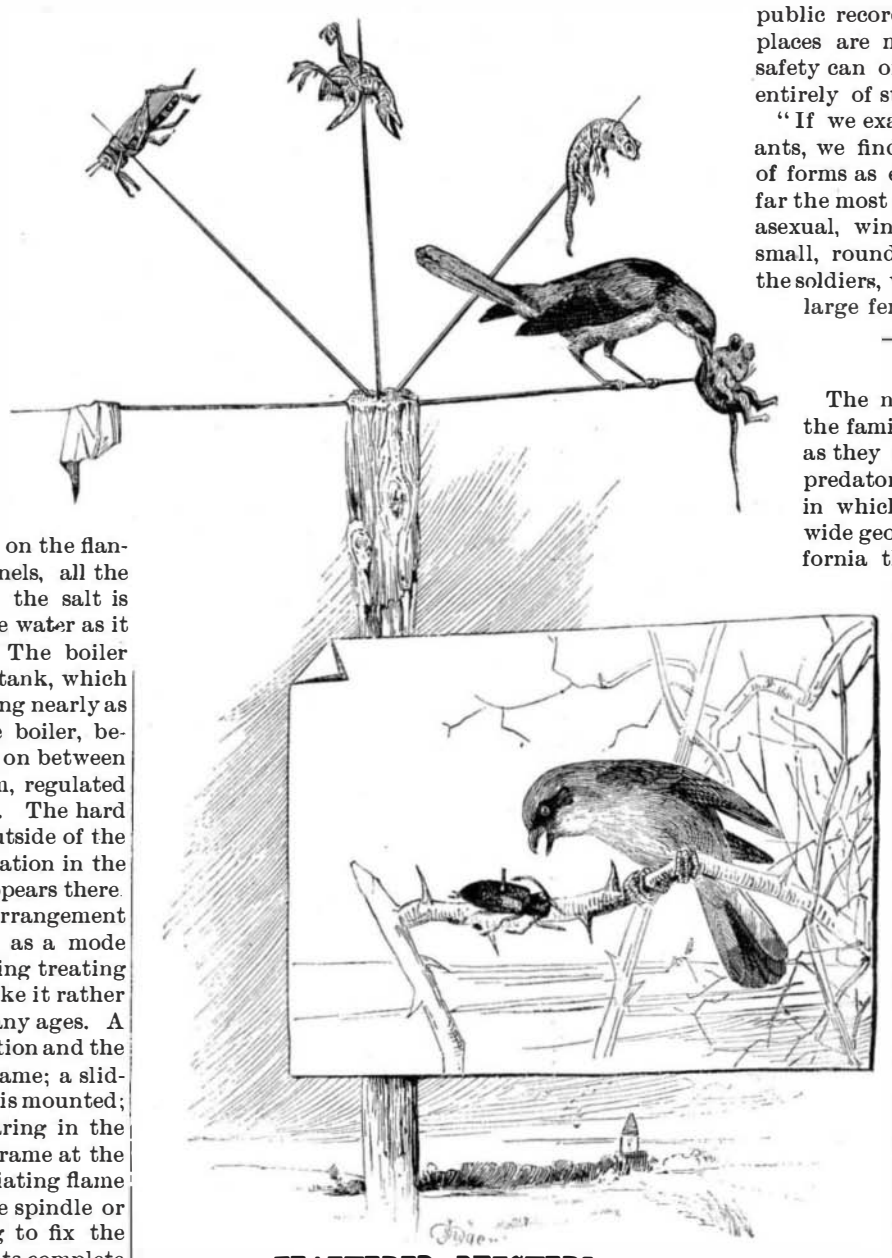
Should this occur—and it must occur many times before sufficient salt is incrusted to causeany serious loss of heat—it can be got at by throwing the top open and releasing the overflow tank. The domes are cleansed by allowing a quantity of water to flow over them when not at work. The inventor explains the non-appearance of salt in the boiler and on the flannels by saying that, in the case of the flannels, all the water fed to them is not vaporized; thus the salt is kept in solution, and is carried off in the water as it runs to waste or to the overflow tank. The boiler does not show any because of the overflow tank, which is always wasting water, and its water being nearly as heavily charged with salt as that of the boiler, because a certain amount of circulation goes on between them; so the salt is kept at an equilibrium, regulated by the salt carried away in the overflow. The hard salt that does appear is only found on the outside of the overflow tank, TT. So long as the evaporation in the boiler is not allowed to empty it, no salt appears there.

Fig. 1 of our engravings shows another arrangement by the same inventor for utilizing friction as a mode of heat. As this is not like the still—a thing treating of life and death—he has thought fit to make it rather fantastic, and his design carries us back many ages. A single casting, taking a snake-like configuration and the necessary course, forms the whole of the frame; a slidingbox carries the wood in which the boiler is mounted; the spindle of friction wheel has one bearing in the mouth of the creature and another in the frame at the opposite side of the friction wheel; the radiating flame piece or wheel boss is in one piece with the spindle or is fixed thereto, the purpose of it being to fix the wooden wheel; an ordinary handle and bolts complete the machine, the boilers for which may have various sizes or shapes, according to purpose.

The inventor devised it as specially suitable for lectures on physics, for use in magazines where fire is not allowed, or for heating shaving water, where half a minute's vigorous work every morning serves the purpose of providing a little hot water for this purpose, waking the shaver up, and providing him with exercise which is better now than in July.



BOARD AND PAMPHLETS PERFORATED BY THE TERMES FLAVIPES.



FEATHERED BUTCHERS.

THE TERMES FLAVIPES.

We received some time ago, from Mr. Joseph Eichbaum, of Pittsburg, a pamphlet which had been curiously eaten away by a small boring insect. The pile containing the pamphlet stood on a half inch board, and was about three feet high. Both board and pamphlets had been completely penetrated as represented in our engraving. Mr. Eichbaum found a small white worm, to which he was inclined to attribute the injury. After examining the result of its work, however, Professor C. V. Riley, the Government Entomologist, decided that it was due to the activity of that mischievous pest of the libraries, the white ant. He describes it as follows:

"The pamphlet perforated with numerous round, or oval, or oblong holes, or even with long branching slits, admirably illustrates the work of one of the most dangerous insect enemies to libraries and stored paper. This is the notorious white ant (*Termes flavipes*), which has received its popular name from its external resemblance to our commoner ants, as well as from its somewhat similar mode of life, *i. e.*, congregating in large, well organized colonies. Otherwise, the white ants have no relation to the true ants, the former belonging to the order Neuroptera, the latter to the Hymenoptera. The colonies of *Termes flavipes*, the only species of white ant occurring in North America east of the Rocky Mountains, are to be found in the ground under large stones, or within old stumps or roots, but never exposed to the light. As the food of these insects consists of dry vegetable fiber, their work in the field proves beneficial by hastening the decay and crumbling of old logs, etc.; but, unfortunately, these insects also destroy fence posts and fence boards, enter our houses, and stealthily weaken the beams and rafters. But, above all, they prefer to attack rows of old leather bound books or piled up paper, working through covers and pages in the manner illustrated by the pamphlet sent by Mr. Eichbaum. As the white ants never come to the surface, but always work in the interior of woodwork or within books, the mischief done by them is usually not observed until the destruction is complete, and herein lies the great danger from these insects. Thus quite a number of instances are on record where in public or private libraries large rows of valuable books or documents were found to be utterly destroyed by the white ants before their presence was suspected.

"In the Southern States, and especially in tropical countries, the white ants are much more numerous and their inroads into houses more frequent than in the North, so that in some places it is only possible by incessant watchfulness to preserve and protect the public records. Books kept in rather damp and dark places are more exposed to this danger, but perfect safety can only be secured in buildings constructed entirely of stone and iron.

"If we examine the individuals of a colony of white ants, we find among them the same wonderful variety of forms as exhibited in honey bees or true ants. By far the most numerous class are the workers, which are asexual, wingless, yellowish white, the head being small, rounded, and the jaws very minute; then come the soldiers, with immense head and jaws, and then the large females."

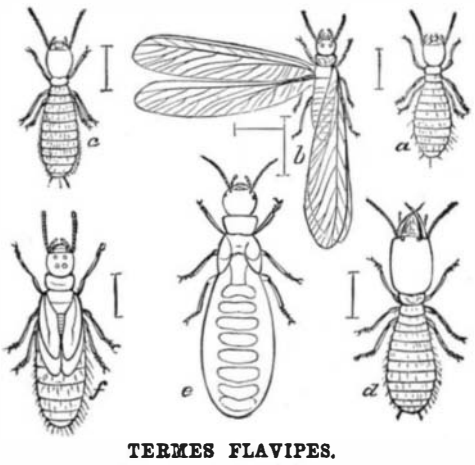
FEATHERED BUTCHERS.

The name butcher bird, that is often given to the family *Laniadæ*, or shrikes, is not misapplied, as they are quite equal to the hawks and other predatory birds in their courage and the cruelty in which they seem to delight. They have a wide geographical distribution. In southern California they are particularly common, and at the time of writing, Dec. 17, in Los Angeles County, they are to be seen upon almost any tree, where they sit motionless, awaiting the approach of their prey, which is of a most varied character.

The shrikes are powerful birds, of attractive mien, presenting an appearance indicative of courage. In many the upper mandible is arched and hooked, forming a powerful weapon with which to tear and lacerate their prey. The adults attain nearly the size of a robin.

It is, however, the habits of the bird that are the most interesting, and the term butcher is applied perhaps from the fact of their impaling their victims. In California they catch a large variety of lizards, including the horned toad, mice, and kangaroo rats, and one has been seen flying laboriously, carrying a blue jay quite as large, if not larger, than itself. As a rule, game thus captured is taken to some favorite spot and impaled or hung up, and then torn apart, so that in a locality frequented by these birds quite a museum is often found, composed of the dried remains of various animals, the dismembered parts, bits of bone, and other material. In southern California the orange tree offers every inducement to these butchers, the thorns with which the branches are armed being used for this singular purpose of laceration. Sitting perfectly immovable on a twig, the bird suddenly espies a horned toad or lizard, and darting down, before the frightened animal can bury itself or seek shelter, it is seized in the powerful beak and borne struggling to the place of execution. At first the victim is often held down with one claw, after the manner practiced by hawks, and so torn and lacerated; but generally a sharp thorn or a pointed twig is selected, and the body forced against it until it is firmly impaled. This having been accomplished successfully, the body is sometimes left, as often the capture is seemingly made in wanton pleasure, for the mere sake of killing; the victim left disemboweled—a grim warning to others.

When the butcher is disposed to devour its game, the thorn is used to help tear it apart, the flesh being



TERMES FLAVIPES.

a, larva; *b*, winged male; *c*, worker; *d*, soldier; *e*, large female; *f*, pupa. (After Riley.)

torn in both directions. So strong is this habit that in confinement the bird still takes advantage of any sharp object. Thus a pointed stick, sharpened for the purpose, being given a caged butcher bird, all its food, consisting of raw meat, was immediately placed upon it, and either left or devoured.

A neighbor of mine arranged a series of spikes in a star form, for the benefit of the birds that carried on their depredations in the vicinity, and found that they eagerly took advantage of the artificial thorns, a variety of animals being arranged upon the spikes. Not only were living creatures impaled, but various

gaudy objects that might attract attention. My informant watched one bird for a long time, at work, attempting to disengage a piece of red flannel from a bush where it was entangled. It was eventually successful, and immediately the gay cloth was hung among the victims, a ghastly piece of humor, the red pennant waving in the breeze, seemingly intensifying the horrors of the butchery.

This bird, which was of extreme size, was seen attempting to carry off a young pouched gopher; but it was only able to bear it to the ground under the impaling machine, where, by discordant shrieks, it showed its rage and displeasure.

The butcher bird appears to entertain a particular hatred to caged birds, darting toward them with the greatest fury, and, if unable to reach them, flying about the cage, in some instances causing the death of delicate canaries from mere fright. In a case that came under my notice a butcher bird noticed a canary hanging inside a window, and darted at it with such force that the pane was shattered. The butcher must have been severely shaken up at least, but it kept fluttering about, endeavoring to reach the caged bird, and only left when driven away by the interposition of some of the family.

This occurred in Connecticut, but the birds here in their winter home exhibit the same hatred. In our neighborhood a pair of birds were hung out under a live oak, and on going to take them in, the owner found both birds lying on the bottom of the cage headless, these important members having been ruthlessly torn off, and one ornamenting the thorn of a neighboring orange tree. As the cage was neither broken nor bent, it was somewhat of a puzzle how the outrage was perpetrated, but later the same bird was seen darting at another caged canary that hung in a window. The butcher rushed at it, seizing the wire with one claw, and by beating the cage with its wings it completely demoralized the inmate, who finally, in its struggles, flew near the bold intruder, who quickly threw out one of its powerful claws and grasped viciously at its victim. Undoubtedly it would have torn the canary's head off in this way had it not been disturbed.

The butcher birds are not at all particular as to their food, it varying from blue jays and gophers to grasshoppers, even worms, scorpions, and centipedes being found impaled on the same or neighboring trees.

Although these birds are cruel and vindictive, they are bold and courageous in any contingency, attacking the largest hawk or eagle in the defense of their young. The peculiar bravery of the little king bird, a member of this family, is well known. I have often seen them combine against a hawk and utterly rout him. Crows seem to be especially disagreeable to them, and one king bird is quite sufficient to dispossess an ordinary crow. Wilson says, in referring to the American butcher bird: "The character of the butcher bird is entitled to no common degree of respect. His activity is visible in all his motions, his courage and intrepidity beyond every other bird of his size (one of his own tribe only excepted, *L. tyrannus*, or king bird), and in his affection for his young he is surpassed by no other. He associates with them in the latter part of summer, the whole family hunting in company. He attacks the largest hawk or eagle in their defense with a resolution truly astonishing; so that all of them respect him, and on every occasion decline the contest. As the snows of winter approach, he descends from the mountainous forests and from the regions of the north to the more cultivated parts of the country, hovering about our hedgerows, orchards, and meadows, and disappears again early in April."

The common American form is the *Lanius borealis*, while the familiar English species are the great gray shrike (*L. excubitor*) and the red-backed shrike (*L. collurio*). The former is about the size of a thrush, with a powerful black beak, protected at its base by bristles. The upper portions of the plumage are pale blue ash, with white underneath. The wings and tail are black, also a band that crosses the eye, some white being on the scapulars and tail. Referring to this bird, an English writer says:

"It is common all the year in France, and is known in this country chiefly as a somewhat rare winter visitant. It is one of our late birds of passage, but its arrival is soon made known to us by its croaking, unmusical voice, from the summit of some tree. Its nest is large and ill concealed; and during the season of incubation the male bird is particularly vigilant, and uneasy at any approach toward his sitting mate, though often by his clamorous anxiety he betrays it. The female, when the eggs are hatched, unites her vociferations with those of the male, and facilitates the detection of the brood. Both birds are very assiduous in their attentions to their offspring, feeding them long after they have left the nest, for the young appear to be heavy, inactive birds, and little able to capture the winged insects that constitute their principal food. I could never discover that this bird destroyed others smaller than itself, or even fed upon flesh. I have hung up dead young birds, and even parts of them, near their nests, but never found that they were touched by the shrike. Yet it appears that it must be a butcher too, and that the name *Lanius*, bestowed on it by Gesner two hundred and fifty years ago, was not lightly given. My neighbor's gamekeeper kills it as a bird of prey, and tells me that he has known it to draw the weak young pheasants through the bars of the breeding coops; and others have assured me that they have killed them when banqueting on the carcass of some little bird they had captured. All small birds have an antipathy to the shrike, betray anger and utter the moan of danger when it approaches their nests. I have often heard this signal of distress, and, cautiously approaching to learn the cause, have frequently found that this butcher bird occasioned it. They will mob, attack, and drive it away, as they do the owl, as if fully acquainted with its plundering propensities."

The red-back shrike derives its name from the fact that the back, scapulars, and wing coverts are a rusty red hue. It arrives in England in May, breeds in the southern counties, and departs in September for France and the countries bordering the Mediterranean.

The butcher bird in southern California greatly resembles the English great gray shrike, and presents an attractive appearance when on the wing, the black, gray, and white markings affording a striking contrast. They are quite valuable from the fact that they destroy so many noxious insects.

How the Ocean Bottom is Lighted.

One of the most striking things noticeable in dredging is the great variety and brilliancy of colors in the deep sea animals. There are bright red sea anemones, deep purple sea pens, delicate pink corals, pure white sea cucumbers, and dull black fishes, all mixed up in a mass of bluish gray mud. A few of the animals are blind, but most of them have very well developed eyes. In depths of over 1,000 fathoms it is physically impossible for the faintest gleam of sunlight to penetrate. It must be darker on the ocean bottom in 2,000 fathoms than the darkest starless night, that is, if nothing but sunlight were to be depended upon. If it was as dark as that, neither eyes nor colors would be of any use. Nature does not support useless organs, and when an organ is no longer needed, it is dropped. The fish of Mammoth Cave, no longer needing eyes, have become blind. Such would be the case in the deep sea. Another proof that there is light on the ocean bottom is the fact that many unprotected animals assume the colors of larger animals on which they habitually live. There is a brittle star that is always found in the branches of a bright orange-bush coral, and unless looking at it very closely, one can hardly distinguish it. There is an object in this—the starfish wishes to conceal itself; but if the ocean bottom was totally dark, there would be no need of such an arrangement, for the darkness alone would be sufficient.

One evening the dredge came up at eleven o'clock, and the electric light suddenly went out while we were examining its contents. Just before it became dark, I had thrust my hand in the mud to draw out a rare shell; and when I withdrew my hand it glowed with phosphorescence, the mud was covered with a phosphorescent light, and many of the animals when touched gave out a brilliant glow. This was the secret of the deep sea eyes and colors. With such a light, both sight and color would be as useful at the bottom of the sea as on the surface.

I believe, if we could suddenly find ourselves on the ocean bottom, in 2,000 fathoms, we should see brilliant white lights, casting intense shadows, illuminating the ocean bottom in an effectual manner. There would be vast tracts of darkness almost absolute, and here the blind forms would habitually live, having no use for colors or light. Groves of coral would shine with this intense light, shrimp and fish would dart about, specter like, over an illuminated pathway, each carrying his own lamp, and the whole ground would be one glow of phosphorescent light.

On the surface many animals are phosphorescent; the large schools of mackerel and menhaden can be seen for miles emitting a bright light. In the evening, on the seashore, the surface is often aglow with silvery light. On such nights the sailors say, "A storm is coming." The billions of embryos and microscopic animals that fill the surface waters each emits a little firefly spark, and all vie with each other to see which can excel in brightness. The result is a sheet of pure white light. The boat leaves a train of bright light and silvery drops fall from the oar back into the water, sending a little spray of light into the air, and spreading out little ripples of phosphorescence. Why these tiny animals emit their little sparks is not known, though it is generally said that it is the result of nervous excitement or irritation. When sailing in the Gulf Stream, I have passed through schools of jelly fish, when the prow of the vessel turned up brilliant waves of living light, and the whole surface for miles around was aglow with phosphorescence. In this case the light is for protection. Animals that might be dangerous enemies to the soft bodied jelly fish have learned that behind that brilliant light lurk deadly stinging powers, and they instinctively avoid it. But young and inexperienced fish have not yet learned the lesson; and so, attracted by curiosity, they approach the light and receive the deadly shock, and furnish food to the well protected jelly fish. If one escapes, it never tries the experiment again, for just as certain as it comes near the jelly fish it receives a shock that, if not fatal, is strong enough to inspire it with terror that will never be forgotten. An inoffensive animal has learned the terror that the jelly fish inspires its enemies with, and has assumed the same protective light. This is Pyrosoma, the sea lamp, a cluster of ascidians that have no stinging power whatever, but which defraud fish that might be dangerous enemies into the belief that they are jelly fishes.

There was a time when the ocean bottom was much nearer the surface than at present, and when sunlight pervaded the entire water. Phosphorescence was then in use by a few animals just as it is to-day, for protective powers. Gradually the ocean bed sank and became darker, until the sunlight was no longer of use to the denizens of the deep. The few phosphorescent animals found another use for their light than protection. It became serviceable as a lamp to illuminate their dark home. Other animals saw the use of the light, and, just as in the case of Pyrosoma, began to adapt themselves to their surroundings by becoming phosphorescent. There is some strange law of evolution that allows this to be done. Animals and plants alike in their struggle for existence can assume colors and forms best adapted for survival. This is illustrated on every hand in the sea and on the land. What the power is that allows them to do this is unknown. Be it Providence, instinct, or unconscious change, the result is the same; it is done and is being done every day, nearly always to the advantage of the species.

RALPH S. TARR.

How an Astronomer Captured a Comet.

In the SCIENTIFIC AMERICAN of January 16 we gave a notice of the recent discovery of a new comet by Mr. W. R. Brooks, of Red House Observatory, Phelps, N. Y. The following extract from a private letter by Mr. Brooks to a friend, which we are permitted to make, gives an interesting account of some of the circumstances attending the discovery:

Mr. Brooks says: "When I discovered the new comet in the early evening of December 26, 1885, it was in the constellation Aquila, and already low down in the western heavens. It was fast settling down into the tops of the trees of my orchard, and for some time the limbs of the trees were visible in the field of the telescope along with the comet, greatly to my embarrassment. I had secured the approximate position of the comet, but had not obtained its direction of motion, which I was very anxious to do in order to telegraph the discovery that evening. But the comet soon disappeared behind the trees, and further observations were impossible that night from the observatory. So I removed the telescope from it spermanent stand, carried the instrument across the garden and around the house to the front yard, which faces the west. It was a heavy lift and a big armful, for the telescope tube is of iron, and a foot in diameter. I called to my wife and father to bring out a table, laid the upper end of the telescope upon the front fence, and with boxes, door mats, books, and papers placed upon the table raised the other end of the telescope to the proper angle. While I stood out in the road, gazing into the telescope, my wife stood in the yard holding and moving the instrument at my direction to follow the fast setting comet, while father placed books and papers underneath to keep the telescope in position.

"In this way my last observations were made. I followed the comet until it almost touched the distant horizon, and was enabled to telegraph the discovery the same evening by 8 o'clock, with three-quarters of a mile to go to reach the telegraph office. It was promptly cabled to Europe, and in a few hours the discovery was published throughout the civilized world."

Ruined by the Patent Register.

Moseby, who has been away from town for some time, returned the other day. Shortly afterward a friend met him, and noticing his seedy and low spirited appearance, asked:

"Moseby, what's the matter, old fellow?"

"Ruined."

"What?"

"A financial wreck."

"How did it occur?"

"Well, you see I had charge of a bridge not far from here. The owners are very particular about receiving every cent that is due them, so they put in one of those registers. It is a sort of fool arrangement sunk in the foot passageway of the bridge, and makes a mark with a clicking punch every time anybody steps on it. Well, everything was all right until the other day. A big Newfoundland dog got on the blamed thing and began to scratch himself, and, sir, before I noticed him he had charged me up $275. Yes, I am a ruined man."—*Arkansaw Traveler.*

Photo Printing by Machinery.

Regarding the new method of printing by machinery, invented by Mr. John Urie, of Glasgow, having seen the machine at work, we are in a position to give such an account of it as will enable our readers to understand its action.

Externally the machine consists of a long box of about the dimensions of a foot and a half square, and of three times that length. In a recess in the center is fixed a pad, over which a long band of Alpha paper passes, as it is being unwound from a spool at one side upon a drum at the other. Surmounting this pad is a heavy metal frame containing the negative, this being hinged at one side so as to admit of its being raised when it is necessary to move the paper underneath; and above this in turn are two gas burners. Certain clockwork in the interior is actuated by two weights as the motive power.

The time of exposure is regulated by the adjusting of a barrel or drum containing spikes inserted in its periphery, and by which the duration may either be five seconds, three minutes, or anything between. To prevent the heating of the negative by the gas flames that are so near, a glass bottomed trough of water is interposed.

When we saw it in action, the following movements took place: The clockwork, when started, turned down the gas to a very low point, raised the weighty frame, in which the negative was fixed, to a height sufficient to enable the sensitive paper on the spool to be pulled forward a distance equaling the width of the negative, which was no sooner effected than the negative was immediately lowered again upon the paper, with which it remained in that close contact insured by the weight of its frame. Simultaneous with this movement the gas flames were turned up to their full power, and remained so during the period previously determined upon as that necessary for impressing the image on the paper, the whirr of the machinery being heard all the time. At the expiry of this predetermined period down went the gas, the negative being then raised and the paper drawn forward the requisite distance, when the negative resumed its place on the paper, the lights being turned up, and the whole process of exposure re-enacted.

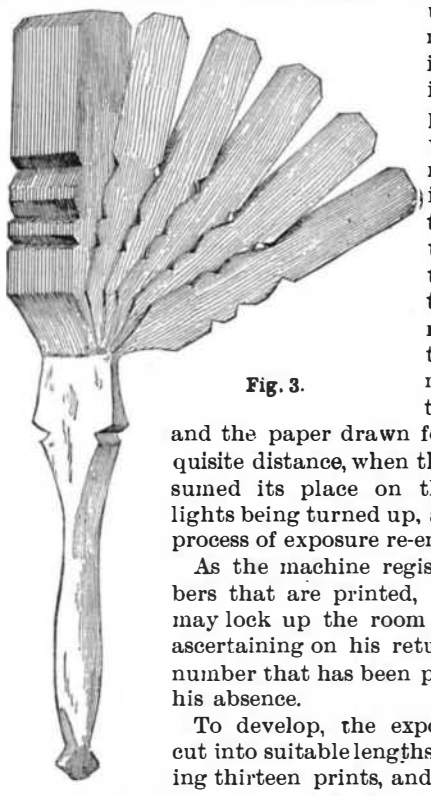


Fig. 3.

As the machine registers the numbers that are printed, the attendant may lock up the room and go away, ascertaining on his return the precise number that has been printed during his absence.

To develop, the exposed paper is cut into suitable lengths, each containing thirteen prints, and is placed in a bath of ferrous oxalate, by which the latent image becomes visible, at first very faintly, although it soon acquires great vigor. The band of prints having been washed is then transferred to a bath containing alum solution, in which it remains ten minutes. It is then placed in a gold toning bath, where it acquires any color desired. This tone may be determined with accuracy, as the prints undergo scarcely any change at all when, subsequently, they are fixed by hyposulphite of soda. It will be understood that one print is identical with another in vigor and tone, and that these qualities are quite under the control of the operator. As many as two hundred *cartes* or cabinets may easily be printed in an hour by one machine.

As regards quality of print, it is all that need be desired.—*Photo. Times.*

Best Plant for Holding Banks.

The best plant at present known for consolidating, by the interlacing of its roots, the loose soil of a newly made embankment is, according to M. Cambier (of the French Railway Service), the double poppy. While the usual grasses and clovers need several months for the development of their comparatively feeble roots, the double poppy germinates in a few days, and in two weeks grows enough to give some protection to the slope, while at the end of three or four months the roots, which are ten or twelve inches long, are found to have interlaced so as to retain the earth far more firmly than those of any grass or grain.

Though the plant is an annual, it sows itself after the first year, and with a little care the bank is always in good condition.

WHITTLED FANS.

If you had been passing a certain bustling and smoke-begrimed railroad depot, in a city not far from our great metropolis, during the pleasant summer days, you would have noticed an industrious blind man whittling away at a piece of wood which, when he had laid his knife aside, he dexterously twisted into a fan, much to the delight of the numerous small boys and other passers-by who were attracted by his peculiar occupation.

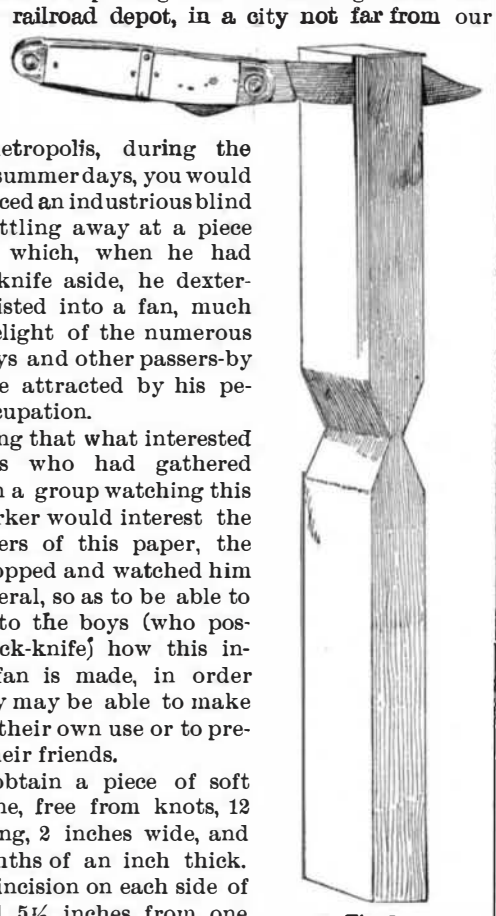


Fig. 1.

Thinking that what interested the boys who had gathered around in a group watching this blind worker would interest the boy readers of this paper, the writer stopped and watched him make several, so as to be able to describe to the boys (who possess a jack-knife) how this ingenious fan is made, in order that they may be able to make them for their own use or to present to their friends.

First, obtain a piece of soft white pine, free from knots, 12 inches long, 2 inches wide, and seven-eighths of an inch thick. Make an incision on each side of the wood 5½ inches from one end to the center of the incisions, and leave the wood a quarter of an inch thick between them (Fig. 1). Now split the shorter end of the wood downward (see knife in Fig. 1), as far as the two incisions, into sections one-sixteenth of an inch thick. Twenty-four parts or blades are needed to make a well proportioned fan. Cut off the surplus ones, half from each side, before making the handle.

The longer part of the wood is thinned down into a handle, any shape the maker desires (see Fig. 2). Now make three more incisions on the same flat sides as the first were made, beginning three-quarters of an inch above the handle. These incisions should be about a quarter of an inch deep, three-eighths wide, with a quarter of an inch of the flat surface left between each incision (Fig. 2).

Before bending the blades into shape the wood must be thoroughly soaked in water, or they will snap off while being bent.

When the wood is well saturated, begin to bend the blades on one side (as shown in Fig. 3) until the center is reached. Overlap the shoulder (made by the top incision) on the left side of each blade with the right of each succeeding blade. When one-half of the blades are in position, turn the fan to the other side and bend them in the same way. This will complete the fan (as shown in Fig. 4). V. S.

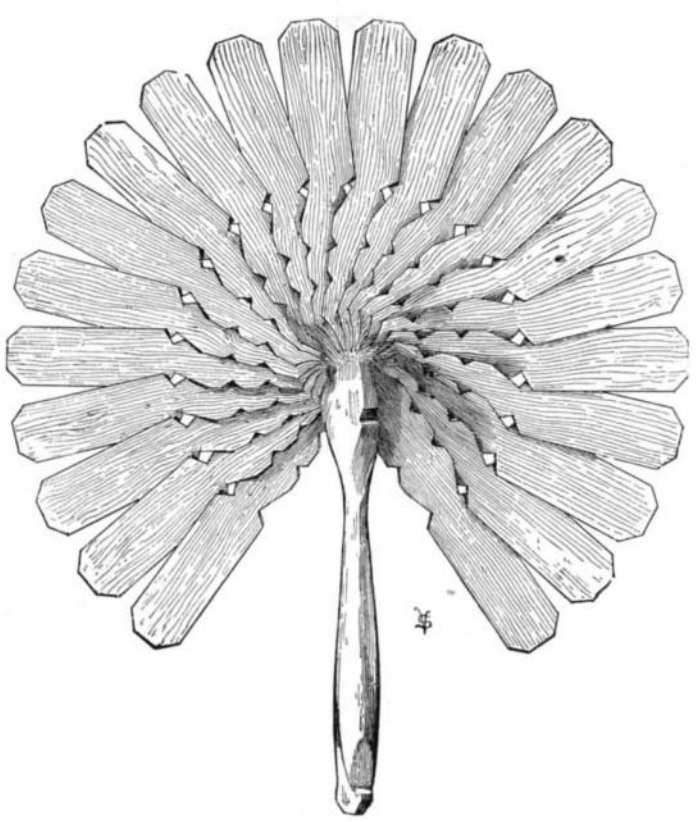


Fig. 4.

Navigating the Suez Canal by the Electric Light.

In presence of the continued increase in the traffic through the Suez Canal, even during the present commercial crisis, and to provide for the still greater increase that is anticipated in consequence of the abolition of the pilot dues and the lowering of the tariffs, by which merchandise now reaching Europe from the East and from Australia by the route round the Cape will be able to be sent through the Canal, the company has for the last two years been making experiments with electric lights, with a view to enable vessels to continue their passage through the canal during the night. These experiments (says the Paris correspondent of the London *Standard*) have at length proved so successful that it has been resolved to permit from the 1st of January next all vessels of war and postal steamers provided with the requisite electric lights to navigate by night that portion of the canal comprised between Port Said and kilometer fifty-four. Therefore, in almost half that portion of the canal where ships have to put into sidings to allow other vessels to pass them—in the Bitter Lakes vessels pass each other without stopping—vessels of war and mail boats, that together represent 22 per cent of the total traffic, will be able to continue their passage at all times of the day and night. This will constitute a great saving of time, and M. De Lesseps in his circular expresses the confident hope that the trial will be so successful as to enable him to authorize within a short time night navigation for all descriptions of vessels through the whole length of the canal.

Torpedo Experiments.

The London *Times* gives particulars of some important experiments carried out recently on the torpedo ground outside Portsmouth Harbor, in the Solent. Within the area of the torpedo field situated opposite the sea fronts of Forts Monckton and Gilkicker, near Portsmouth, an important experiment in submarine mining was carried out recently by Captain Markham and Commander Robinson, of the Vernon, on the part of the Royal Navy, and by Major Bucknill and Captain Wrottesley, on the part of the Royal Engineers. At each corner of a quadrilateral was sunk a heavy mine, consisting of 500 pounds of gun-cotton, inclosed in wrought iron cylinders, all four being in separate electrical connection with a battery on shore. The distances of the mines apart were the same as is usually observed in the navy as being within effective destructive range.

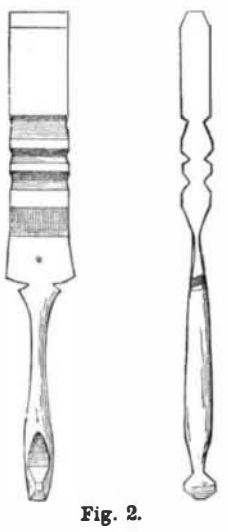


Fig. 2.

At various known distances from the charged mines were submerged a great number of cases of various construction loaded down with dummy gun-cotton as target mines, and the object of the experiment was to ascertain the effect upon the different structures of exploding heavily charged submarine mines in their neighborhood. Twelve of the targets consisted of simple Royal Engineer mines, lined with plaster of Paris and cement, also of electro-contact mines. The targets also included naval countermines, fixed mines, and electro-contact mines, service and experimental. Among others were samples of the ingenious mechanical fixed torpedo invented by Lieutenant Ottley, late of the Vernon, which sinks to a predetermined depth on being thrown overboard, and a solitary example of the mines which were manufactured in England for the use of the Chinese Government on the commencement of hostilities with France. This differs from the service pattern in form and material, being constructed of cast iron instead of wrought iron, and semicircular or umbrella-shaped in section, instead of cylindrical or spherical.

The various mines were all fixed buoyantly, and were destitute of blowing-up charges, as the purpose in view was not to discover whether the explosion of the heavy mines would detonate those in their midst, but to learn the comparative effects of the concussion on the containing vessels and gear, the force of the explosive at different ranges being measured by crusher gauges. Such heavy charges of gun-cotton, amounting in the aggregate to 2,000 pounds, and having an energy equal to about 8,000 pounds of gunpowder, had not previously been simultaneously discharged at Portsmouth. The charges were simultaneously exploded at a quarter past 12 on a half-ebb tide. As a spectacle the effect was somewhat disappointing. The spouts of water were almost connected, and were extremely jagged in outline, but they did not rise to the height expected, the stream of mud which overflowed the interior lining of the jets showing that the mines were scarcely buoyant at the time of the explosion. The detonation was not unpleasant on shore, but the radial extension of the disturbance must have been effective, as fish were stunned at considerable distances out to sea. The results of the experiment cannot yet be known, but it is believed that the Chinese mine is broken up.