SCIENTIFIC AMERICAN

A MOTOR CAR FOR THE MULTITUDE—A RECENT DEVELOPMENT OF THE MOTORCYCLE—[See page 435]

November 11, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

© 1916 SCIENTIFIC AMERICAN, INC

"Stop Facial Punishment," Says Mennen

Among Heidelberg students, the sabre-gash is a sign of distinction.

Among American business men, the razor-gash is the sign of awkward, inefficient shaving.

The unsightly face of the man who hasn't learned how to shave betrays an inefficiency which is likely to crop out in many another detail of the day's work.

Mennen's Shaving Cream makes shaving safe and swift—almost a pleasure.

An abundance of water, hot or cold, hard or soft, converts half an inch of Mennen's Shaving Cream into a rich, firm, moist, copious lather that softens the stiffest beard, and makes the shave easy.

Mennen lather stops the punishment which the frothy, quick-drying, lumpy, or uneven lathers of so many shaving preparations have inflicted upon the face of man. It contains no free caustic, and is rich in the emollient properties of glycerine. You need no lotion after shaving with Mennen's. Use only Mennen's Talcum for Men, neutral in color.

GERHARD MENNEN CHEMICAL CO

Laboratories:
1721 Orange Street - Newark, N. J.
Canadian Factory - Montreal, Que.

Sales Agents for Canada:
Harold F. Ritchie & Co., Ltd., Toronto, Ont.

This Coupon brings you two samples for 10 cents

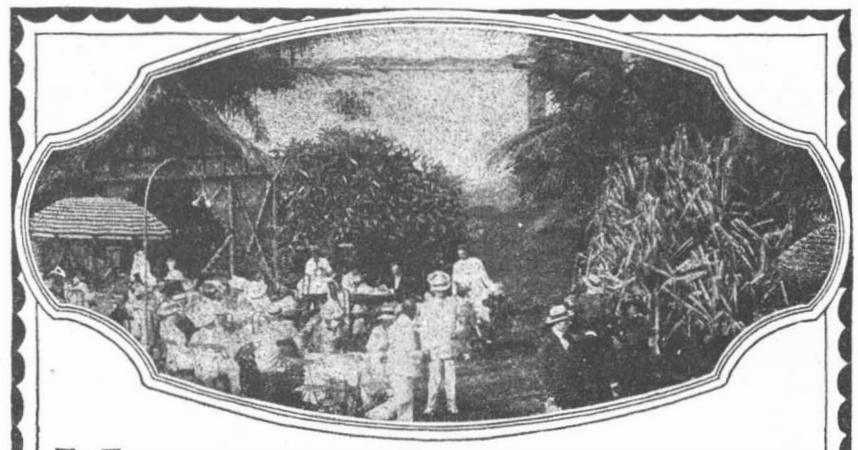
Gerhard Mennen Chemical Co.
Laboratories:
1721 Orange St.,
Newark, N. J.

Enclosed is 10c for which please send me a medium-sized tube of Mennen's Shaving Cream and, free, a trial can of Mennen's Talcum for men.

Name_____

Address_____

City_____ State_____



NASSAU-BAHAMAS

A PARADISE of beautiful flowers and vegetation, where the average winter temperature is only 72°; charming social life; boating, golf, tennis, polo, motoring and ideal surf bathing.

HAVANA—CUBA

Interesting and restful because of the fascinating charms of tropical life and climate. Excellent hotels.

Direct service from New York each Thursday at noon and Saturday morning at 11 o'clock. Luxurious twin screw steamers; 10,000 tons displacement; broad decks, spacious social halls, excellent cuisine.

A 24-day luxuriously restful cruise to Progreso, Vera Cruz and Tampico, Mexico, visiting Havana and Nassau en route; an all expense included trip.

Write for rates, reservations and illustrated descriptive matter.

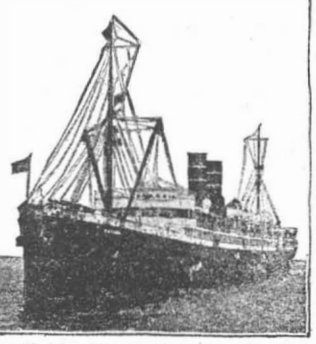
WARD LINE

New York and Cuba Mail Steamship Company
Foot Wall Street, New York

Regular, direct passenger and freight service between New York and west coast ports of Central America and Salina Cruz, Mexico, via the Panama Canal.

AGWI LINES

DISTRICT PASSENGER OFFICES:
BOSTON—192 Washington Street
PHILADELPHIA—701 Chestnut Street
WASHINGTON—1306 F Street, N. W.
NEW YORK—290 Broadway



"If John D. Rockefeller can do what he has done in oil, why can't I do it in tobacco?"

He could—

—and how he *did* is told in the story of JAMES B. DUKE in this week's LESLIE'S, the eighteenth of the B. C. Forbes series, the "Men Who Are Making America."

B. C. FORBES

$5.00 brings Leslie's for a year. Indicate on the coupon whether you wish to have your subscription start with the first Forbes article or with the current issue.

Leslie's

Illustrated Weekly Newspaper
Established in 1855

225 Fifth Avenue, New York City

Sci Amer.

LESLIE'S
225 Fifth Avenue
New York City

Enclosed find $5.00. Please send me Leslie's for one year, beginning with (the issue of July 27th) or (the current issue).

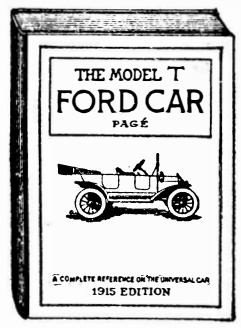
Name.....

Address.....

JUST PUBLISHED

A New, Complete Book for every Ford Owner, Dealer, Salesman and Repairman.

The Model T Ford Car



Its Construction, Operation and Repair

By VICTOR W. PAGÉ, M.E.
Author of "The Modern Gasoline Automobile," etc.

300 (5x7) Pages. Over 100 Specially Made Engravings and 2 Large Folding Plates

Price $1.00 Postpaid

This is the MOST COMPLETE and PRACTICAL instruction book ever published on the FORD CAR. All parts of the Ford Model T Car are described and illustrated in a comprehensive manner—nothing is left for the reader to guess at. The construction is fully treated and OPERATING PRINCIPLES MADE CLEAR TO EVERYONE. Complete instructions for driving and repairing are given. Every detail is treated in a non-technical yet thorough manner.

This book is written specially for FORD DRIVERS AND OWNERS, by a recognized automobile engineering authority and an expert on the FORD, who has driven and repaired Ford Cars for a number of years. He writes for the average man in a practical way from actual knowledge. ALL REPAIR PROCESSES ARE ILLUSTRATED AND FULLY EXPLAINED.

WRITTEN SO ALL CAN UNDERSTAND—NO THEORY, NO GUESSWORK
AUTHORITATIVE—UNBIASED—INSTRUCTIVE—COMPLETE

Contains Special Chapters on

1. **The Ford Car.** Its parts and their functions. The Ford Three Point Suspension System—Frame Assembly Details—Spring Construction—The Ford Body—The Ford Power Plant, Etc. 2. **The Engine and Auxiliary Groups.** How the engine works, the fuel supply system, the carburetor, making the ignition spark, cooling and lubrication.—Induction Coil System Action Explained—Why a Magneto Is Used on a Ford—Wiring Dry Cell Batteries—Master Vibrator Systems—The Ford Muffler, Etc. 3. **Details of Chassis.** Change speed gear, power transmission, differential gear action, steering gear, front axle, frame and springs, brakes, etc. 4. **How to Drive, and Care of the Ford.** The control system explained, starting the motor, driving the car, locating roadside troubles, tire repairs, oiling the chassis, winter care of car.—Lighting System—Electric Lighting for Ford Cars—A Typical Engine Stop Analyzed—Conditions that Cause Failure of the Ignition System—Common Defects in Fuel Systems—Adjusting Transmission—Adjusting Loose Front Wheels—What to Do When Rear Brakes Do Not Hold, Etc. 5. **Overhauling and Repairing Mechanism.** Systematic location of troubles and remedies—Faults in Power Plant and Symptoms—Value of System in Overhauling—How to Take Down Motor—Carbon Deposits and Their Removal—How to Repair Cracked Water Jacket—Reseating and Truing Valves—Method of Valve Grinding—Inspection of Piston Rings—Piston Ring Manipulation—Fitting Piston Rings—Wrist Pin Wear—Inspection and Refitting of Engine Bearings—Knocking Indicates Loose Bearings—Adjusting Main Bearings—Scraping Bearing to Fit—Rebabbitting Connecting Rod—Testing Bearing Parallelism—Camshafts and Timing Gears—How to Time Valves in Ford Engines—Repairing Ford Magneto—Packings and Gaskets for Ford Engines—Precautions in Reassembling Parts—How to Take Down Transmission—Relining Brake Bands—Rear Axle Troubles and Remedies—Care of Springs—Steering Gear Repairs—Miscellaneous Chassis Parts, Etc., Etc.

The illustrated chapter on repairing and overhauling alone is worth many times the price of this book.

MUNN & CO., Inc.
233 Broadway **Woolworth Building** **New York, N. Y.**

© 1916 SCIENTIFIC AMERICAN, INC

SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXV.] NUMBER 20] NEW YORK, NOVEMBER 11, 1916 [10 CENTS A COPY [$4.00 A YEAR

Building a Front Door on the Philippines

By Monroe Woolley

WHEN we went into the Philippines we were compelled to go around to the back door for a port. The Spaniards arranged their port of entry so that their ships could come in from the front door. Spanish ships sailed around Africa, across the Indian Ocean, and dropped their mud-hooks in Manila bay. But what was a front door to them is a back door to us, which cannot be reached without circling around half the archipelago. We have changed this, however, and we have not moved Manila to do it. We have simply built another port of entry on the Pacific side of Luzon, and thus brought our dependencies in that part of the world from three to five days nearer home.

It has been said that we were the first people to install sewers east of Suez. There is some satisfaction in this accomplishment, if true. Sewers help to prolong life and to make existence pleasanter. But putting sanitary systems "somewhere east of Suez" is not the biggest thing we have done in the east, in the minds of many. Some aver the elaborate educational system we have bestowed on our wards is our grandest accomplishment; others claim the political autonomy we have given ranks first; still others say the railroads we have secured are the most beneficial to the people. But to the American people, to our government, and to Pacific shipping interests perhaps nothing we have done in the Philippines is so important, so sane, and so profitable as the building of what is destined to become a metropolitan port on the east coast of Luzon.

The saving this port will make in the army transport service will reach thousands of dollars monthly. It will be the same with other lines in the Philippine trade. There will be two principal ports to fortify and defend from hostile aggression, but there will likewise be two chief ports to serve Philippine commerce and industry. When China-sea typhoons menace one coast perhaps the other will be clear of storms, so when the back door is locked entrance may be had at the front. And Luzon's east-coast port, as long as we are stewards over the realm, must, because of the geography involved, be known as the "front-door entrance," notwithstanding that old Manila will for a long time retain her prestige as a world port.

The Philippines could not sooner have had an east-coast port on Luzon for the reason that they had no railroad to connect the two coasts. We have made the new port possible by the recent completion of a rail line connecting both shores of the largest island. In the days of the Spanish galleons rich cargoes of silks and spices and gold used to come from Mexico across the Pacific to be unloaded on Luzon's east coast. The cargoes were carried by pack animals and cargadores over the divide to the west coast to Manila. But this time-consuming route and method of shipment lapsed into disuse as the capital-city port grew and flourished as a shipping center.

Gumaca was the east-coast port which the galleons graced with their presence. But we have laid the foundation for a larger, modern port by the commencement of engineering improvements at a place near Gumaca, called Hondagua—a word which means "deep water," the thing most requisite for a prosperous port.

Hours and minutes count now as heavily as days in shipping and railroad circles, and Hondagua may quickly become as familiar a place to the world as Manila has been in the past. The terminus of the new railroad from Manila, connecting with all other Luzon lines to the northward and southward, it opens up some two or three hundred miles of coast line hitherto almost isolated from the world. The new port is but eight hours from Manila by rail, and this schedule will be shortened from time to time as the road and service are perfected.

The new road taps thousands of acres of the richest land in the islands—virgin soil. It so happens that the richest, most extensive, and most productive hemp and cocoanut plantations in the Philippines are located in provinces fronting on the east and southernmost coasts of Luzon. This has meant in the past that these products must be shipped in small coasting steamers clear around the southern point of Luzon and then northward to the capital, consuming two or three days' time, ofttimes more. Now this roundabout way of shipment will be eliminated, and where it is necessary to relieve an urgent market by early shipments of hemp the crop can go to Manila very quickly by rail, or leave for world ports direct from Hondagua.

As a harbor Hondagua probably is superior to any other in the islands. It has deep water everywhere, is free of obstacles, and the island of Alabat, some twenty-five or thirty miles in length, lies across its entrance, thus making it landlocked and giving it protection from the heavy swells of the Pacific. The port itself is situated in the bight of Lopez bay. A few miles distant is the town of Lopez, situated approximately midway between Gumaca and Calauag, and forming with them a triumvirate of *barrios*, or villages, which may quickly unite to form a New York or San Francisco of the Philippines.

The road from Manila to Hondagua has just been opened to traffic. The railroad has chartered the government coastguard cutter Samar for marine service in connection with the line at its terminus. The Samar carries passengers and freight from Hondagua terminus to ports on Luzon northward and southward from Hondagua, and to the numerous populated islands lying close by in the Pacific. The service is weekly at present, but will be made more frequent as traffic and the growing importance of the "front door" port warrants.

The new road traverses a stretch of primitive hardwood forest, the trees festooned and matted together with creepers and vines. Here and there may be discerned beautiful orchids and other attractive tropical vegetation. Thus, the road is likely to develop some new hardwood timber areas.

In getting an east-coast port the Philippines will make another acquisition of importance in the new project. Laguimanoc, on Tayabas bay, offers an especially pretty seascape, and lovers of surf bathing and of fishing are finding it a paradise. Due to this fact alone the new railroad is becoming popular for week-end excursions from the capital. The Laguimanoc beach is white and sandy, and gently sloping. The bay is over-populated with fish, and a fishing club has already been formed.

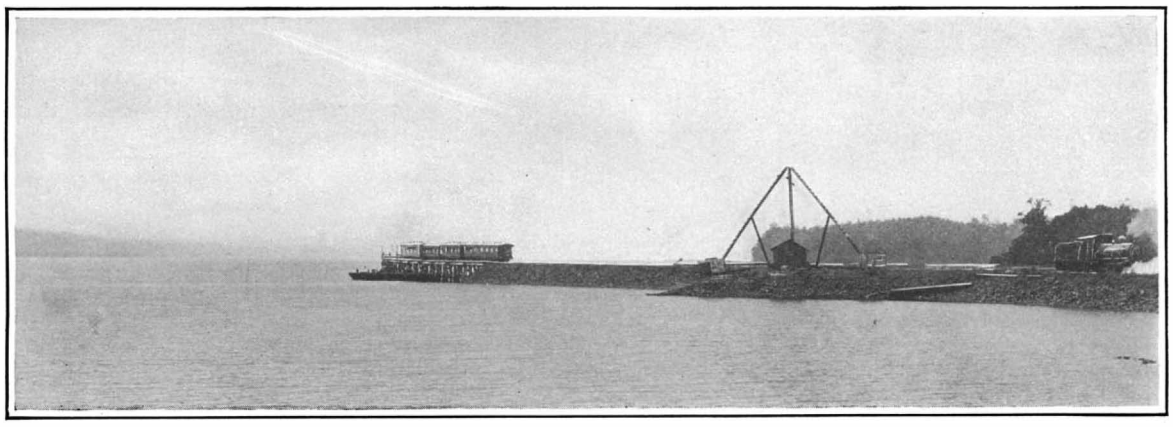
In crossing the Luzon divide, between the China sea and the Pacific ocean, the train runs through some wonderful scenic territory. There are verdure-clad hills, roaring canyons, zig-zag climbs, and an almost endless vista of stately cocoanut groves. The first sight of the Pacific is to be had when the train reaches Lamon bay, where a former American Philippine official dreamed, years ago, of having a Pacific port. From this vicinity onward the road skirts the coast to Gumaca, the ancient Spanish port and one of the oldest towns in the islands, and gives an entrancing view of the sea. At Hondagua the road runs out on to a long pier, with a challenge to trans-Pacific business. And who can say but what this long and lonesome pier is to be the forerunner of many, many more?

It required four and one half years to build this latest extension of the Philippine railroads. The work had in it something of the heroic. The engineering difficulties, combined with the wild, rugged nature of the country, rendered the task a most arduous one. Eight thousand Filipino laborers, working under white engineers, put the project through, but not without undergoing much sickness and hardship.

When we became overlords of the Philippines there was but one little line, running out of Manila to the town of Dagupan, northward. Now the vast sugar fields on the southern islands, notably in the Visayan group, are tapped by fine railroads, and the big island of Luzon is fairly netted with lines running northward and southward, and crosswise. It is no longer necessary to sail around Luzon to get anywhere—one can cut across on the railroad in almost any direction.

Most Philippine roads are of bastard gauge—neither narrow gauge nor standard gauge, they have a width peculiar to themselves. This is due to the fact that British capital is interested to a large extent in the roads, just as Britishers control many of the industries

(*Concluded on page* 444)



Land locked harbor at Hondagua showing pier where ships can come up alongside of train

Round-house and yards at Hondagua—small now but capable of mushroom-like growth

© 1916 SCIENTIFIC AMERICAN, INC

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, November 11, 1916

Charles Allen Munn, President, Frederick C. Beach, Secretary
Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Matter at the Post Office Department, Canada
Trade Mark Registered in the United States Patent Office

Copyright 1916 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Navy as a Career for Young Men

IN spite of the popularity of the United States Navy, it is doubtful if more than a rather small majority of our citizens understand that, for the intelligent and ambitious young man, the Navy offers a career in which the pay is as good, if not better, than that which the average man of the class which enters the Navy can command in civil life under the existing industrial and economic conditions. And lest this statement should be misunderstood, we draw attention, at the very outset of this discussion, to the fact that the enlisted man in our Navy is housed, fed, clothed, doctored, provided with recreation and otherwise cared for, without having to put his hand into his pocket or break into his monthly pay for a single five-cent piece.

What this means, a brief consideration will make clear. For if the enlisted were in civil occupation, let us say as a clerk or mechanic, it is certain that, under the existing conditions of high cost of living, he could not get board of the same excellent quality that he obtains in the Navy, and his room, for less than $6.00 a week; that his commutation or carfare and luncheons would cost him $3.00 a week; that his clothes, including everything from head to foot would cost him $1.50 a week, and that his recreation, including sports, theater, movies, outings, to say nothing of his "best girl," would cost him fully $2.00 a week. All these expenses would total, say, $50.00 a month. Therefore, in view of the present cost of living, and supposing that in civil life the enlisted man would want to be as well fed, as well clothed, and as generously entertained as he is in the Navy, we are making only a fair estimate in putting down the saving to the enlisted man, due to the Government's care of him, at $50.00 per month.

Starting with his entrance into the Navy as an apprenticed seaman at one of the training stations, he is paid $17.50 per month, and this rate of pay continues until he qualifies at the training station, when his pay is raised to $20.90. When the qualified apprentice is assigned to general service, let us say in the seaman branch, his first rating obtainable aboard ship is that of seaman, and as such, he is paid $26.40 per month. If we add the $50.00 per month representing the cost of board, clothing, recreation, etc., as estimated above, we find that the seaman is practically earning the sum of about $75.00 per month.

Not so bad, that, for a young man who may yet want two or three years of coming of age.

And it should be noted here that the law provides for the appointment to the Naval Academy, each year, of fifteen enlisted men. Any young seaman who is under twenty years of age and has been in the Navy at least one year, may enter a competitive examination; and if successful he will go to the Naval Academy and receive its priceless benefits of mental, moral and physical training and experience.

The seaman's rate pay will continue for the four years of his enlistment, or rather this will represent the minimum pay which he will receive; for $26.40 is not by any means the limit of his wage-earning opportunities. A man enlisting in one of the lower ratings is advanced one step at a time with a corresponding raise in pay; that is to say, if he shows proficiency and good conduct—both of which are absolutely essential to a man's advancement in the Navy. Thus, a seaman is eligible for advancement to the position of 3d-class petty-officer; that is to say he may be promoted to be a coxswain, gunner's mate 3d-class, or quarter-master 3d-class, in which case, his pay will be raised to $33.00 per month. As a petty-officer of the 2d-class in the seaman's branch, he will receive $38.50 a month; and as a petty-officer of the 1st-class he will receive $44.00 per month. Should he reach the position of turret-captain of the 1st-class, he will receive $55.00 per month. Furthermore, if he prove to have special qualifications, he may get an acting-appointment as chief petty-officer, in which the pay ranges from $55.00 to $66.00 per month, and after a year's service as chief petty-officer, and should he pass an examination before a board of officers, he will become a permanent-appointment, chief petty-officer, and draw a pay of $77.00 per month. Add to this the $50.00 per month or more that his living would cost him on shore and his pay it will be seen is equivalent to something over $125.00 per month.

The Navy Department is naturally desirous of retaining its enlisted men in service, and in order to promote reënlistments it holds out some generous monetary inducements. Thus, after his discharge at the end of four years, if a man reënlists within the next four months, he receives a bounty of four month's pay at the rate he was paid on his discharge. Furthermore, upon reënlistment his pay is increased by $1.50 as a recognition of his previous honorable discharge, and also his pay is increased by an additional sum of $5.50 for his first reënlistment and by $3.30 per month for each subsequent enlistment. Nor is that all; for if he is recommended by his Captain, he receives a Good Conduct medal after the first reënlistment and a Good Conduct Bar on each subsequent reënlistment, and the holder of such a token receives 82 cents a month for each medal, pin, or bar, he possesses, for all his subsequent enlistments that are continuous. It will thus be seen that on a second continuous enlistment his pay is increased by $7.00 per month; on the third enlistment, by $5.62 per month, and so on through his naval career.

Now let us see what are the increments of pay for a seaman who reënlists before the expiration of the four months allowed. In the first place, he will receive four month's pay at the old rate of $26.40, which amounts to $105.60. This will be equal to an increase per month of $2.20. For his honorable discharge he will receive $1.50, and his increase of pay due to reënlistment will be $5.50. Altogether he will receive an increase for the coming four years of $9.20 monthly. This means that his monthly pay has gone up from $26.40 to $35.60. There is a similar increase in the pay of petty-officers and men on special duty. The 3d-petty officer will get $51.00; the 2d-petty officer $58.33, and the 1st-petty officer $65.67 per month.

It must not be supposed that advancement in the Navy stops with the position of chief-petty officer; for the young civilian, intelligent, industrious and obedient, who has moved up from apprentice to seaman through the grades of petty-officer to chief-officer, may now, if he has it in him, pass on to the next grade of warrant-officer—a life position attainable by promotion from the enlisted grades. As a warrant-officer the pay, depending upon the length of service, will vary from $1,500 to $2,400 per year, with the benefit of retirement at sixty-two years of age on three-quarters pay.

Excellent as is the position of a warrant-officer in our Navy, there are yet higher avenues of promotion for an enlisted man; for the boatswain, gunner, or machinist, or a chief-boatswain, chief-gunner or chief-machinist who has been in his grade four years and is under thirty-five years of age, may enter the annual examination for appointment as ensign. A man who wins a commission in this manner is entitled to the same pay, privileges, honors and opportunities for further advancement, as are open to officers who are graduates of the Naval Academy.

We have spoken above of the financial side of the question, and we think that a good case has been made for the plea that the average opportunities of pay in the Navy compare most favorably with, and, indeed, on the average are superior to those offered to the average young man of the class from which the Navy draws its recruits. But over and above this are the great educational advantages due to the enlisted man's opportunity for seeing the great world. Not only does he have the chance of becoming acquainted with the great seaport cities of his own country, but an extended enlistment is pretty certain to give him acquaintance with all the foreign countries whose shores are washed by the Seven Seas.

And, lastly but never to be forgotten, is the fact that, in addition to the excellent trade schools which have been established in the Navy, in which the young man has an opportunity to acquire proficiency probably greater than that which he could gain in civil life, he has gradually been built up, both in character and physique, to that high standard of excellence, which marks the young Americans who have found in Uncle Sam's Navy both a home and an honorable calling.

More Ignorance About Halos

FROM time to time the SCIENTIFIC AMERICAN has adduced startling evidence of the fact that the one subject, above all others, concerning which the otherwise well-informed man of science can be depended upon to be as ignorant as any layman is atmospheric optics. This ignorance manifests itself in connection with even the commonest of photometeors, and prevails among meteorologists, astronomers and physicists. We have known the leading British journal of meteorology to publish a description of the familiar supernumerary bows of the rainbow—a phenomenon which is to optics about what a field daisy or a dandelion is to botany—as the record of an exceedingly novel and astonishing spectacle.

Solar and lunar halos constitute the largest group of photometeors. A few years ago it was less surprising than it is now that all but the commonest forms of halo should be comparatively little known, because there was a dearth of good descriptive literature concerning them. The classic memoirs of Bravis on the subject were not very easy of access. However, Mascart's "Traité d'Optique" and Pernter's "Meteorologische Optik" gave quite extensive accounts of these phenomena, and finally, in 1911, Dr. Louis Besson published in the *Bulletin* of the Astronomical Society of France (*L'Astronomie*) admirable descriptions of all varieties of halo known to science. An English translation of Besson's memoir was published in the *Monthly Weather Review* for July, 1914, under the title "The Different Forms of Halo and Their Observation."

Since Besson's useful compend of this subject appeared the number of optical "mares' nests" discovered and reported in the scientific journals has sensibly diminished. A scientific man who observes a halo is now more likely to state—if he thinks the matter worth mentioning at all—that he has seen the "halo of 46 deg.," or the "parhelic circle," or the "oblique arcs of the anthelion," and so forth, than to furnish a circumlocutory description of luminous arcs of such and such sizes and in such and such positions—all apparently nameless and awaiting classification.

It appears, however, that the subject of halos is still *terra incognita* in certain quarters where other and not distantly related branches of physical science are assiduously cultivated. A remarkable illustration of this incongruous state of affairs was presented at a recent meeting of the British Astronomical Association.

Dr. Crommelin, of Greenwich Observatory, had read a description of a lunar halo, contributed by an absent member. "After doing so," says the *Journal* of the association, "he mentioned a curious phenomenon which he himself had recently seen.

"It was, he said, about 6:30 in the evening. The sun was about 8 degrees high, and it was about 45 degrees above the sun. There was a brightly-colored arc convex to the sun. The colors were just as vivid as in a primary rainbow, red at the bottom, violet at the top. There was no rain anywhere in the neighborhood, and in any case if there had been rain it was not a part of the sky where any visible rainbow could be seen. Mr. Bryant suggested that it was a tangent arc of the secondary halo (45 deg. from the sun). The arc lasted about two minutes, and then slowly faded.

"*Mrs. Wilson:* I saw the object at Totteridge. I could not make out what it was. What was your date?

"*Dr. Crommelin:* I have not got the date here. (It was subsequently found to be May 4th, at 6:18 P.M.)

"*The President:* Is there anything very unusual in having the tangent bow of the back circle [sic] at 22 deg. radius [sic]?

"*Dr. Crommelin:* It is a curious thing having a tangent arc without the halo itself being visible.

"*The President:* That is an interesting point.

"*Mr. J. E. Maxwell:* Would it be possible for a fleecy cloud to hide the halo itself, so that you could only see the tangent arc?

"*The President:* It might be."

There was more of this infructuous discussion, but we have quoted enough. The outstanding and incredible fact is that, although Mr. Bryant came near hitting the nail on the head, nobody present at this gathering of really eminent British astronomers was qualified to tell Dr. Crommelin, without a moment's hesitation, that what he had seen was the circumzenithal arc of a halo—or, as Mascart has happily called it, the upper "quasi-tangent" arc of the halo of 46 deg.—a phenomenon which is probably visible in the vicinity of London about once a month, on an average, to anybody who looks out for it. At the observatory of Montsouris, in Paris, where halos are regularly observed, this arc was seen 111 times during the ten years 1898-1907. Moreover, far from its being a strange thing to see the quasi-tangent arc without the heliocentric halo, the two are very rarely seen together. This arc often occurs in the absence of any other halo phenomena. Its commonest accompaniment is a parhelion, or sun-dog.

The circumzenithal arc is a beautiful and striking object. Hence its appearance is continually being recorded in the scientific journals by people who—for some mysterious reason—do not take the trouble, before reporting their observations, to consult the literature of optics, or even an ordinary encyclopædia article on halos, in order to find out whether what they have seen is an already well-known and *named* phenomenon.

It would be difficult to find a parallel to this situation in any other field of science.

© 1916 SCIENTIFIC AMERICAN, INC

Automobile Notes

Dust in the Eyes.—Notwithstanding the best fitting goggles automobile tourists are frequently inconvenienced quite seriously by dust in their eyes, and although it seems impossible to exclude the dust, the subsequent treatment for the abatement of the annoyance is quite simple. A solution of borax in warm water will quickly remove the dirt, and may be applied either by means of an eye-cup, or by a small swab of cotton, particular attention being given to wiping out the inside of the lower eyelid, where the bulk of the dust will collect. Besides cleansing the eye, this solution will be found decidedly soothing, and to allay the natural inflammation.

Shortage of Gasoline in England.— In explanation of the gasoline famine in England the government has stated that it is not due to any diminution of the world's supply, but because the Navy Department has requisitioned so many tank steamers for its own purposes, and because neutral countries do not care to send their tankers into the dangerous waters of Europe. In connection with this matter, there is now complaint of a lack of cans for the distribution of motor fuel; and this is largely explained by the fact that gasoline cans have been found to serve a hundred useful purposes in the trenches, and consequently they never come back. Moreover, it is strongly hinted that many Englishmen at home have hidden away innumerable cans of gasoline in contravention to the recent act limiting the use of motor fuel.

More Fuel Trouble in England.— When the British government limited the supplies of gasoline a number of substitutes, all more or less resembling kerosene, appeared on the market, and motorists scrambled for them greedily. Now the courts have apparently decided that these "substitutes" are covered by the act, to the dismay of the car owners, who are frantically citing all kinds of Acts passed during the last 30 years defining or regulating the qualities of petroleum, and derivatives, against the recent decision. These efforts will probably be fruitless, as the latest definition of "motor spirit" distinctly includes "Any inflammable hydro-carbon (including any mixture of hydro-carbons and any liquid containing hydro-carbon) which is capable of being used for providing reasonably efficient motive power for a motor car."

Change Your Crank Case Oil.—No matter how good a quality of oil or grease you use in your crank case it will not retain its proper lubricating qualities forever, but steadily deteriorates by use, and also gathers a continually increasing amount of grit and foreign matter from the wearing of bearings and carbon formed in the cylinders. The result is that, although there may be the proper quantity of oil in the base, its quality has deteriorated, and it has become positively injurious. The same remarks apply to the lubricant in the gear and differential cases, where the accumulation of foreign matter is particularly rapid, owing to the constant rubbing together of the gears. It is good policy to change all oil and grease in the cases mentioned frequently—certainly as often as any darkening of the color is seen, and the cost will be more than made up in the increased life of the car, decreased charges for repairs and freer running. Merely diluting the muddy mass with fresh lubricant does not remedy the difficulty.

Gasoline Pumps.— One item in the high cost of gasoline, to the car owner, is the fact that frequently he does not get the quantity he pays for, and this may be the result of accident or intention. Pumps are generally used for filling tanks, and these are subject to numerous defects that affect their accuracy of measure, and may also be manipulated by the dishonest dealer to the detriment of the purchasers. Any defects in construction or installation of a pump results in a decided tendency to undermeasurement. A leaking foot valve, or formation of vapor under the piston, resulting from an excessive lift, causes a decided shortage, and the pump should be operated one or two strokes, before measurement begins, to insure a full delivery. This is especially necessary when the pump has been standing unused for some time. These are accidental failures; but there are several tricks resorted to by dishonest dealers. First, the pump is not always operated through its full stroke; and again, where a long filling hose is used, with a cut-off cock at the outer end, this may be closed before the last measure has been delivered, thus retaining a substantial percentage of what is paid for. Some pumps are fitted with a pipe for returning undelivered liquid to the tank, and some dealers fit the pipe so that it is open at all times, and a portion of the liquid being pumped is continually passing back into the dealer's tank, after being registered by the pump. The pump maker does his best, but cannot control carelessness or dishonesty. The safe way to buy gasoline is to have it pumped into a regular measure, before placing it in the tank. Besides these pump manipulations some dealers, who sell at "cut" prices, make a practice of drawing off a profitable proportion of gasoline from the cars left in their establishments over night.

Science

A Biography of the Late Professor James Geikie is in course of preparation. Persons who have interesting letters or communications from him are invited to lend them to the editor of the *Scottish Geographical Magazine*, Castle Terrace, Edinburgh, Scotland, who will see that they are returned to their owners after being copied.

Geodesy in Great Britain.—A report by Col. Close, Col. Hills and Sir F. W. Dyson presented at the recent Newcastle meeting of the British Association reveals a lack of organization and general neglect of higher geodesy in Great Britain. In consequence of this report a committee was appointed, representing Sections A and E, for the purpose of improving the position of this branch of science and stimulating research.

The Discoverer of the Famous Piltdown Skull found in 1912, Mr. Charles Dawson, died at Lewes, England, last August. He was a solicitor by profession, but had taken an active interest in palæontology from an early age, and had devoted special attention to the fossil reptiles of the Weald around Hastings. His collection of these fossils is now in the British Museum. He made continuous search in the Sussex gravels for remains of early man and his handiwork, and his memorable discovery was therefore no mere accident.

Sun Temple of Mesa Verde National Park.— A recent publication of the Interior Department entitled "Excavation and Repair of Sun Temple, Mesa Verde National Park," by J. Walter Fewkes, describes the most interesting prehistoric building yet found in a region where so many important archæological discoveries have been made. The building is of an unfamiliar type, and is believed to have been used for religious purposes. From the annual rings of a juniper tree growing on a mound of débris, and other evidences, the date of construction is roughly estimated at 1,300 A. D.

Certified Causes of Death.—The importance of accurate statistics of the causes of death is obvious, but it is well known to registrars, pathologists, life insurance companies, etc., that the statements of cause given in death certificates are extremely untrustworthy. This is not necessarily due to carelessness or ignorance on the part of the certifying physicians, for there is a large percentage of cases in which the cause of death cannot be established without autopsy, while in other cases opportunities are not afforded for appropriate antemortem chemical, bacteriological or biological tests. Dr. Haven Emerson, commissioner of health of New York City, has stated that if the 189 titles of the International List of Causes of Death are studied in the light of present-day knowledge of clinical and pathological experience it will appear that there is no plausible guarantee of accuracy in at least 41 per cent of the certificates presented to the registrar of records in the New York City Health Department. A committee of the American Public Health Association has been considering for some time the reliability of the causes of death specified in the International List, and has recently recommended a number of alterations in this list. These are set forth in detail in a recent number of *Public Health Reports*. After suitable discussion, the suggestions finally agreed upon will be submitted to the international commission charged with the revision of the International List, which will meet in 1919.

Economics of the Prickly Pear.— An elaborate report has been made by a commission which was appointed by the Government of Queensland, in 1912, to visit countries in which prickly pears are abundant, in order to ascertain whether there exist in such countries any natural enemies of these plants that might be utilized for their destruction in Queensland, and also the possibilities of using the prickly pear for commercial purposes. The commission traveled widely over the world, and its report constitutes a valuable reference book on the subjects investigated. The introduction into Queensland of several species of insects destructive to prickly pears is recommended. It is also proposed to introduce one fungus disease; viz., the "anthracnose," "shot hole," or "black rot" malady, caused by *Gloeosporium lunatum*. In warm moist weather this organism causes a considerable and rapid destruction of the young segments. In Argentina the fungus *Sclerotium* (or *Sclerotinia*) *opuntiarum* is destructive to various cacti, but its habits are not yet sufficiently well known to warrant its introduction. The use of certain plants that overgrow and choke out the prickly pear is also suggested. Utilization of the prickly pear of course tends to limit its spread. The writers point out that the fruit of certain species is available for human food. The stems and joints have been used in many countries, mixed with other rations, as fodder, and this food seems to augment milk-production. The prickly pear has been used as a soil fertilizer, especially in India, and as a source of alcohol in Spain and Italy. Several other modes of utilization are enumerated.

Industrial Efficiency

Woods for Carving.—Oak is the most suitable wood for carving, on account of its durability and toughness, without being too hard. Chestnut, American walnut, mahogany and teak are also desirable, while for fine work Italian walnut, lime, sycamore, apple, pear and plum are generally chosen.

German Production of Oil from Fruit Stones.— To increase the supply of oil and fat, poppy and sunflower seeds have been even more widely sown in Germany this year than last. In 1915 about 662,250 pounds of oil were obtained from sunflower seeds, and this year promises a rich crop of poppy seed. Attention has also been drawn to the high percentage of oil contained in cherry and plum stones, which are usually thrown away. According to the statistics of 1900 there were 22,000,000 cherry and 70,000,000 plum trees in Germany. Large quantities of fruit stones were collected by school children last year, but great quantities were thrown away or destroyed owing to the difficulty of extracting the oil from them.

Utilization of Lumber Mill Waste.— Over 300,000 cords of slabs, sawdust, edgings and other mill waste were used for making paper pulp last year. Several of the largest sawmills in New York State are installing special apparatus to save material which was formerly wasted or sent to the burner. The price of paper has risen so greatly since the outbreak of the European war that paper pulp manufacturers are becoming more and more interested in the utilization of wood waste. When it is realized that more wood is wasted than actually utilized in our great lumber industry which uses 40,000,000,000 board feet a year, it is seen that there are great opportunities to save this waste.

Facts Concerning Gasoline.— According to the *National Safety Council*, gasoline should be kept and used only in small quantities, and used only by experienced employees who realize the danger in using this volatile fluid and know how to handle it safely. Gasoline should be handled in small safety cans, equipped with safety gauze and safety stopper. Gasoline is exceedingly volatile and will vaporize when exposed to the air at any temperature down to 15 below zero. This vapor is nearly three times as heavy as air, and when mixed with the proper quantity of air becomes violently explosive. The vapor will ignite from any open flame, even from a spark of static electricity from a human body, a spark from an emery wheel, or from a sufficiently heated surface. The gasoline vapor, being heavier than air, will naturally seek a lower level, and if confined where there is poor ventilation, will sometimes remain in an explosive condition for months.

Influence of Hours on Output.—Memorandum No. 12, issued by the Committee of the Ministry of Munitions on the health of munition workers, contains a report by Dr. H. M. Vernon on the relation between output and hours of work. Experiments covering a considerable period fully justify the recommendation previously made by the Committee that the hours of work should not exceed 65-67 hours for men and 60 hours for women; in many cases even a smaller number of hours per week would give the best results. Some striking examples of the effect of continued fatigue in diminishing output are recorded. Thus, in the case of some youths of 14-17 years, working on steel base plugs, a rise of 16 per cent in hourly output took place after the Christmas holidays, and subsequently when the hours of labor were reduced from 70.3 to 57.0 an increase in total output of about 19 per cent was reached. These and other results, remarks *The Electrician*, show that it is possible to be engaged for longer hours and yet do less work.

Paint and Corrosion.— The average thickness of a coating of paint for iron and steel may be one two-hundredth of an inch, states an authority on the subject. In many parts, however, the coating may easily reach a thinness of one six-hundredth of an inch. If, therefore, a paint contains particles whose smallest dimension is one four-hundredth of an inch, it is obvious that the particle will stand out in a paint coating where the thickness of the paint coating is only one six-hundredth of an inch. Many particles of pigment classed as coarse or sandy lead are considerably larger in size than the size indicated by one four-hundredth of an inch diameter, and these will project still farther through the paint film. Such coarse particles become, therefore, the weak point in the film, and corrosion may start around such particles. The paint film itself is weak at such points, as the coarse particles may not be completely encased in the oil of the film. For these reasons, concludes the authority, the superiority of a highly oxidized red lead is really due to its fineness. It is a better pigment. Its superiority, however, lies not only in the more continuous paint film it produces, but in its producing a better working paint—a paint that flows out well but will not run, sag, or weep.

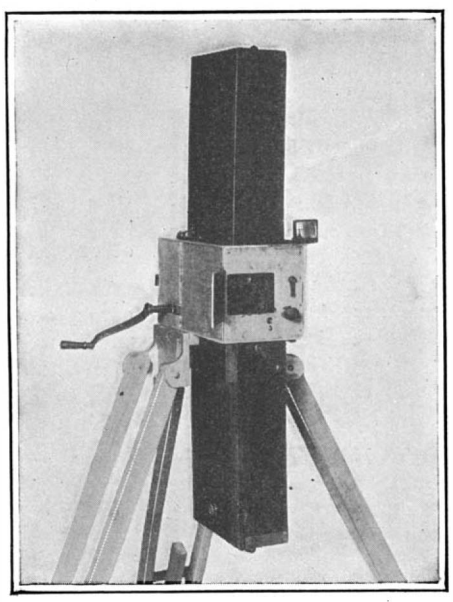
© 1916 SCIENTIFIC AMERICAN, INC

Bringing Motion Pictures Into the Home

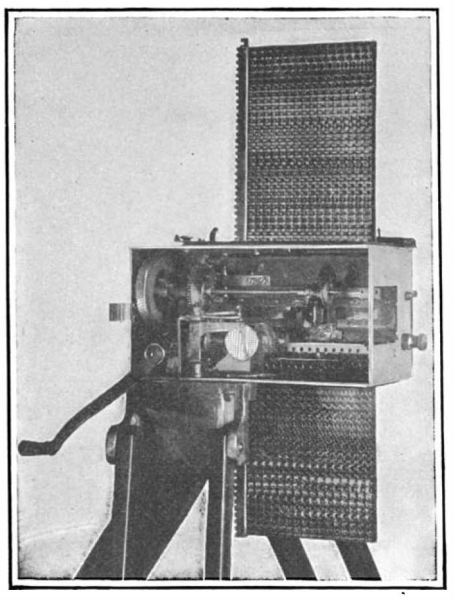
Inexpensive Cinematography the Result of Substituting Glass Plates for the Usual Film

IT has been no fault of inventors if motion pictures thus far have failed to invade our homes on an extensive scale, affording amusement to the family and to the guests, side by side with the versatile phonograph. For there has been no end to the motion picture projectors for home use, in which every conceivable improvement has been introduced not only to simplify the projection of pictures by amateurs, but to render it safe.

Home cinematography, however, cannot become commonplace so long as the usual film is employed, and it is for this very reason that the home projectors already in use are to be found only in limited numbers. Even with film of somewhat smaller size than the standard, and of non-inflammable stock, it has been found impossible to popularize home motion pictures. The reason rests with the excessive cost of film, whether of the standard size or smaller. And if cinematography is to be extended to practically every home, it will be due to the introduction of a cheap substitute for the usual film; in fact, home cinematography will ever have little in common with the standard cinematography, except in ultimate results.



A motion picture camera that utilizes glass plates in place of the usual film

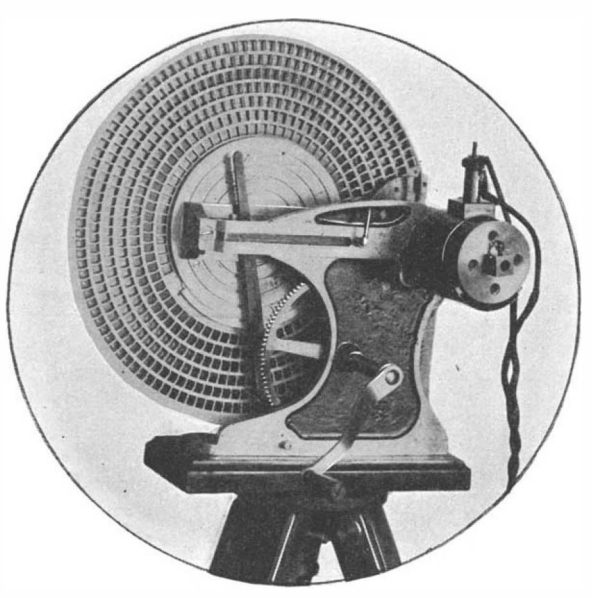


A motion picture projector for the home, which costs no more than a small phonograph

Working along these lines for a number of years, Mr. G. Bettini of New York has evolved several forms of motion picture cameras and projectors for the use of the amateur, in which ordinary glass plates are substituted for the usual film. The prime object has been to reduce the cost of taking and projecting views, while secondary objects have been the simplifying of cinematography and the introduction of certain features not found in the standard motion picture apparatus.

The Bettini camera and projector, in one of its several forms, employs ordinary glass plates measuring approximately 5 by 8½ inches. The images, each measuring one quarter inch square, are arranged on the glass plate in horizontal and vertical rows. Each plate contains 576 separate images, which is equal to about 75 feet of standard film. The exposed negative plate is developed in the usual way, following which a positive is printed. It is this simplicity that makes it possible for anyone with a superficial knowledge of photography to develop his own negatives and print his own positives when employing the Bettini apparatus, and at a cost no greater than for ordinary photography.

The principle of the Bettini plate cinematography is comparatively simple. At first the inventor was confronted with the puzzling problem of bringing the successive squares of the glass plate into position, square by square and row after row, with the lens. To move the plate from side to side and downwards, bringing each successive square in position, was found to be impracticable, since the glass plate, moving in two directions, would then call for a container four times as large as itself. The bulkiness and unwieldiness of such an apparatus would have counted heavily against it; so the inventor set about finding some other method of bringing the plate into position.



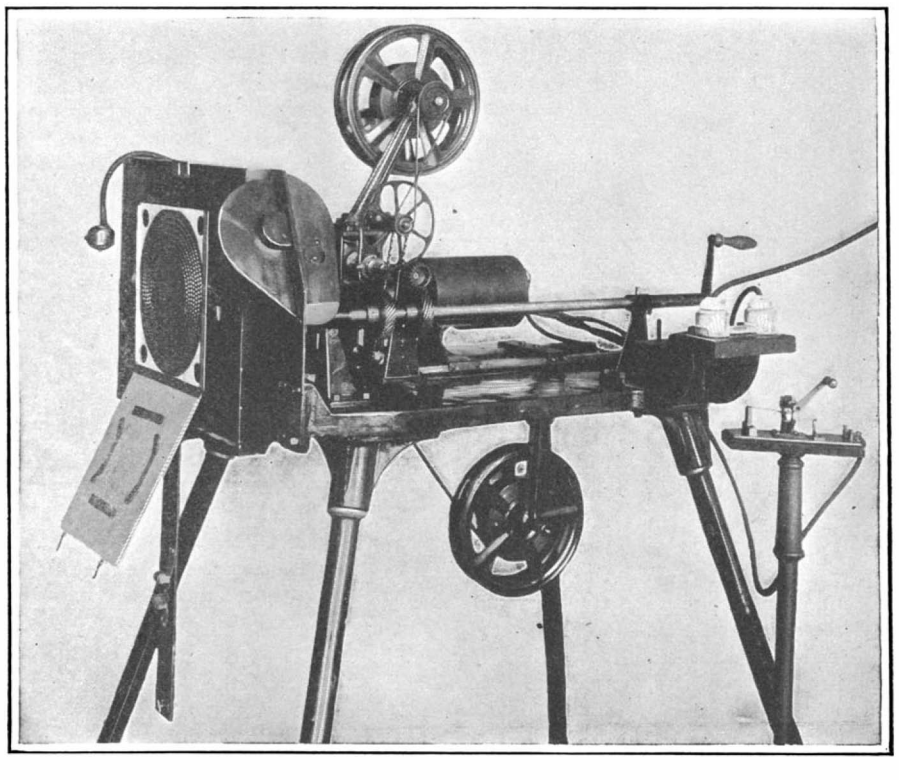
Motion picture projector for children, utilizing circular non-inflammable disks

The present mechanism is highly ingenious in its conception, for the glass plate is moved downwards one row at a time, while the lens (in the instance of the camera) and the lantern as well (in the instance of the projector) are moved across each succeeding row in the opposite direction; that is to say, the lens is first carried from right to left across the first row of images until it reaches the last square, whereupon the glass plate is fed downwards to bring the second row into position so that the lens can be carried from left to right until it reaches the last image on that row, and so on. The principle of projection—and of photographing, with the lantern member eliminated—calls for the mounting of the objective with its prism on one side of the plate, while on the other side of the latter is a second prism on the longitudinal axis of the lantern condenser. Thus the ray of light from the lantern passes through the condenser, strikes a prism which causes it to be bent at right angles, and passes through the image on the glass plate to the lens or objective fitted with a prism which bends the ray at right angles and projects it on a screen. The moving back and forth of the lens or objective is only a matter of a few inches, and hence is not sufficient to materially affect the focus of the photograph or projected image.

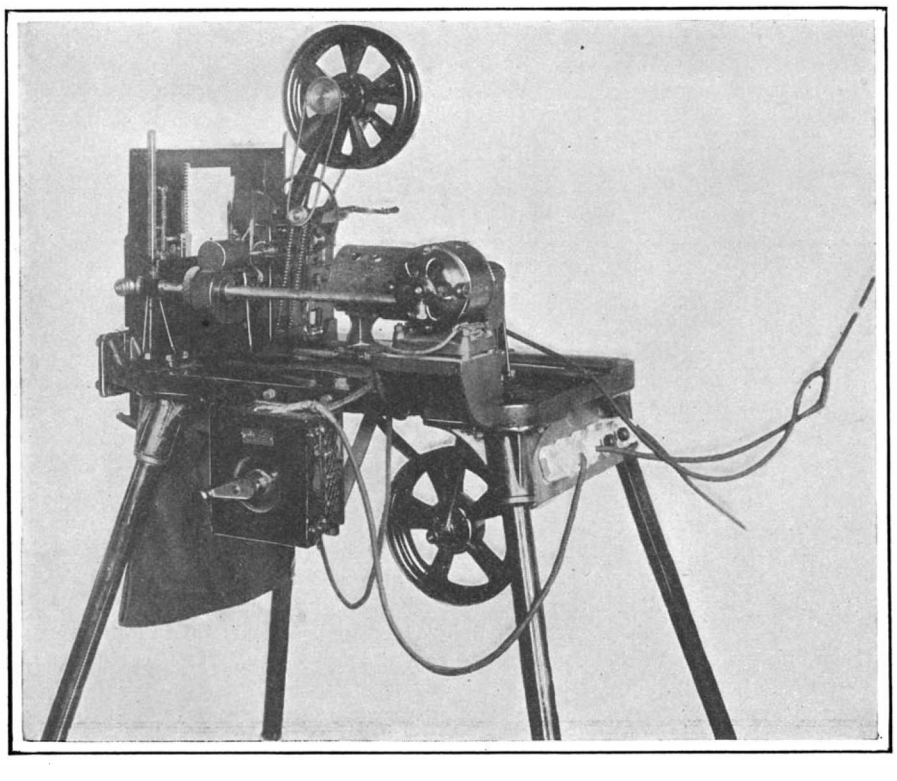
So constant is the feed of the Bettini apparatus that the projected pictures appear on the screen in regular succession and with practically no flicker; in fact, they compare very favorably indeed with the standard motion pictures, which is surprising considering the more complicated movement that is used. There is no noticeable intermission when the glass plate is shifted downwards to bring another row into position, so perfect is the synchronizing of the plate movement and the lens movement.

Fully appreciative of the fact that the home projector would be seriously handicapped if it could only take one plate at a time, therefore limiting the subjects to what corresponds to 75 feet of film, the inventor has made provisions for feeding any number of plates in successive order, automatically and without intermission. The glass plates, it will be noted in the accompanying illustration of the projector, are fitted on one side with a metal holder carrying a rack along its edge. It is with this rack that the step-by-step feed mechanism engages. The upper end of each rack terminates in a hook which engages with a pocket at the bottom of the rack on the glass plate that follows it. Both in the camera and the projector a number of glass plates are arranged in order in an upper container in a slanting position, so that as each plate runs through the mechanism its hook catches onto the next plate; the result is practically the same as if a single glass plate several feet long were being used. The plates, on passing through the mechanism, are automatically disconnected and deposited one by one in a slanting position in the bottom container. In

(*Concluded on page* 444)



By means of this machine the home cinematograph is to be supplied with disks printed from standard film subjects



This printer makes square glass plate positives from standard film. Its operation is entirely automatic

© 1916 SCIENTIFIC AMERICAN, INC

A Motor Car for the Multitude

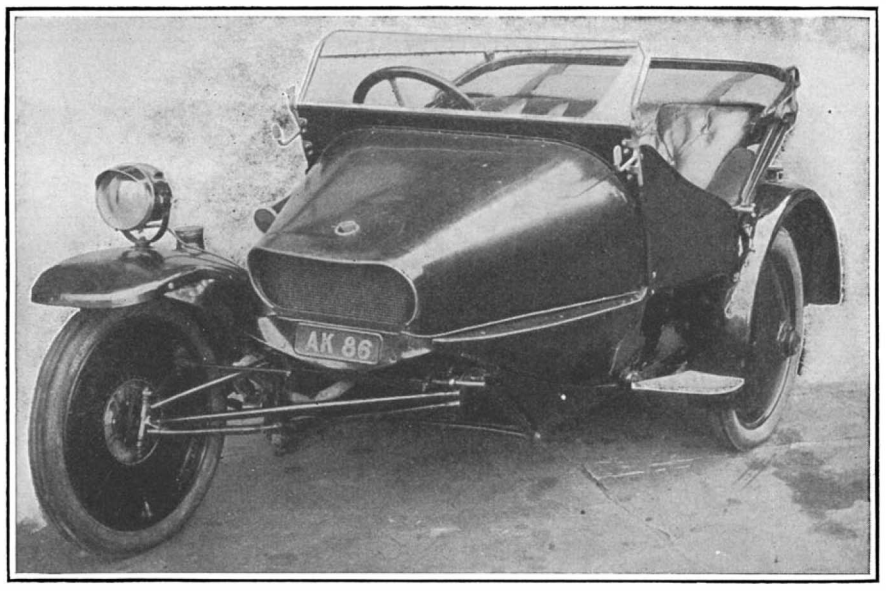
THE mode of the motor car is abroad in the land, and everyone, whether rich or poor, feels that he must possess a motor vehicle of some kind. The requirements of the man of means are easy to meet, for there is a multitude of large and elegant vehicles for him to choose from, but to meet the limitations of the average citizen is much more difficult, for although a number of moderate priced automobiles are available, there still remains a very numerous class of people who are anxious to ride, but who do not feel able to maintain even one of these latter conveyances. It was to satisfy this market that the socalled cycle car was introduced, but the early specimens proved woefully deficient in many directions, and the price kept pace with the process of evolution, so the light car which resulted soon took its place, and became a comparative luxury, and out of the reach of the "great majority."

Another attempt to solve the problem of a vehicle for two, for it is a social problem that is before us, is the motorcycle, with a passenger attachment, first built as a trailer or fore-car,, neither of which satisfied the real demand, and finally a side car, which many have found quite a satisfactory means of locomotion. This combination of a motorcycle and a side car has survived for a number of years, with gradually increasing popularity, for its first cost is low, and it is both simple and economical to operate; but while it affords very comfortable accommodations for the passenger, the driver does not fare so well, and, moreover, it provided him little protection from the elements and the flying dust from the wheels.

Another attempt has recently been made to provide a low-priced vehicle that will comfortably accommodate two people, and give them practically all the comforts of a large automobile, and at the same time be economical to maintain and easy to operate and care for. This creation is the work of an English designer, and, as will be seen by the illustrations, and the picture on the cover of this issue, he has produced a decidedly neat and convenient little car: but interest does not cease with the general appearance of the car, for it embodies a host of ingenious details, only a few of which can be noted here.

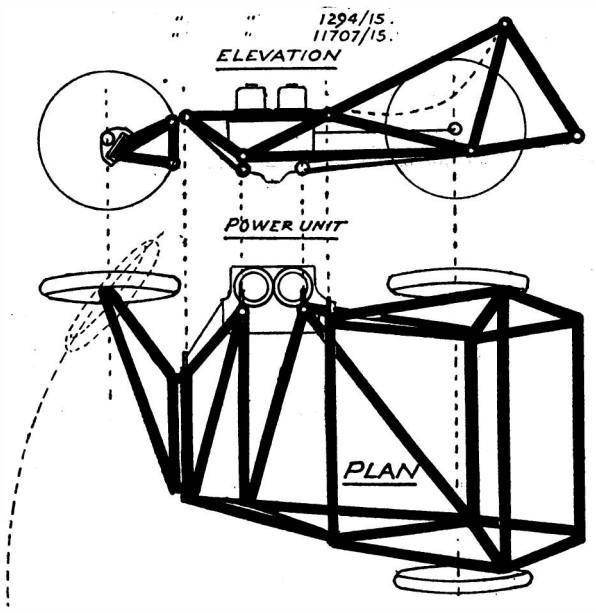
One of the chief points of interest is the chassis, which is built up entirely of steel tubes, combined to form a series of triangular structures in which the tubes are subjected only to tension and compression stresses. There are no brazed joints, but the eye-ended tubes are simply bolted together; and if a tube is damaged in an accident it can be immediately replaced by a telescopic tube, which is carried as a spare, and which can be adjusted to any position. For transportation the entire chassis can be taken down, and the separate parts tied up in a bundle. The motive power consists of a two cylinder, water cooled, two cycle engine, developing five horse-power, which gives a speed of forty miles an hour on a level road; and as a three speed gear is provided the car is capable of climbing any grade ordinarily met with. This engine is located on the right hand footboard, where it is perfectly accessible; and the entire unit, consisting of motor, magneto, and three speed gear, can be readily detached when desired. The body affords almost luxurious accommodations for two people, is provided with a wind screen and an excellent folding top, while the wheels are thoroughly mud-guarded. The wheels shown are of the disk type, which are easily kept clean, and they are of the detachable kind. Each wheel, moreover, is independently sprung by a flexible helical tension spring.

The only thing that is apparently lacking is a reverse gear, but as the wheel base is only 56 inches, and, owing to the three-wheel arrangement, the car can be turned in a six foot radius, the ability to reverse becomes of slight importance. The dimensions of the car are: overall length seven and a half feet; track, 43 inches, and overall width 55 inches. The car will run 50 miles on a gallon of fuel, and the tanks accommodate a supply for 200 miles. The car was originally designed with a view to carrying a machine gun, and it is for this purpose it is now being built, but after the war it will undoubtedly be offered to the public in the form here illustrated.



Converting the motorcycle into an automobile

Some comment has been made as to the appearance of this car, but the worst that can be said against it is that it is novel, and we all know that many a novel creation is approved as soon as we become accustomed to it—as is demonstrated by a comparison of the horse drawn vehicles of twenty years ago and the present motor car. As to the question of practicabilty it may be said that every individual feature involved has been thoroughly tried out, and the identical type of engine has been in successful use in England for at least six years. This little car can make as good an average speed as a regular automobile, and operate in places impossible for the latter.



Novel construction of the chassis

How the World's Largest Silent-Chain Drive Solved a Power-Plant Problem

IT was a strange problem that presented itself at the time of the construction of the temporary Oxbow Bend power house of the Idaho-Oregon Light and Power Company, on the Snake River, about 60 miles north of Huntington. And just as strange has been the novel solution of the problem by John R. Allen, professor of mechanical engineering at the University of Michigan, by means of what is said to be the world's largest silent-chain drive.

The original intention of the engineers was to construct a dam across the Snake River, which at the site selected has a natural fall of 21 feet in passing around the bend. This would have raised the water to 42 feet at the power house. The tunnel across the bend was entirely completed, and the company having charge of the original construction had also purchased the waterwheels and two of the generators. The waterwheels, be it noted here, were intended for a head of 42 feet, at which their speed would be 225 revolutions per minute. Owing to financial difficulties the company was obliged to abandon further operations, and the project was left for three years.

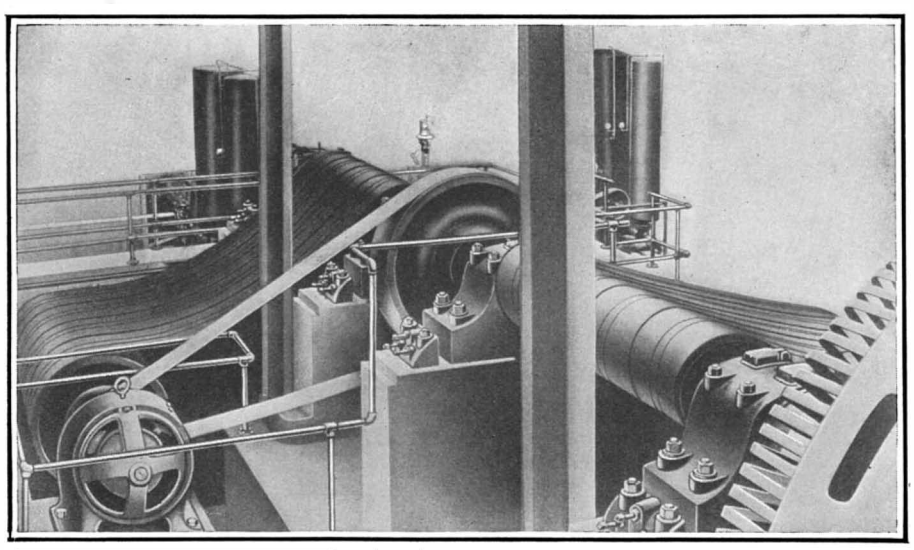
In the meantime, states Professor Allen in a recent issue of *Power*, the company was placed in the hands of a receiver, who found himself very much handicapped for lack of power. There was also a possibility that if this power house was not completed the company's water rights in the Snake River would be forfeited. It was desirable, then, that this construction be made use of as far as possible in building a temporary plant. It was at this point that Professor Allen was called on to advise the company in regard to what could be done to obtain power from the Oxbow plant without expending any large sum of money. The amount of money available made it impossible to build a dam as originally planned, or to buy new machinery. The problem was to use the construction work, the waterwheels, and the generator already owned by the company and to combine them into an operating power plant sufficient for the purpose.

One of the difficulties was in the fact that the generator was designed for 225 revolutions per minute and must be operated at that speed. The waterwheels at 21 feet head would have a normal speed of about 147 revolutions and at the lower head would develop less than one half the horse-power required by the generator. It was decided that, if possible, the experiment would be tried of driving one generator from two waterwheels, provided some form of geared drive could be employed to give the proper speed ratio between generator and the waterwheels.

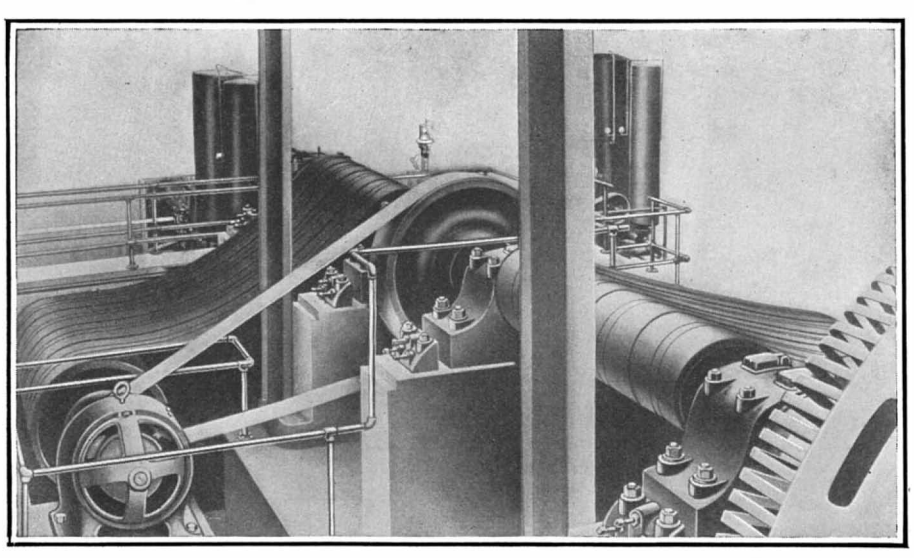
The first consideration was the use of large miter gears. These were seriously studied, but were given up owing to the difficulty that would be encountered in the gears being so large as to cut the tailrace and prevent a proper discharge of water from the wheels. In addition, the expense of very large gears, such as would be necessary in this case, the shafts being 10 feet 9 inches on centers, would be excessive. There was also suggested the possibility of using a crank and connecting-rod drive. This, too, was rejected owing to the many difficult problems involved in construction of this kind.

The third means considered was a silent-chain drive, which involved less expense and took up less space than any other form of drive proposed. In laying out the temporary plant it was found that it would be necessary to lower the wheels five feet from their

(*Concluded on page* 444)



One set of silent chains, transferring power from the waterwheel shaft at the left to the generator appearing in part at the lower right-hand corner



The second set of silent chains, which serves to drive the generator in conjunction with the first set, so as to obtain the requisite power

© 1916 SCIENTIFIC AMERICAN, INC

Strategic Moves of the War, November 1st, 1916

By Our Military Expert

BEGINNING with the present issue, the Strategic Moves of the War will be written by a new military expert. We have always given our military experts the utmost latitude. It may be, therefore, that occasionally the arguments and conclusions of the new author will be at variance with those of his predecessor. If so, the reader will understand that this does not mean an editorial reversal, but a difference of personal opinion on the part of the military experts.—EDITOR.

WHILE trying to get an insight into the probable strategy involved in the present war situation of Europe we should not allow ourselves to become unduly excited or surprised by the nature of the bulletins that have reached us from the several eastern battle fronts through various channels during the past eight or ten days.

We should not make the mistake of drawing definite conclusions from reports of local reverses or successes on anyone of the several fields of operation. Each is but a factor in the general situation and the local results indicated by the daily reports should be carefully weighed and analyzed. In doing this we must consider the general situation as we know it to be, as well as the source or sources from which the report is said to originate; due allowance should also be made for a certain amount of coloring which it may receive, intentionally or otherwise according to the sympathies or antipathies of the channels through which it may have to pass. We should also bear in mind that all sides are uniformly reluctant to give out information of movements of troops, actions, etc., and that as a matter of fact, no information goes out to the world until released by the censor.

It might be well to accustom ourselves to look upon this war of the nations as being somewhat like the constant struggle going on between a great flood and a skilfully devised system of dikes and dams. There is a constant, terrific pressure exerted everywhere. One force seeking to overcome and break through the obstacles and flood the country, the other endeavoring to hold it back and restrict the destructive element. Your sympathies may enable you to detect which of these great forces, the Allies or the Central Powers, is the flood and which the restraining dams and dikes, and having once settled on the designation, you may, if your sympathies are not strong enough to bias your judgment, be called upon, from time to time, to reverse your original designation according to which side seems to be able to assume the offensive for the time being.

Take for instance the western battle front. We may say that from the beginning of hostilities until the battle of the Marne, the Central Powers were the flood and the Allies the ineffective and apparently powerless dams and dikes. The battle of the Marne reversed the situation and with the possible exception of the Teutonic attempt on Verdun, the Allies on the western battle front may be said to be the flood, forever pressing, pushing, feeling for a possible weak spot, a crack or fissure in the powerful dams and dikes restraining them, through which they may rush the reserve troops which they undoubtedly hold for such emergency. That the two forces are still fairly equal in strength is made quite evident by the record of events of the past few days.

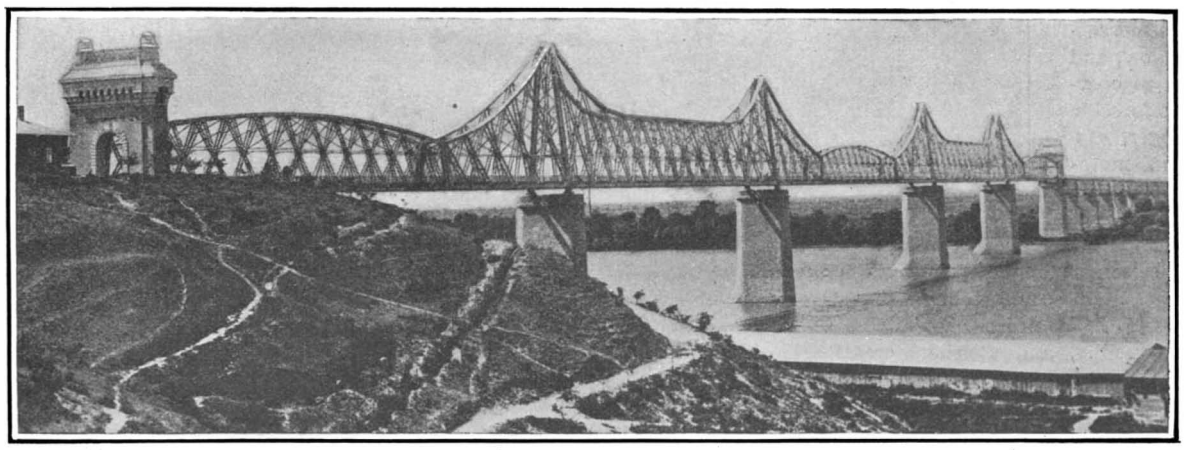
The situation is somewhat different on the eastern battle fronts. There, the Russo-Rumanian forces have been alternately floods and dikes with varying success.

A great deal has been written before, at the time of, and since Rumania's entrance into this war. Many writers expected to see the collapse of Germany's resisting power as coincident with Rumania's declaration of war. This opinion was not warranted by the existing conditions.

I think it would be well for us to stop thinking of Germany as being exhausted, starving, or otherwise on the verge of collapse. Let us rather see in Germany a wonderfully organized nation, wonderfully prepared for the present conflict by over fifty years of earnest endeavor with but one main object in view; a nation of great resources, all mobilized for the nation's needs. A large and splendidly equipped and trained army under one supreme commander; a great General Staff trained and equipped to provide for all possible military emergencies, and last but not least, a practically united national sentiment in favor of the aims and aspirations that are supposed to have caused this war. It is true that Germany has suffered, and now suffers by reason of a restricted food supply, and scarcity of supplies and materials usually imported from outside sources, but so have the other nations on both sides of the struggle. The loss in men has been appalling, but there is no positive evidence at hand to indicate that Germany's resources either in men or materials are exhausted or nearly so, and so long as the national spirit remains, as at present, willing and even anxious to make more, and still more, sacrifices for the national cause, we must be prepared to read reports of brilliant maneuvers, such as have recently taken place on the eastern front.

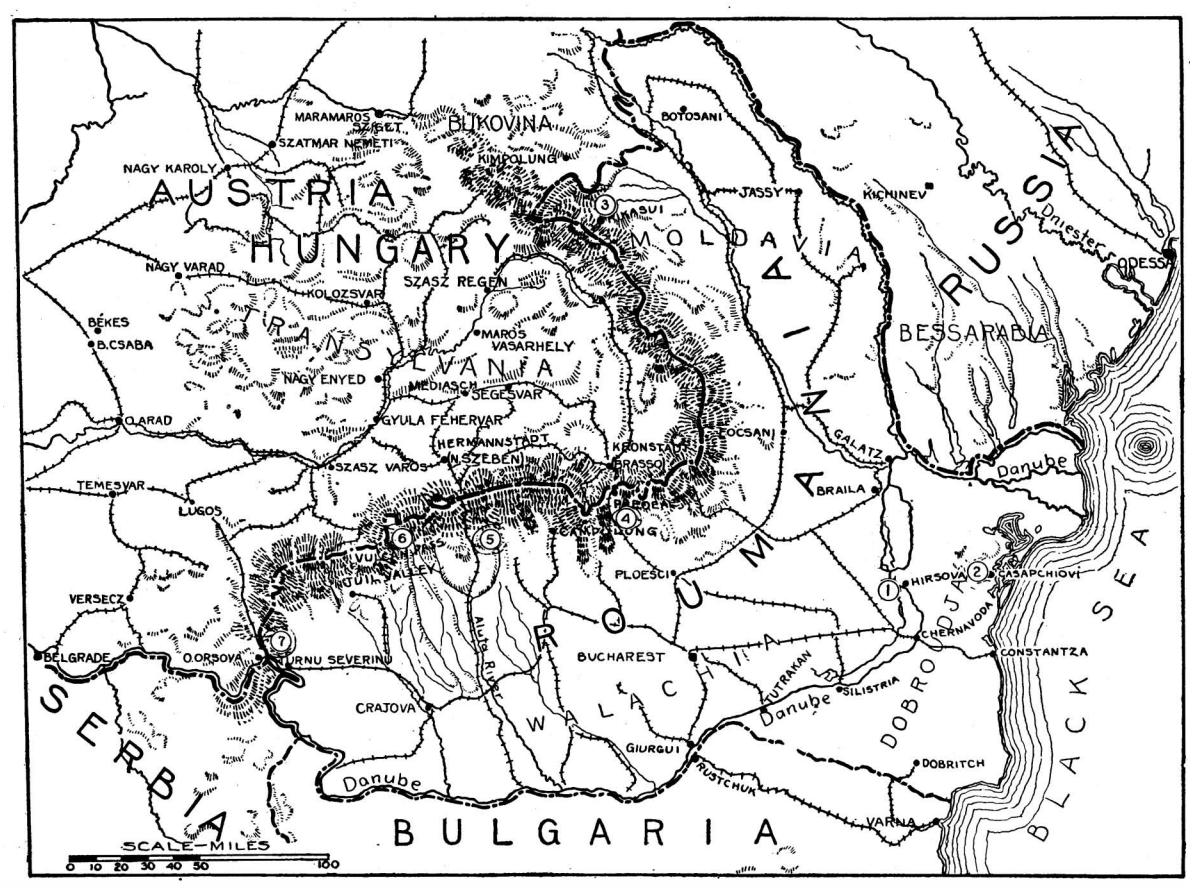
It would be foolish to say that the entrance of Rumania into the war had taken the Central Powers by surprise. To do this would be to ignore the magnificent service of information which is a part of the German Governmental system, and knowing the efficiency of this service it would be even more foolish to suppose that the German General Staff had failed to provide against all possible contingencies.

I am rather inclined to believe that the German plans were well laid to meet just such a possibility. Of course we must realize that it would have been absolutely impossible for the Central Powers, busy as they are in other fields, to keep on the immediate frontier of Transylvania, the army or armies required to prevent Rumania's invasion of the former territory. Had it been possible for the Central Powers to spare from the north eastern and western fronts a force large enough to prevent Rumania from crossing the frontier into Transylvania, Rumania would have remained neutral, for she must have known that a Teutonic force of that size camped at her own door would have been sufficient to invade her at the first suspicious move on her part; and at the present writing Rumania would probably have shared the fate of Belgium and Serbia.



The great bridge over the Danube, at Cernavoda, recently destroyed by the Rumanians

The Central Powers, unable to prevent the invasion of their own territory at the beginning of hostilities with Rumania decided to allow her to develop her drive and let her army become more or less exhilarated by its early successes, an unfortunate failing common to all troops that have had little or no experience in war. But when the proper time had arrived, the troops selected and assembled for the purpose under the command of Falkenhayn, an officer of great ability, were launched against the invaders, and in a few weeks Rumania's victories had turned into defeats, her armies had recrossed their frontiers and were now fighting on their own soil against the Teuton invaders. The Transylvania drive and counter drive occupied the center of the stage for a little over four weeks and those who seemed to be able to see, in its earlier stages, a sure indication of the crumbling of Teutonic power of offensive are now equally certain that the events of the past two weeks are simply the prelude to Rumania's destruction.



The war in Rumania

(1) Hirsova on the Danube, recently captured by the army under Mackensen. (2) Casapchiovi (?), a port on the Black sea of no great value, also captured by Mackensen's army. These two points seem to indicate the northern limit of the Teutonic advance in the Dobrudja. (3) Rikasui, where the Rumanians are said to be holding their own. (4) Campolung, to the north of which the Rumanian army is said to have repulsed two enemy attacks on October 30th. (5) Region east of the Aluta river, where bad weather hampers operations. (6) In the Juil Valley, south of Vulcan Pass, the Rumanians report pursuing the retreating Teutons and capturing 312 prisoners and four machine guns. (7) The Orsova region, where a violent bombardment is in progress.

The operations in the Dobrudja are apt to create confusion in the mind of the ordinary observer. Personally, I do not expect great operations and corresponding results to follow the occupation of the Dobrudja territory by the Teutonic armies in the very near future. There can be no serious menace to Rumania's communications as long as these armies remain south and east of the Danube. On the other hand, this movement was undertaken with some more definite object than merely counteracting the invasion of Transylvania. The first drive served that purpose. The present invasion is, I believe, a preventive measure. Until a few years ago, a very large portion of the

(*Concluded on page* 446)

© 1916 SCIENTIFIC AMERICAN, INC

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Hull Protection Against the Torpedo

To the Editor of the SCIENTIFIC AMERICAN:

I note some remarks regarding the "unsinkable" warship and as I have spent quite some time thinking this simple matter over and also have written my thoughts elsewhere on this subject, I would ask the privilege of expressing my theory to the readers of the SCIENTIFIC AMERICAN: I am convinced that with the stupendous expenditures which are being made, the results of this war should be most thoroughly and carefully considered before constructing something which the nations at war will unquestionably be able to improve on.

We have read in the press a few articles describing a new monitor covered on the outside up to the water line, apparently with some light material variously stated as from 2 to 10 feet thick, and that is about all the information available. Several responsible correspondents report that the explosion of torpedoes produced no effect. It is obvious that any possible means of protection against mines or torpedo is of the utmost importance. Therefore this point must be given thorough consideration and careful investigation.

The question naturally occurs is this point being properly considered and investigated.

Are there in this country any boats being built or protected in this manner?

Are there in this country any tests being made of boats protected in this manner?

No! It is hardly being given a thought, and yet why? Are we always going to follow after Europe in such matters?

If the subject is carefully considered by any one at all versed in the action of high explosives, they will realize that the action of a torpedo will take the path of least resistance. Therefore if the hull of a vessel is fairly well armored, and above all, thoroughly braced and strengthened, then provided with an outer shell spaced away from the hull say about 5 to 10 feet and having crosswise bulkheads open at the top, the force of the explosion will blow out at the top where it meets the least resistance, only filling say one or two compartments crossways of the boat. The strengthening and protecting of a boat in this manner would seem a comparatively easy undertaking, but as usual, it will probably have to be done by someone other than an "expert" in such matters.

As an illustration, I stopped at the Hotel Raleigh, in Washington several years ago, and while sitting in the lobby, happened to get into conversation with several army officers regarding the possibilities of man flying in a machine. My suggestion that it was possible and that the Wright Brothers in Dayton had done such a thing, was laughed at. That same day the Wrights made a long flight at Kittyhawk, and it was published in the papers there. This again illustrates the conservatism of those long associated with one business profession.

It will probably take just as long for our naval experts to realize that boats must and can be protected from the torpedo, and I make the prophesy that protection of this nature will be a fundamental part of a warship in the near future. I will add to my prophesy that when properly applied, the speed and fighting qualities in open battle will be just as great.

Several years ago I had the opportunity of seeing the results produced by detonating very heavy charges against comparatively light armor, the results being practically nil.

Remembering these results, I cannot help come to the conclusion that if a torpedo is exploded against the face of a well protected and braced hull, and having free access to the atmosphere above, that the results will be correspondingly nil. It is the resistance, or inertia of the water, which has forced in the hulls of some of the largest and finest warships and merchantmen in the world, sending them to the bottom, irrespective of size.

I would sincerely like to see an explosion against the side of a ship, protected as I describe, demonstrated, and hope it will occur here soon, if it has not already been tested out in Europe.

W. F. COOPER.

Norwalk, O.

The Steam Car—A Challenge

To the Editor of the SCIENTIFIC AMERICAN:

Your issue dated October 28th contains an article on the steam-propelled automobile by "A Rider in a Steam Car" which was ostensibly designed as a reply or rejoinder to one in your issue dated September 9th by Mr. Prior.

It is the general belief that, when one sets forth his views on a subject which is more or less vital to the health, happiness or well being of the readers of a journal which is designed as a medium for instruction which the SCIENTIFIC AMERICAN is, one would expect that the writers of such would be competent to handle their subject in a manner that would be instructive, but not necessarily technical; but in this case of "A Rider in a Steam Car," the article is neither instructive nor technical; and more than that, it proves that the person knows not one correct item relative to the steam car, and he is evidently very unfamiliar with the "family" steam car, or this car must be of the vintage of the "One Horse Shay."

The writer is the pleased owner of a 1916 steam car and, as there is but one steam-driven automobile being made in marketable quantities at present, will allow "A Rider in a Steam Car" one guess as to the make.

Kerosene being slightly more than one third the expense per gallon of gasoline and giving slightly more heat units, I am using kerosene; but for those who are not particular about expense, also the greater explosive risk in the use of gasoline, the latter fuel can be used in generating steam with no change in the appliance by which liquid fuel is used. The mileage will be less, however, and the "soap factory" perfume will be the same because there is none such with either fuel.

Having formed the habit years ago of never talking without a working knowledge of my subject and being prepared at all times to illustrate the facts of my "conversation," will engage to do this: Take "A Rider in a Steam Car" on a trip covering from one hundred to two hundred miles in my five-passenger steam car, "up hill and down dale," any description of road from smooth asphalt or brick to logging roads in mountainous country and (this has to do with the manipulation of valves), if a valve is moved on the car other than the steam throttle valve throughout the journey, I will pay his expenses in coming to and going from the city in which I live, to his home.

Should the trip cover two hundred miles, we will take water once; and should a gasoline-propelled car pass us on the level going, or on the hills (any make of car), I will then pay the above mentioned expenses; and should he say at the end of the trip that the ride was not the smoothest, safest and fastest he ever had in any car he can collect the expense.

We will also burn kerosene; and if he can detect any "smoky lamp" or "soap factory odors" during the ride, he will be welcome to collect.

C. F. LAMBERT.

The Preservation of Drawings

To the Editor of the SCIENTIFIC AMERICAN:

The Board of Water Supply of the City of New York will in a short time hang drawings in underground chambers and it will be necessary to protect these drawings from dampness.

About eight or ten years ago a man called with a process for casting drawings in a transparent solid which apparently was neither celluloid nor collodion although it looked somewhat like both. We had no use for his scheme at the time, but would like very much to try it now, so we would be very glad to hear from any of your readers who have run across this process or a similar one.

The drawing will be in some cases larger than 36 inches by 48 inches and should be made rigid enough to hang on a wall.

C. D. BELL,
Assistant Engineer in Charge of Drafting.

Concerning Uranus

To the Editor of the SCIENTIFIC AMERICAN:

I am one of the many readers of your paper who read with special interest the monthly articles by Professor Russell on astronomical matters.

I have been watching for Uranus under the directions given in the August and September articles, and have met with some difficulty. The data given are:

August 1st—1½° N. E. of Iota Capricorni, moving *eastward.*

August 31st—¾° N. of Iota Capricorni, moving *eastward.*

September 1st—42′ N. 2′ W. of Iota Capricorni, moving *eastward.*

September 30th—27′ N. 13 W. of Iota Capricorni, moving *eastward.*

By charting above the motion seems westward instead of eastward, and the planet's motion seems over three times as much in August as in September. Have the printers made a mistake, or is it true that the rate of apparent motion changes so greatly?

W. P. MOFFET.

7th U. S. Cavalry.

The above communication was referred by the Editor to Professor Russell, who in his reply makes the following statements:

1. The apparent motion of Uranus during August and September was actually westward—as is always the case for any planet near opposition. See any textbook on astronomy.

2. The motion was actually more rapid in August than in September, and before the end of October the westward motion ceased, and the planet returned toward the eastward.

3. Owing to some error, for which I am doubtless responsible, but which I cannot place, the position of the planet was given as 2′ east of Iota Capricorni on September 1st, and 13′ west of it on September 30th, whereas the true data should have read 9′ east and 40′ west, respectively. The motion of the planet, though slower in September, was not as much slower as the published numbers would indicate.

HENRY NORRIS RUSSELL.

Princeton, N. J.

Professor Cleveland Abbe, 1838-1916

THE death of Professor Cleveland Abbe, which occurred at his home in a suburb of Washington on October 28, closed a period in the life of the venerable meteorologist during which a kind of sunset afterglow rested upon him; a renewal of fame in which he himself would have delighted to find a parallel to the beautiful *recoloration des Alpes*—the second twilight, which casts a rosy splendor over the snowy heads of the mountains after the first setting-in of night. Professor Abbe had been living in strict retirement for more than a year, but various circumstances—especially the bestowal upon him of the Marcellus Hartley medal of the National Academy of Sciences last April—had brought about a reawakening of public interest in the career of "the father of the Weather Bureau" and the original "Old Probabilities." His own story of his pioneer efforts at weather forecasting and of the founding of the Weather Bureau was published in the SCIENTIFIC AMERICAN of May 20, 1916.

Although he was the dominating personality in the Weather Bureau almost from its beginning, Professor Abbe did not originate the project of establishing such an institution on a national scale. This was at least a generation old before he turned his attention definitely to meteorology. It had been persistently advocated by Lieutenant Maury before the Civil War, and the credit for inducing Congress to undertake the experiment belongs perhaps chiefly to Professor I. A. Lapham. But while others were waging a propaganda, Abbe was furnishing a tangible demonstration that the scheme was both feasible and of public utility. In 1869 he organized at the Cincinnati Observatory, of which he had recently been made director, a complete system of telegraphic weather reports and daily weather predictions—the prototype, on a small scale, of the service established the following year by the Federal Government. It is of interest to note that the use of manifold maps for the exhibition of the daily probabilities was developed here under his supervision.

In January, 1871, Professor Abbe was appointed a civilian assistant in the office of the Chief Signal Officer, where his unique experience acquired at Cincinnati enabled him to set the national forecast system in operation. He had previously gained the nickname of "Old Probabilities," but after he merged his identity into that of the Signal Service this name, commonly shortened to "Old Probs," attached itself to the service as a whole, and especially to the Chief Signal Officer, General Myer. Only a small part of his career was devoted to forecasting. He found innumerable other tasks awaiting him in his new field of activity, and there were few meteorological problems, either practical or academic, to which he did not, at one time or another, give his attention.

Professor Abbe was noted among his scientific associates for his unbounded and infectious enthusiasm. In virtue of this quality he exercised a stimulating influence upon the younger men of the Weather Bureau, for whom he never tired of finding new and interesting tasks, and whom he was ever ready to aid with knowledge from his encyclopædic store. The same quality of enthusiasm made him perennially youthful and a delightful companion. His sense of humor was unfailing—even when he himself was the butt of a joke, as when he found himself baffled by some of his own notes, scribbled in a handwriting rivaling in illegibility the justly celebrated scrawls that Horace Greeley used to inflict upon his compositors.

His scientific achievements are a matter of public record and need not be further related here. They were summarized by the president of the Royal Meteorological Society, when the Symons Gold Medal of that society was conferred upon him in 1912, in the statement that he "has contributed to instrumental, statistical, dynamical and thermodynamical meteorology, and forecasting," and "has, moreover, played throughout the part of a leader who drew others into the battle and pointed out the paths along which attacks might be successful."

He was in his seventy-eighth year at the time of his death.

© 1916 SCIENTIFIC AMERICAN, INC

Construction of the Balboa Dry Dock

Provision at Panama for Repairing the Largest Vessels in the World

THE Panama Canal is to have two mammoth dry docks—one located at Balboa, and the other at Cristobal. The main dry dock, which is now under construction at Balboa, will be capable of accommodating the largest vessel afloat. It will have a length of 1,000 feet, a depth over the keel blocks of 29.3 feet at mean low water, and an entrance width of 110 feet. The entrance will be closed by miter gates, similar to those used in the Canal locks.

This great dry dock is being constructed of concrete, resting on a hard rock bottom. Although construction was commenced on it over one year ago, it will require more than another year to complete and put into operation this immense undertaking. Construction of the dry dock to be situated at Cristobal will commence some time in 1917.

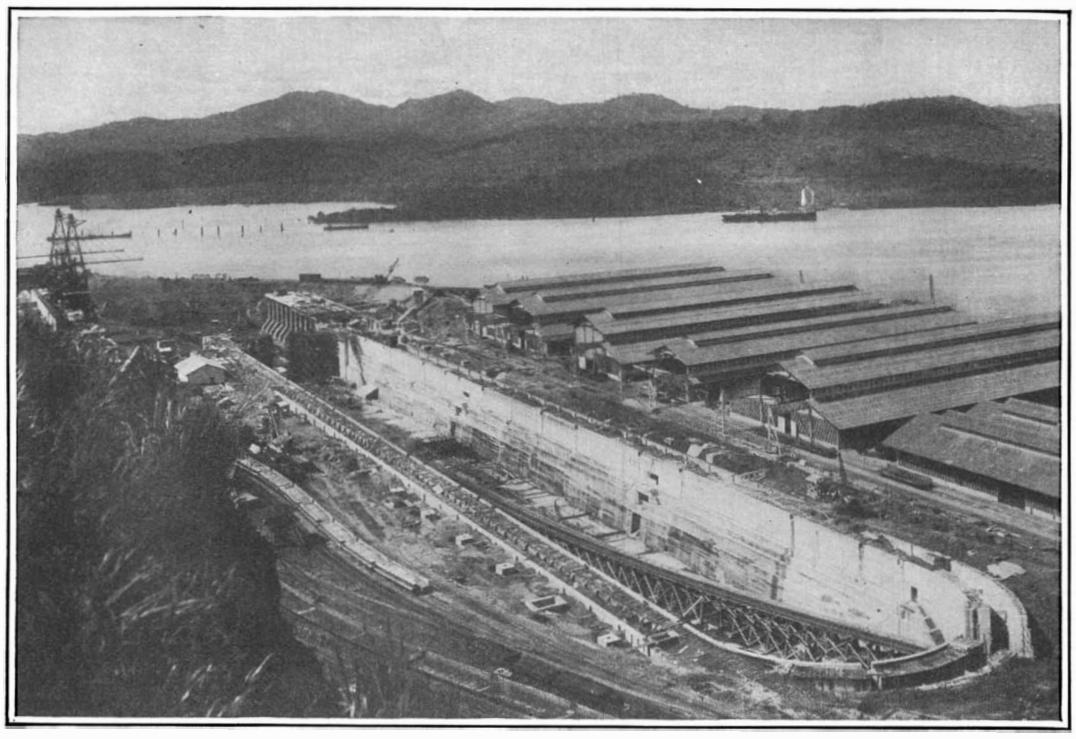
The main shops and repair plant of the Canal are situated at Balboa in the immediate vicinity of the main dry dock, between it and the commercial piers, and have ample installation and capacity for making extensive repairs of any kind, on the largest vessels, with the possible exception of the largest crank shafts, and the longest tail shafts. Two large floating cranes will also be available, should they be required, with a capacity of 250 tons each.

The Balboa dry dock gate will have the same general construction as the lock gates. Its girders are exactly like the lock gate girders, being interchangeable with them. The length and thickness, 65 feet by 7 feet, of the dry dock gate leaves will be the same as for the leaves of the lock gates. The height, by a different spacing of girders, will be 56 feet, to which the nearest approach among the lock gates is 54 feet 8 inches, the height of the upper guard gates at Pedro Miguel and Gatun Locks. The lock gates vary in height from 47 feet 4 inches, for the upper guard gates of Miraflores Locks, to 82 feet, for the lower operating gates of Miraflores Locks.

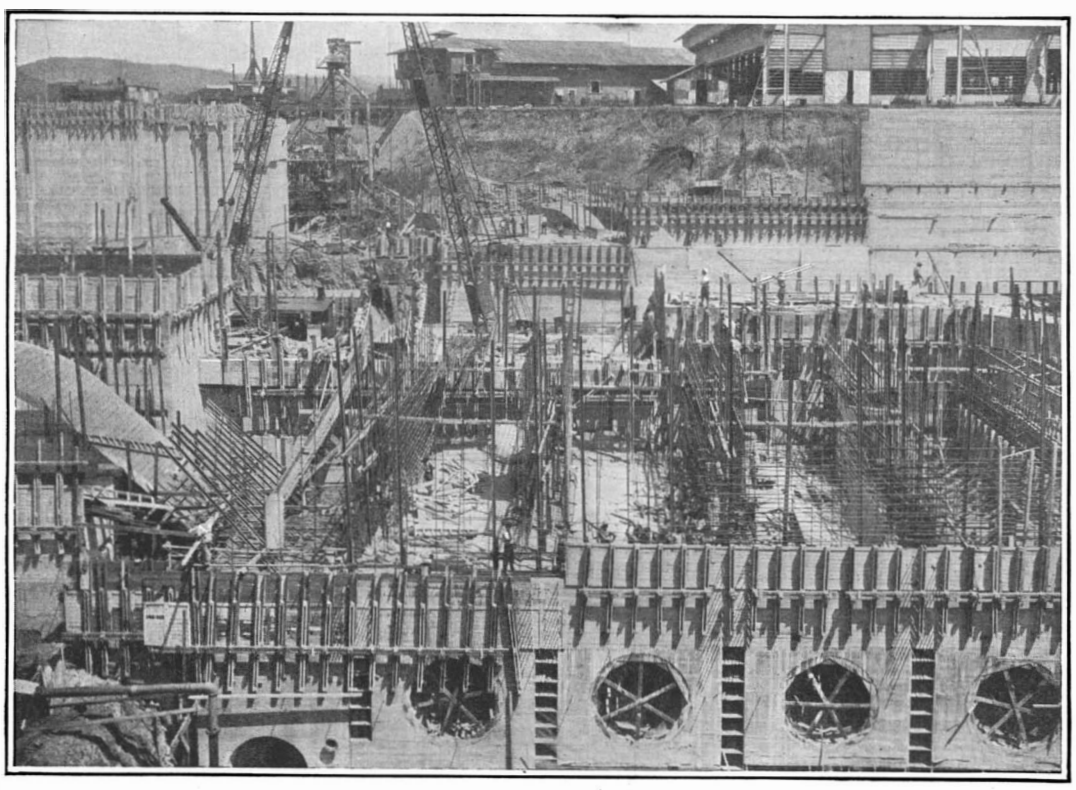
The top of the sill for the Balboa dry dock gate will be at elevation 39.5 feet below mean sea level, which will give a depth of water over the sill at extreme high tide of nearly 50 feet, and at extreme low tide of scarcely less than 30 feet. The sill is practically completed. It is of granite, a facing of smooth stones set in concrete. This is a variation from the practice adopted for the lock gates, the sills of which consisted of greenheart timber set in iron castings, embodied in concrete. The bottom of each leaf will have a timber facing, as the lock gates have, to make a close contact with the sill.

A further variation from the lock gate construction will be in the use on the dry dock gate of wooden quoins and miter posts, instead of rolled steel. The hollow quoins at the hinge ends of the leaves will be of granite. The placing of this granite has been begun. On account of the use of the timber bearings the pintles of the leaves will be set 6 inches farther apart, center to center, than was done in the case of the lock gates. In provision for the replacement of the timbers, as well as any other repairs which may be required by the dry dock gates after the removal of the coffer dam, a seat has been built in the entrance, as at the entrances to the locks, for the use of the floating caisson. In the locks the seat consists of an offset, or niche, in the concrete of the walls, faced with castings, but for the dry dock it was decided to strengthen the shoulder by embedding horizontal steel brackets in the concrete. The bearing surfaces of the caisson sill will be of granite.

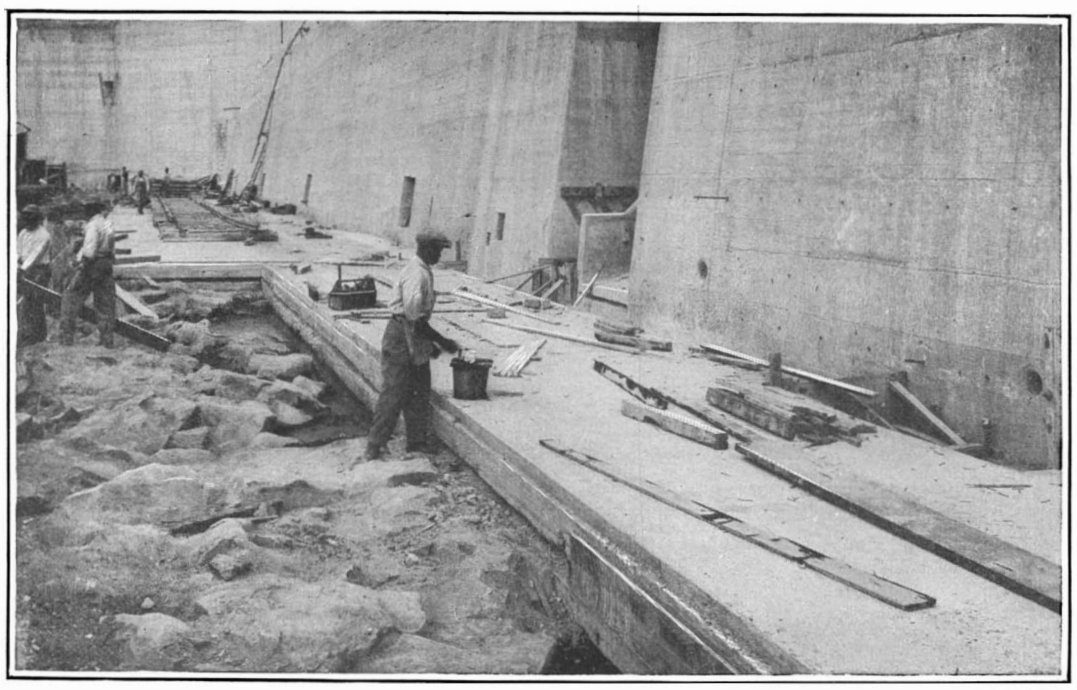
It is estimated that 175,000 cubic yards of concrete will be required for the construction of the Balboa dry dock.



General view of the dry dock during early construction



The concrete reinforcing over the suction chamber



Floor slab set on a rock foundation

The Current Supplement

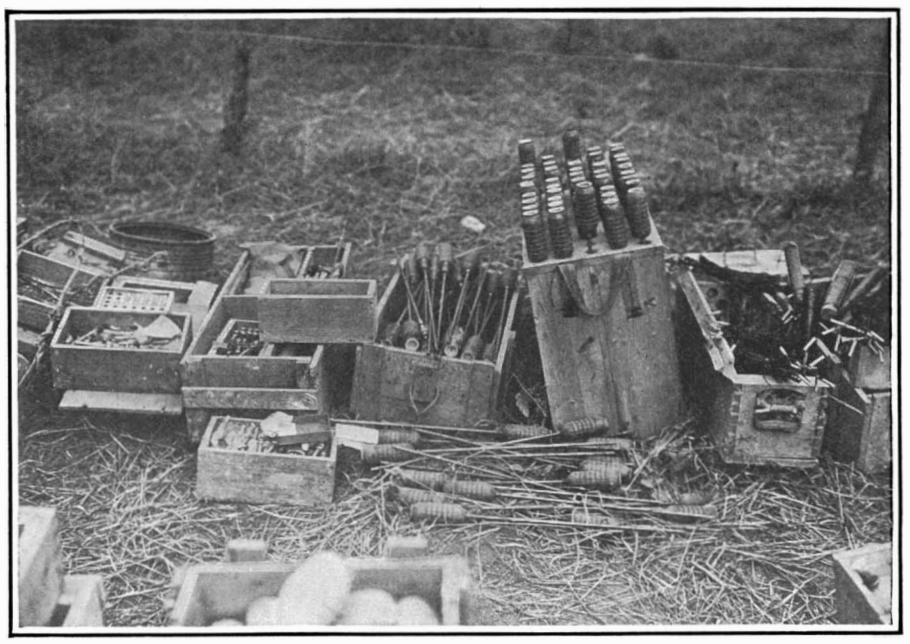
AN interesting paper in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2132, November 11, 1916, is an address on *Pure vs. Applied* Science, which discusses the tendencies of the day to demand practical results from scientific investigations instead of merely demonstrating abstruse theories. Another paper of importance is *Hereditary Reaction-System Relations*, an extension of Mendelian concepts. *The X-Ray Spectrum* discusses this interesting phenomena, and describes how spectra of metals are formed. It is accompanied by explanatory diagrams and illustrations. *Our National Parks* gives many facts relating to our magnificent public play-grounds that are known to but few, and the article is illustrated by a number of new and beautiful photographs. The article on *Bird Migration* is concluded in this issue. An article that should be of interest to many amateur scientists, and possibly to others, is on *Charging Small Storage Batteries*. Several explanatory diagrams accompany it. Another illustrated article is on *The Wind as an Earth Sculptor* which tells how the character of the earth's surface is changed by the action of the wind on loose soil, forming dunes and deserts according to circumstances. In the emergency now existing as a result of the impossibility of obtaining supplies of artificial dyes from Europe the paper on *Natural Dyestuffs* is timely, telling as it does of the various materials offered by nature for the purpose, and how they are used. This issue also offers a number of other interesting articles.

Identification Bands on Wild Ducks

THE U. S. Biological Survey announces that many wild ducks of several species have been liberated, bearing an aluminum band around one leg, with a number on one side and on the other a request that the Department of Agriculture or the Biological Survey be notified. Persons capturing or killing such ducks should send the bands to the headquarters of the survey, in Washington, accompanied by a statement as to the date, place and circumstances of capture. Such reports will be of value in connection with studies that are being made to determine the longevity of individual ducks and the routes of migration of the species. An important feature of this work is the study of the history of ducks which have been supposedly cured of the "duck sickness" prevalent around Great Salt Lake, and there released. Hundreds of thousands of birds have perished from this malady, an account of which has already been given in these columns.

© 1916 SCIENTIFIC AMERICAN, INC

German hand grenades, captured on the Somme



Grenades carried on rods for firing from rifles

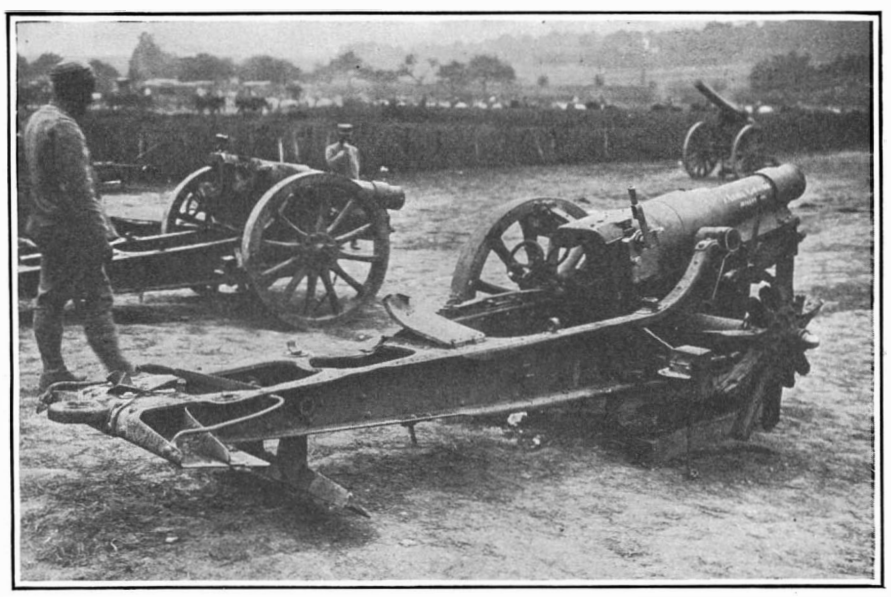
War Booty Captured by the French in the Somme Offensive

IT is the claim of the Franco-British army, which now for nearly four months has been making a practically continuous drive into the German line on the Somme, that the extent of their success is not to be measured in terms of territory taken so much as in the degree to which it is holding the flower of the German army in its front, and breaking it down in munitionment, manpower and morale. The steady advance of the Allies in this four months' continuous battle has been marked by a great slaughter of the enemy and considerable captures of heavy and light guns, machine-guns, and the various implements of trench warfare; also the toll of prisoners has been large. The total capture to date has been between 70,000 and 80,000 prisoners, and some 400 guns, big and little.

The photographs accompanying this article show some of this captured material, and it will be noted that in the case of some of the guns, such as the 6-inch and 4.1-inch howitzers herewith illustrated, the Germans failed to get them away because they were disabled. The 6-inch howitzer seems to have been struck by a shell on the left-hand channel-iron forming that side of the trail, and the fragments of the shell apparently have carried away the breech mechanism and have demolished the right-hand wheel. The 4.1-inch howitzer has been badly knocked about, apparently by a shell bursting in front of it, the explosion and fragments lifting up the forward part of the gun carriage and penetrating and bending back the gun shield.

The most interesting, as showing the novelties of construction developed by trench warfare, are the two German bomb throwers, designed to throw a large bomb with a small charge of powder and light powder pressure. The gun is built up of wooden staves which are wrapped with wire, the wire giving the necessary tangential strength to withstand the bursting stress of the powder. It is probable that at least the powder chamber and possibly the whole of the bore is metal lined.

One of the most remarkable developments of trench warfare is the re-introduction of the medieval grenade or bomb. This is made in a wide variety of forms, two of which are shown in our pictures. Of these the hand grenade consists of a wooden handle carrying at one end the high explosive. Another form is a bomb which is provided with a long rod that fits the bore of the rifle. A large part of the grenade attacks takes place at very close quarters, as when these terriffic weapons are used in clearing out the trenches and driving the enemy out of dug-outs and other concealed positions. A press correspondent at the front has stated that, in some cases, the men are sent forward armed with the bomb in place of the rifle, the former being found to be more effective in positions where the space is so limited as to interfere with the free use of the bayonet.



Krupp 6-in. howitzers, captured on Somme

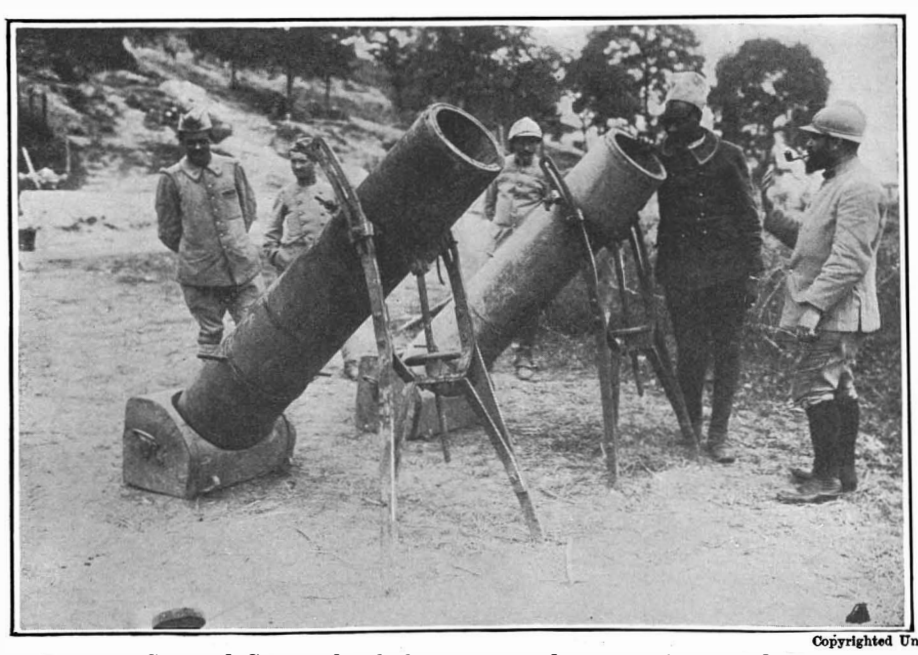
Novel Methods of Recruiting the Army

THE War Department is making strenuous efforts to recruit the army in accordance with laws enacted at the last session of Congress, and some novel methods have been put into operation. The failure to get as many men as was expected is accounted for by officials of the Department by the wave of prosperity that is going over the country, whereby men have obtained positions easily and at good salaries.

To meet the demands for the present and the immediate future, the recruiting service must be capable, it is said, of furnishing annually an average of one recruit per thousand of population. Officials of the War Department say that this can only be accomplished by canvassing every accessible locality in the United States, and establishing, through the aid of the available postmasters, subagencies. The postmasters are to be allowed a fee of $5 for each recruit enlisted through their good offices.

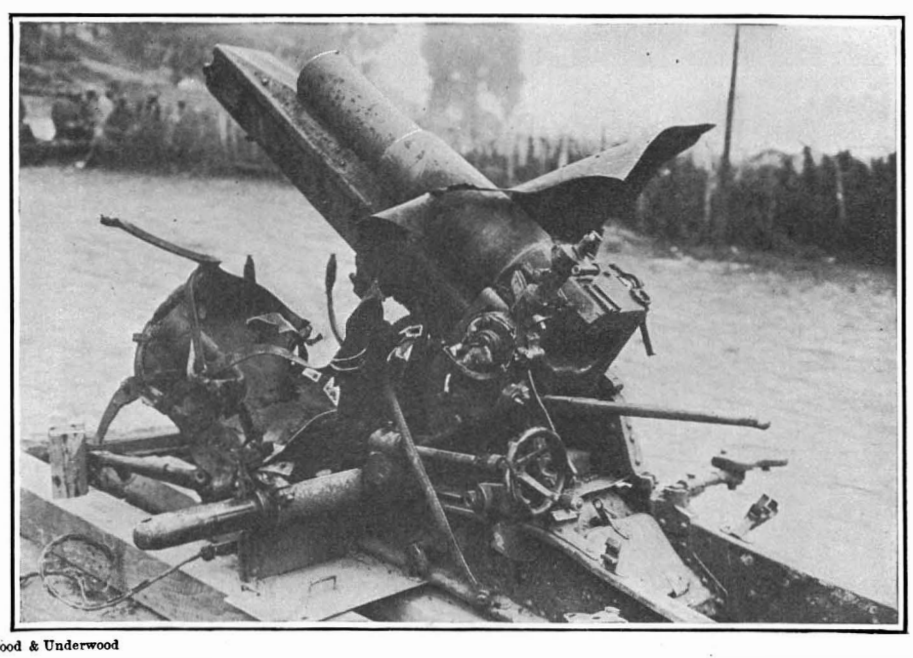
While the present organization of the recruiting service is considered satisfactory, the time has come to establish definite limits to each district, not only to facilitate the work through the 65,000 postmasters, but also to give each recruiting officer exact information as to the outlying areas for which he is responsible. Hereafter, without lessening the efforts that have heretofore been taken to procure recruits in the cities and large towns, special additional effort is to be made thoroughly to comb all the rural sections. This can be done effectively only by securing the coöperation of the postmasters of the United States.

Under the law authorizing furlough to the reserve after one year's service, any young man who meets the requirements for enlistment may receive, without expense to himself, a training and discipline of much greater value than that which thousands of business men and students all over the country have been willing to take at their own expense at Plattsburg and other training stations.



Copyrighted Underwood & Underwood

Captured German bomb-throwers; wood staves, wire wound

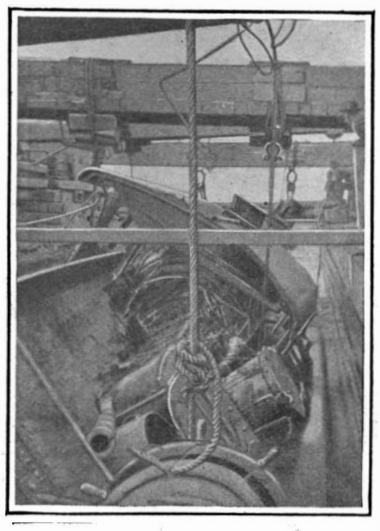


German 4.1-in. howitzer, damaged by shell-fire

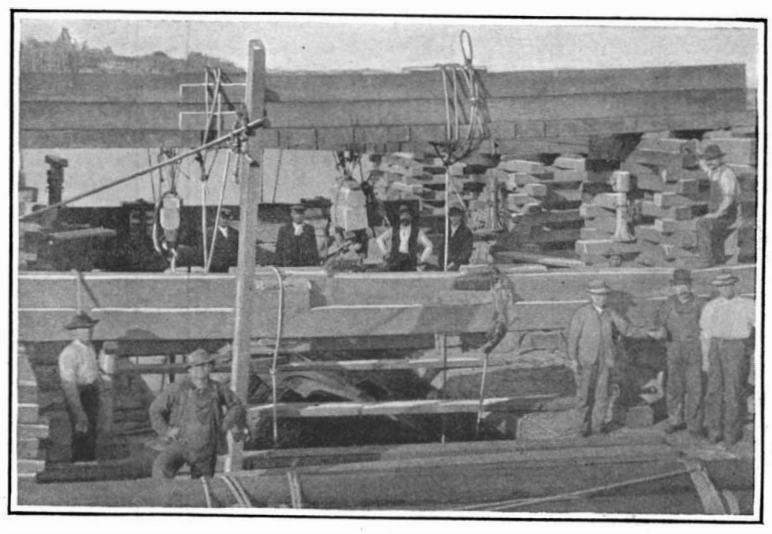
© 1916 SCIENTIFIC AMERICAN, INC

Rescuing a Drowned Locomotive

IN repairing an old railroad trestle at San Pedro, Cal., a 120-ton locomotive that was used to move the pile-driver crashed through a weak part of the trestle upon which it had been standing. It toppled over the piles and, rolling down a steep sloping embankment to the bottom of the bay, came to rest upside down beneath 30 feet of slime, mud and water.



The locomotive partly out of the water



The timber frame work for rescuing the drowned locomotive

As there was no opportunity afforded to use a large modern wrecking crane to replace the engine on the track and no floating derrick barges of sufficient power to lift the big engine were available, it remained for a railroad superintendent to develop an original idea to rescue the "drowned" monster.

Two 200-ton barges were secured and placed side by side 12 feet apart. These were then rigidly fastened together at each end by stout girders and 4½ inch manila rope. The barges, thus fastened, were towed out over the approximate location of the sunken engine; but before they could be set properly over it several projecting pile stumps had to be sawed off close to the bay bottom by a diver armed with a short piece of cross-cut saw.

As a bridging across the barges to support the locomotive during the operation of raising, three huge clusters of timbers were made. One of these was located at each end of the barges and one in the middle. From these supports 1½ inch steel cables were dropped to the engine and made fast by a diver. The tender was handled separately from the engine in a like manner.

After first turning the engine and tender right side up the work of hoisting started. Fifty-ton hydraulic jacks were placed under each end of the timber bridges. Railroad ties were used for cribbing in the manner shown in the photographs.

When the supporting bridges had been jacked up to a height of 10 or 12 feet above the decks of the barges, extra cable lashing was let down to hold the engine in suspension until the supporting timbers could be lowered again to the deck. This operation had to be repeated three times until the engine was finally raised to such a height that it and the barges might be towed intact to some mud-flats half a mile distant up the bay. At this point a spur railroad track ran close to the water. An extension of this spur was made out on the mud-flats during low tides and at high tide the barges and suspended engine were towed over this and the engine lowered on the track.

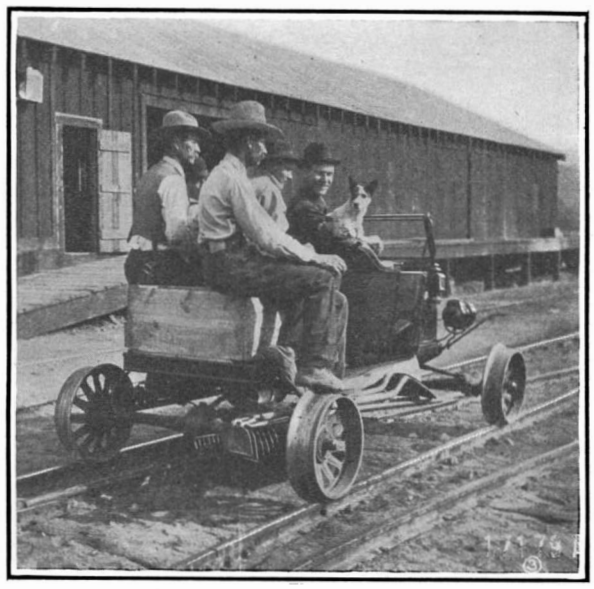
Another locomotive next towed the rescued one up onto the main track and to the round-house for repairs.

Fighting the Forest Fire

FIRE losses in our National Forest reserves amount to from $20,000,000 to $25,000,000 annually. The Government estimates that 20 per cent of this great loss is caused by sparks from railroad locomotives. In its endeavor to reduce future losses of this kind the Forest Bureau has inaugurated what is known as a railroad fire patrol service. The apparatus used is an ordinary automobile with its rubber tires removed and flanged wheels substituted. With a crew of five men these auto cars follow closely upon the wake of passenger and freight trains and extinguish from two to five or six fires daily during the dry and windy seasons.

The fire-fighting equipment carried on the railroad "speeder" comprise mattocks, long-handled shovels, rakes, hoes, a cross-cut saw, hand water pump and folding canvas water buckets.

The crews are out on patrol for four or five days at a time, which necessitates carrying food and cooking utensils with them. The accompanying illustration



Track-auto for catching the forest fire while it is young

shows two good-sized boxes in the rear of the car upon which the fire-fighters are seated. These contain the "grubstake" for the trip.

An Architectural Oddity

ARCHITECTS to please the popular taste for novelties are eternally scrambling for new ideas. And when the search for the truly new lags, it is a simple matter to hark back to bygone generations and copy building fashions so old that they are new.

One of the most striking apartment houses in San Francisco is a building constructed of cement in exact imitation of the homes of the Indians of Arizona. There were many examples of these buildings at the big fair, and perhaps the suggestion for the house we illustrate came from them. In any event, built of modern materials by clever workmen, this style of architecture, garnished with a patch of lawn and with climbing vines on the walls, is indeed pleasing to the eye of the observer.

A Dome of Reinforced Concrete

A CONCRETE dome of 101 feet in diameter and but 2½ inches thick is being built as the roof for a dance hall at Ocean Park, Cal., the reinforcing steel of the dome being so connected with that of the 16 pedestals and their supporting cross-beams that the structure will be monolithic when complete.

Expanded metal lath was fastened inside the framework of reinforcing metal as soon as it was set up, and to this plaster was applied from the inside. After this had dried thoroughly the 2½ inches of concrete was applied to the big framework from the outside with trowels, using the metal lath and plaster as an inside form, and doing away altogether with the outside form.

The reinforcing metal is so arranged in the dome as to take up each strain as it occurs, instead of being placed at points where the strain would accumulate. Inside the dome, commencing at the spring line, a wall is run up for 10 feet, this to carry decorations of the hall, although it will take up a part of the strain of the big dome as well.

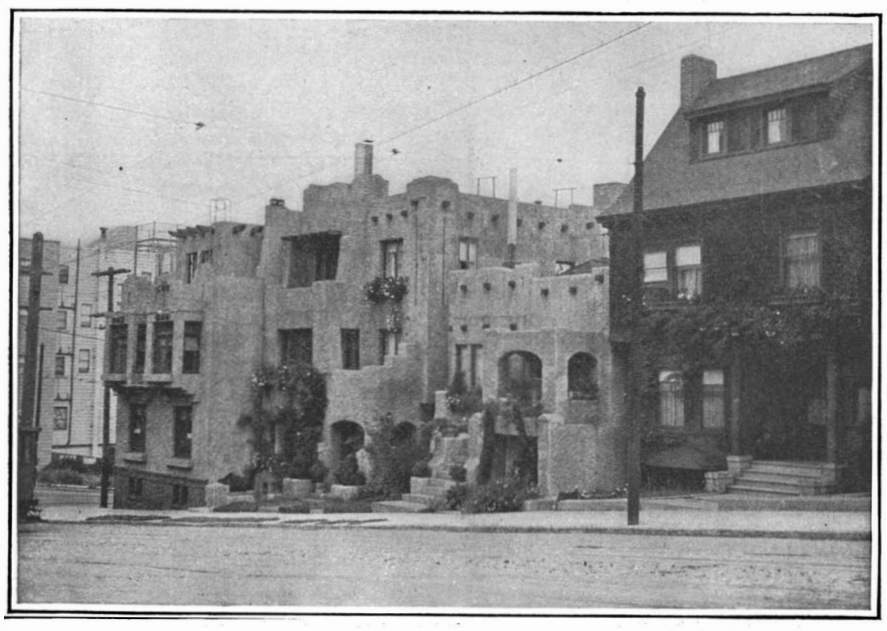
The accompanying view was taken from an adjacent building looking down upon the roof of the one-story structure that will surround the dancing floor. The upper dark part shows the framework with lath fastened inside, while the lower light part of the dome shows where plaster has been put on the inside of the lath.

The variation in spacing of the horizontal reinforcing bars is shown in the engraving, as none of the concrete had been applied when the photo was taken.

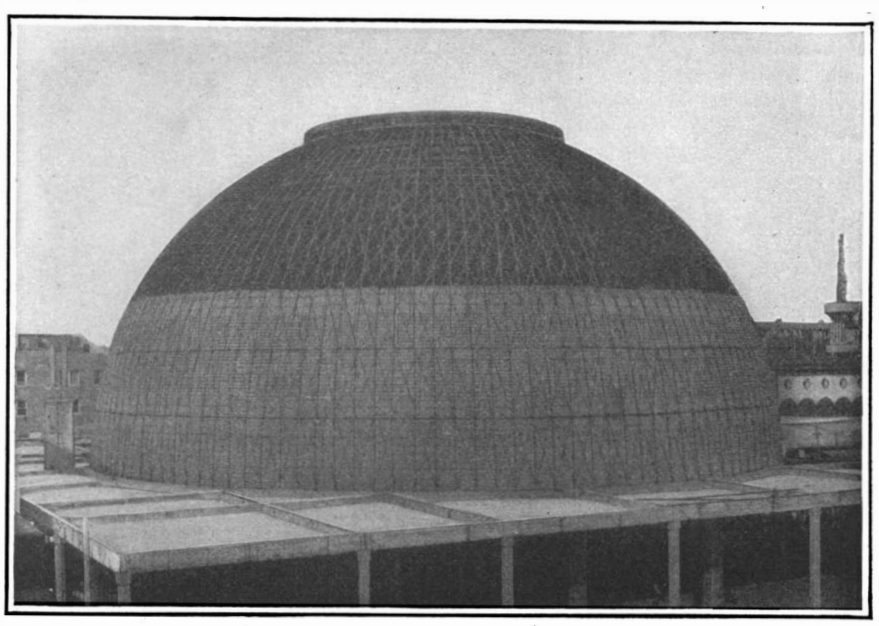
Concrete Roads for New Zealand

THE New Zealand authorities, both local and national, are carefully studying the subject of good roads, realizing that this is the best way to open up the hinterland of the Dominion. The roads of the country, in the main, are not in very good condition. There are some good stone roads about the larger centers, but few of them extend out more than 25 or 30 miles. Their upkeep has been found very expensive, especially in the northern part of the country, since the rainfall is heavy and washouts are numerous because the stone used is soft and grinds up rapidly.

Of late, much has been said in regard to the construction of concrete highways, and it is thought that this will be far cheaper in the long run than the stone roads as they are now constructed, for the reason that the upkeep will be so very greatly reduced. It is estimated that a mile of 12-foot concrete road 4 inches thick could be built in New Zealand for $2,000 more than a mile of ordinary stone road, on which there would be a saving in upkeep for the first five years of at least $1,200, while at the end of ten years there would be a saving of $7,000 or $8,000.

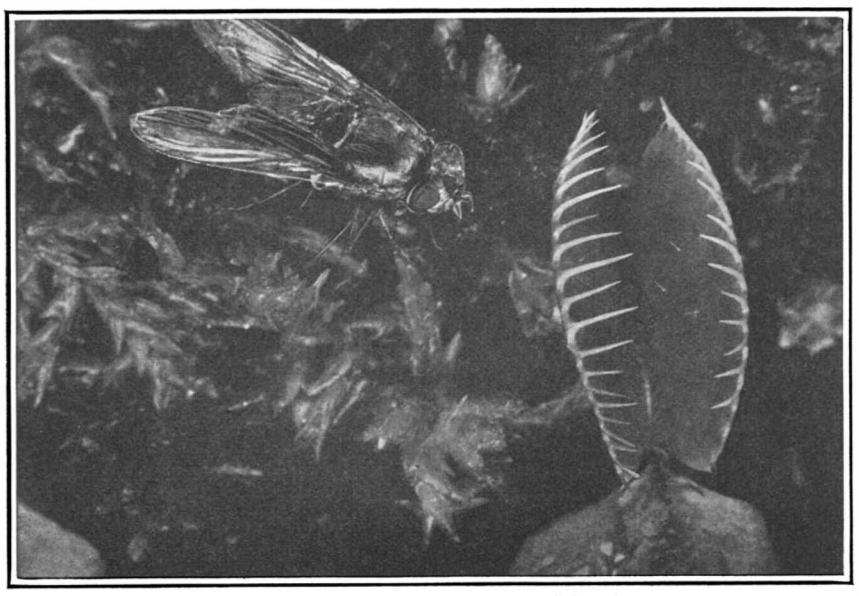


Apartment house modelled after Arizona pueblos

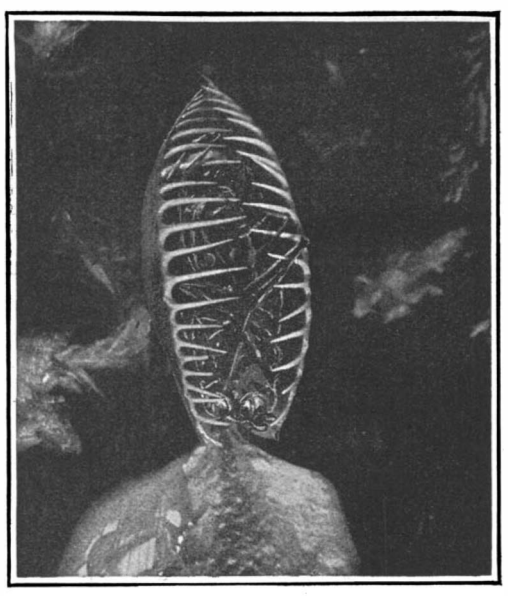


Reinforced concrete dome

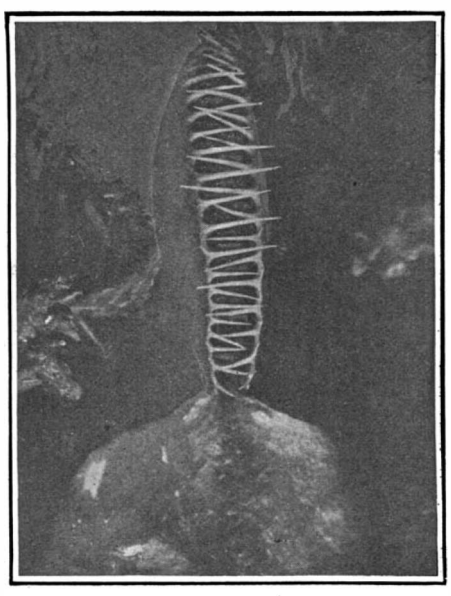
© 1916 SCIENTIFIC AMERICAN, INC



Venus flytrap — The victim approaches



Closing on the fly



The capture completed

The Venus Fly Trap at Dinner

By S. Lenard Bastin

OF all the plants that are carnivorous in habit none is more singular than the Venus Fly Trap (*Dionaea musciplua*). The species occurs in restricted localities finding its home in boggy patches in North and South Carolina. The greatest stronghold of the plant is not far from the town of Wilmington. Such a singular plant has long ago been introduced to the botanical gardens of the world where it usually finds accommodation under the shelter of a glass house. Here, it is possible to maintain the highly moist atmosphere needful for the perfect development of the Venus Fly Trap.

The habit of growth in the case of the Dionaea is remarkable. The plant, when well established, sends out its more or less prostrate leaves in a circle; these surround the base of the flower stalk which rises to the height of 5 or 6 inches bearing a number of white blooms. Every leaf is the most perfect little fly trap. The long winged stalk bears at its end a bi-lobed blade. These halves are able to move on one another. A similar action is to be observed in the case of a book which is thrown open on the hands, and then quickly shut. The margins of the lobes are adorned with a dozen to a score of bristles; when the blades are closed these bristles interlock. The centre of each half of the leaf is covered with bright pink glands and, just at this part, are three hairs arranged in triangular fashion. These hairs bend flat on a joint at the base when the blades of the leaf are closed.

It is in these hairs that the sensitive part of the leaf of the Venus Fly Trap is chiefly to be found. With a pencil point one may move about between the lobes of the leaf, but as a rule nothing happens until the sensitive hairs are touched. Then, at once, the halves of the leaf start to close; if the organ is young, and the temperature is high, the lobes draw together with great rapidity. In a short while the appearance of the leaf is entirely altered, and it should be noted that the borders of bristles interlock in such a way that there is no possible chance of escape for anything that should happen to be within this marvelous natural trap. Actually it has been shown that there are really two phases in the movement of the leaf of the Dionaea. The first is a sudden contraction of the lobes, and this is followed by a much slower movement extending over several minutes during which time the drawing together of the halves is completed.

The process described is just what happens when an unhappy insect is tempted to explore the leaves of the Venus Fly Trap. The first stage in the tragedy is when the creature's attention is directed to the attractive rosy patches on the leaf. It is not certainly known whether there is any secretion, although it is possible that the flies find something to their taste. Anyhow they are tempted by the bright color to make an examination, which is almost certain to end in one way. A very small amount of movement on the lobes will bring the fly up against the sensitive hairs. The stimulus from these organs passes to the cellular tissue, with the results already described. The first movement makes sure of the capture, the second provides against the least possibility of escape.

Soon after the closing of the leaf of the Venus Fly Trap the glands on the surface pour out an abundant secretion. This has been shown to contain formic acid and a digestive ferment. It is rather curious that the juice has distinctly antiseptic properties. Thus in the case of leaves fed with such quantities of meat as to kill them with indigestion, it was found that the portions between the lobes kept fresh and good whilst those outside were putrid. That absorption by the leaf follows digestion is shown by the final disappearance of all the digestible substances, whether the capture be a fly or a piece of meat. After a period, which may be a week or ten days, the leaf re-opens and the unwanted substance is allowed to roll away. The trap then spreads itself out for another capture. As the leaves become older the hairs tend to be less and less responsive to any stimulus, and finally they are not able to catch flies at all. For some while after this the leaves may be quite green and healthy in other respects.

The leaves of the Venus Fly Trap are remarkable on account of their wonderful powers of discrimination. The sensitive hairs are exquisitely responsive to contact with solid bodies but wind, and even drops of rain, take no effect. Inorganic or non-nitrogenous bodies placed on the leaves without touching the hairs do not excite the least movement, but it has been shown that nitrogenous matter, providing this is at all damp, induces the closing of the lobes. In such a case the movement is very slow and may extend over several hours. One cannot play tricks on the Venus Fly Trap. A tiny pebble which the writer dropped on to the sensitive hairs induced a closing of the leaf but, in three hours, the lobes opened and allowed the useless substance to roll away. Minute lumps of hard dry meat were accepted in the same manner, only to be rejected a little later as the failure of the plant's digestive fluid to attack them with success developed.

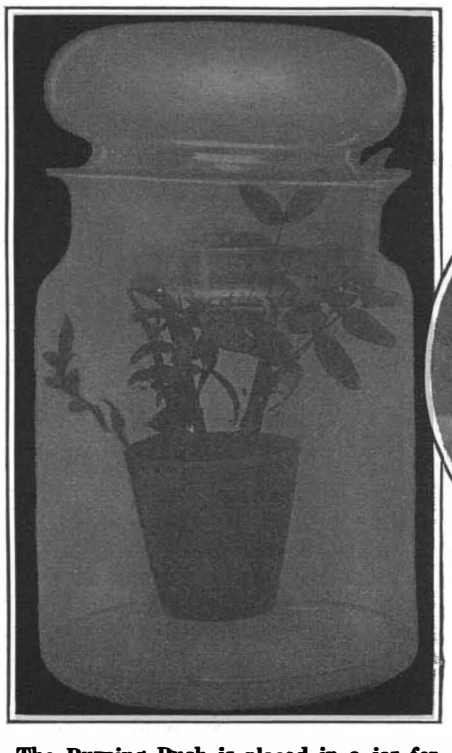
The Burning Bush

ONE of the most remarkable plants in the world is certainly the so-called Burning Bush, *Dictamnus fraxinella*. This species is native to Western Asia, though nowadays commonly to be found in gardens in temperate regions. A great many people who grow the plant are quite unaware of its strange habits. As a matter of fact the Dictamnus secretes a fragrant essential oil in great abundance. This is produced in especially large quantities by the flower stems, in warm weather volatilizing so that the air surrounding the plant is impregnated. Further this vapor is highly inflammable and, if a naked flame is brought near to the plant, the fumes at once take fire with a most singular result. The whole plant is surrounded with crackling shooting flames, reddish in color, and leaving a highly aromatic odor behind them. The Burning Bush is not injured in any way by the fire; for the flames do not actually come into contact with the plant itself.

Several conditions are needful if the experiment with the Burning Bush is to be a success. Thus it is essential that the air should be very dry and warm, also that there should be practically no wind. The best effects are secured only just after the opening of the flowers. It will be realized that these conditions cannot always be relied upon. A plan has recently been devised by means of which the inflammable nature of the vapors given out by the Dictamnus may be shown with startling effect.

A strong plant of the Burning Bush is raised in a pot. At the time when the flowers are just reaching perfection the plant is placed in a glass jar or a shade. This is closely covered for some hours before the time of the experiment. On removing the cover a light is held over the plant when there is at once a tremendous outburst of flame. So great is the rush of fire that it is wise to keep one's face away from the top of the jar; a nasty burn is not by any means out of the question. After an interval of an hour or so with the jar or case closed up the experiment may be repeated with similar results.

In connection with the Dictamnus it is rather remarkable that the species is common where the incident of Moses and the Burning Bush is said to have occurred.



The Burning Bush is placed in a jar for a few hours

The blossom of the Burning Bush. The inflammable vapor arises chiefly from the stalk which carries this flower

A flame brought near them blazes up with great violence

The Brown-Tail Moth

THE report of the U. S. Bureau of Entomology for the last fiscal year states that the severity of the brown-tail moth infestation has steadily decreased. Lighthouses along the coast of Connecticut and Long Island have been examined, but no migrating moths have been found. Fewer moths have been found on trains coming from infested regions during the season when the moths are flying than in any previous year. Hence this serious pest is believed not to be spreading, if indeed not actually in its decline.

© 1916 SCIENTIFIC AMERICAN, INC

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

New Multiple Telegraph System Based on the Attunement of Frequency

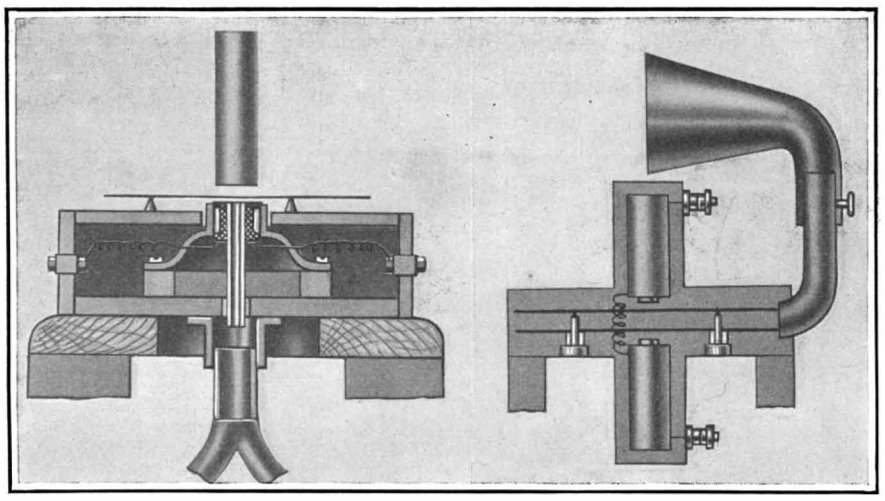
IN Europe there has recently been developed a system of telegraphy which makes it possible for any station to communicate with any other station on the same line, without disturbing in the slightest degree communication between the remaining stations.

In the new system the receiving instrument of a given station is affected only by an alternating current of given frequency, while its transmitting apparatus is capable of generating an alternating current of any of the frequencies necessary to be received at any of the other stations. It is said that the best practice is to employ frequencies between 600 and 1,100 per second, adopting, for example, a progression of fifties; that is to say, frequencies of 600, 650, 700, and so on until the required number of frequencies is obtained. By this choice up to 11 stations can be connected to one line. If it is desired to include a greater number of stations, the choice is presented of using a shorter progression or of extending the extreme frequencies above 1,100 and below 600. It is necessary to avoid employing frequencies of which one is an exact multiple of the other; and the progression cannot be less than by 40 between successive groups, on pain of the reception becoming indistinct, since a difference of 40 in a frequency of 1,120 is only a variation of 4 per cent. Hence, without exceeding the limits, 600 to 1,100, it is impossible to include more than 14 stations on a line.

The receiving apparatus employed with the new system is in the form of a mono-telephone, or a telephone attuned to a given frequency, which produces a clear sound only in response to a current of given frequency. Two types of receiving apparatus employed are shown in the accompanying illustration.

In essential principle the system consists of a steel membrane measuring from one to two millimeters in thickness, carried by three points placed 120 deg. apart on the circumference of a circle concentric with the membrane and in correspondence with the nodes of vibration of the fundamental tone for which the membrane is made; that is to say, having a radius equal to 68/100 of the radius of the membrane itself. A strong magnet placed below the membrane, as shown in the first instrument depicted in the accompanying illustration, has a vertical core the axis of which passes through the center of the membrane. The magnet is wound with wire to a total resistance of from 200 to 400 ohms, and connected to the transmission line. It will be noted that the magnet core is hollow and is connected below with a tube whose two openings consist of flexible tubes terminating in receivers which the operator attaches to his ears, leaving his hands free. It will be recognized at once that an ordinary membrane would vibrate under the influence of alternating currents of all frequencies, but that a membrane supported as here indicated could vibrate distinctly only in response to a current of frequency corresponding to its diameter. Further, by placing above the center of the membrane a tube closed at one end—the upper end—and of proper length, the fundamental vibrations of the membrane are considerably reinforced and confusion made impossible. For frequencies between 600 and 1,100 the length of the sound waves, that is to say the ratio of velocity to frequency, is from 30.3 to 55.5 centimeters; and the length of the resonance tube above the membrane is precisely one quarter this figure.

The use of receivers fixed to the operator's head may be avoided by the installation of a loud speaking telephone of the type shown in the second view. It is formed of two horizontal membranes mounted closely together, the lower supported on three hollow columns and the upper by three points which project from the axes of these hollows and pierce the lower membrane. Each membrane is under the influence of a separate magnet whose end is close to the center of the membrane in question and wound with a coil in circuit with the transmission line.



Two types of mono-telephones employed in a new European system of multiple telegraphy

A telephone horn is connected by means of an elbow tube to the box holding these membranes.

Aside from the receivers already described, it is possible to receive messages dispatched by placing a relay of mono-frequency in combination with a differential relay.

Eliminating disputes with the telephone company—a counter mounted on a desk instrument

The Counter as a Bookkeeper for Your Telephone Calls

THERE are few more fertile sources of dispute than a telephone bill, for it is a fact that few people indeed keep track of their telephone calls. As a result, the number of telephone calls charged for by the telephone company each month is usually discredited and often paid under protest, although the figures do not lie since the telephone organization keeps accurate count of the calls of every subscriber to its service.

Simple as it seems, it is a rather difficult matter to maintain an accurate count of telephone calls for any length of time; at least if the volume of telephone calls is considerable, such as in the average office. Practically nothing short of an automatic device can be depended upon for an accurate total at the end of any desired period.

A simple solution of the problem is presented in the use of a simple counter, mounted in some convenient manner on the telephone instrument so that its dial faces the user, as shown in the accompanying illustration. In the instance of a telephone desk-instrument the push-button of the counter is in position to be depressed by the thumb of the right hand which grasps the stand, so that if the counting of the call is not automatic it is at least unavoidable.

Flexible Magnetic Coupling Built Like an Accordion

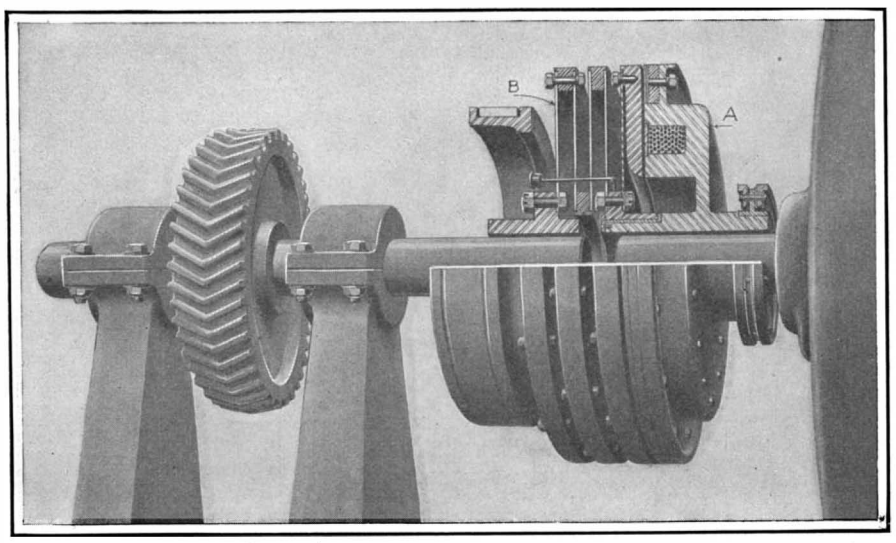
ANY user of herringbone gears is familiar with the bad effect of end thrust, or any constraint which does not leave the gears perfectly free to aline themselves. The resulting noise, vibration, and wear are quite objectionable, especially in the case of rubber calendar rolls where a very smooth action is desired. Many efforts have been made to remedy the trouble, which has always been an objection to the use of herringbone gears.

The use of any fixed end thrust causes too much constraint, while the lack of fixed end thrust allows any lateral motion due to the drift of the motor armature or any other external forces acting on the shaft to be transmitted directly to the pinion, with the unfortunate results already mentioned. Flexible couplings have been, and are being, widely used with the idea of relieving the gears from these end thrusts, but the existing types are designed primarily to take care of mis-alinement and possess sufficient axial friction at working loads to transmit end pressure of objectionable magnitude. They therefore do not afford a true solution of the problem, which has been to design some form of connection between the motor and herringbone pinion which would (1) transmit the necessary power; (2) leave the pinion free to aline itself with the gear; and (3) leave the pinion unaffected by any end thrust, caused by lateral motion of the shaft. In other words, what has been wanted is a perfectly extensible coupling.

A coupling which appears to solve the several problems involved has recently been developed, and is shown in the accompanying illustration. It is depicted in connection with the magnetic safety clutch, *A*, which has now been in use on calendar rolls for some years. The clutch and coupling together go to make an ideal drive for rubber rolls.

The mechanical construction of the new coupling is of the simplest, as will be noted from a study of the drawing. The only problem in the design has been to make the flexible disks, *B*, as strong as is necessary to transmit the torque, and at the same time to secure the utmost flexibility independent of the amount of torque transmitted. It will be noted that the amount of torque transmitted is only dependent upon the thickness of the disks, and the size of the bolts. The extensibility of the coupling, on the other hand, is only dependent upon the flexibility of the disks, and is absolutely independent of the amount of torque transmitted, in that it is the same when no load is being transmitted as when the load is maximum.

In order to secure the utmost extensibility, the disks of the coupling are laminated; *i. e.*, each disk consists of several thin disks bolted together. The deflection of a thin circular plate under a given load varies inversely as the cube



A number of thin, flexible disks are the basis of this extensible coupling and magnetic clutch for herringbone gear drive

(*Concluded on page* 444)

© 1916 SCIENTIFIC AMERICAN, INC

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

PROTECTIVE HELMET.—C. LA F. STOCKS, Blue Ridge, Ga. This inventor provides a means of adjusting the size of the supporting ring in order to accommodate different sized heads, the skull cap and sweat band being so secured to said ring as not to interfere with said adjustment. The vertical guards are also connected to said ring in a manner to permit of relative movement between the same when adjusting the latter.

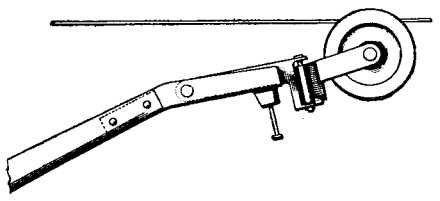
CUTTING DEVICE.—F. N. PURDUE, 9 N. Harrison St., East Orange, N. J. This invention refers to shoe machinery, and provides a cutting or trimming device, more especially designed for cutting a temporary cover of linen or other fabric material close to the sole of a shoe or slipper and without danger of cutting or marring the upper sole of the shoe, boot or slipper.

Electrical Devices

STORAGE BATTERY AND BOX.—F. D. SHINDEL, 2310 Main St., Northampton, Pa. The improvement relates to storage batteries and deals more particularly with terminal connecting devices. The general objects are to improve and simplify the construction of storage battery terminal connectors so as to overcome the objections inherent in the terminal connectors at present in use.

STOP FOR WIRE INSULATORS.—M. W. MARSHALL, care of H. C. Brandt, 2107 E. 18th St., Cleveland, Ohio. An object of the invention is to provide a stop adapted to hold an insulating tube at desired points on an electric wire. As, for exampe, where wires cross or pass other obstructions, which stops are detachable and will not injure the insulation of the wire.

TROLLEY POLE.—E. J. DACEY, Eriton, Pa. This invention pertains generally to trolley



TROLLEY POLE.

poles for electric cars and the like, and more particularly to certain improvements thereto whereby to do away with all friction on curves and preventing arcing between the wheel and the wire in maintaining the same to close even contact at all times. The engraving shows a side elevation of the upper portion of the trolley pole.

ELECTROCHEMICAL SWITCH LOCK AND INDICATOR.—J. W. MARK, 935 Welling St., Richmond Hill, N. Y. This devise is for use in power houses or sub-stations and the like, on either high or low potential circuits where the opening of a live circuit at a knife or transfer switch would be dangerous not only to the equipment of the generating or substation but also to human life.

Of Interest to Farmers

GRAIN CUTTER.—S. I. DERR, 364 New St., Emaus, Pa. This invention has particular reference to a device for cutting oats or other grains for chicken feed. It so treats whole oats that the hull is not separated from the kernel and thereby making it practical for all of the grain including the hull to be eaten with a relish, eliminating waste and providing for the chicks the full nutrient value of the feed.

SICKLE DRIVE FOR HARVESTERS.—C. QUESNELL, 659 Pettygrove St., Portland, Ore. This invention is a mechanism for driving the sickle-blade or cutter of harvesters, particularly the combined harvesters and threshers. The flexibility of the strap connection practically "cushions" the sickle blade so that no jar or shock or noise is produced as when chains are employed in place of straps.

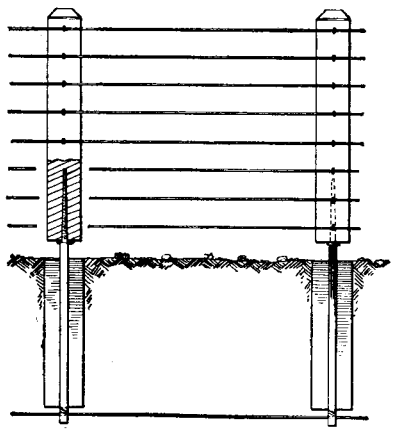
PLOW.—B. O. CUMMINGS and D. S. MCARTHUR. Address the former care of The Bain Adams Co., Portland, Ark. The principal objects of the present invention are to improve various articles of construction and arrangements of parts of the plow forming the subject of Messrs. Cummings and McArthur's Patent 1,149,811, issued August 10th, 1915, and to provide a plow capable of more efficiently accomplishing the purposes for which the original plow was devised.

Of General Interest

ELAPSED TIME INDICATOR.—A. D. LEGG, 300 E. 30th St., Baltimore, Md. The inventor provides a double chart together with an endless flexible indicating member which need not at any time extend beyond the edges of the chart and which has its indicating month data arranged in form to coöperate with the chart itself.

BOTTLE CLOSURE.—R. C. WILSON, Athens, Ga. The improvement relates particularly to bottle caps or shields adapted to be associated with cork stoppers, the object being to provide a cap capable of firmly gripping and retaining a cork without itself entering, at any point, into the neck of the bottle in connection with which it is used.

ATTACHMENT FOR FENCE POSTS.—J. COLLON, Grindstone City, Mich. A series of holding devices is provided adapted to be arranged in the ground to form a solid rigid sup-

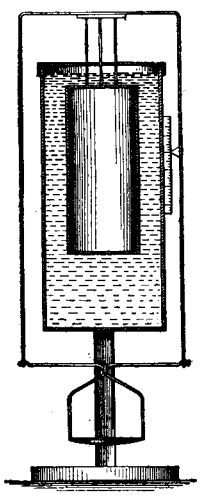


ATTACHMENT FOR FENCE POSTS.

port for the several posts, the devices being connected together and permitting a post to be connected with each of the devices, to hold the post upright and rigid, to permit the attachment of fencing wires or the like, and wherein any post when it becomes rotten or broken may be removed, and replaced without disturbing the anchoring mechanism.

ORDNANCE.—W. C. BUCKHOUT, Lincoln Park Station, Yonkers, N. Y. This invention provides improvements in ordnance whereby the recoil or backward on the breech block is utilized to offset the longitudinal and circumferential strains, to render the ordnance exceedingly strong and durable and to insure long life to the ordnance.

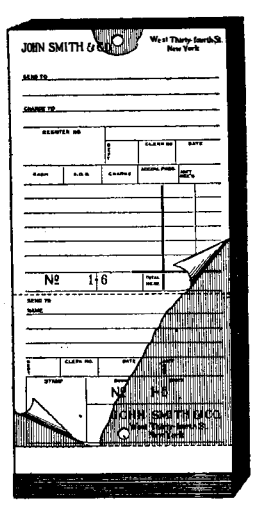
HYDROSTATIC SCALE.—H. B. GEPHARDT, 724 Broome St., Topeka, Kan. This invention provides a substitute for the costly sensitive beam balances now employed in physical and chemical laboratories. It provides such a device which involves the principle of an



HYDROSTATIC SCALE.

hydrometer but wherein the float is entirely submerged beneath the surface of a suitable liquid at all times, thus preventing atmospheric influences thereon, and also preventing the lodging of the dust or the like thereon which tend to render the scale inaccurate.

DUPLICATE SALES CHECK TAG.—A. GREENSTEIN, 120 Woodycrest Ave., Highbridge, New York, N. Y. This invention relates to shipping devices and particularly to facilities for the billing and delivery of packages or other articles in or from retail stores or the like. It comprises a duplicate salesbook having record slips and beneath each of which



DUPLICATE SALES CHECK TAG.

is a leaf or sheet adapted to receive the duplicate record, but which leaf is formed of tough paper or its equivalent and having a hole at either or both ends whereby the duplicate sheet may be treated as a tag and readily adapted to be tied to the package coincidentally with the wrapping of such package.

Household Utilities

CHILD'S TOILET.—BETTY B. COOKE, 1345 4th Ave., Louisville, Ky. This invention relates to toilets, and the main object thereof is to provide devices of this class, whereby the need for placing a child upon conventional toilets, as in public places, is avoided. The intention is to provide these toilets in all places of public character, where mothers or others are likely to bring very young children.

SEWING MACHINE ATTACHMENT.—J. KIMMEL, 230 E. 75th St., New York, N. Y. This invention has particular reference to attachments for sewing binding upon various commodities or fabrics. It provides means in connection with a sewing machine for sewing heavy binding upon the soles or uppers of fabric slippers or the like in a much more rapid manner than has heretofore been possible by hand and with a neater result or appearance than can otherwise be accomplished.

AUTOMATIC SAFETY MILK BOTTLE LOCKER.—J. J. DREW, 2483 Elm Place, Bronx, N. Y. In this patent the invention has reference to lockers for milk bottles and the like and has for an object the provision of an improved construction whereby the device will automatically become locked after a filled bottle has been placed in position.

TOOTH BRUSH HOLDER.—W. A. RAY and R. M. OLIVE. Address Dr. W. A. Ray, 113 Green St., Fayetteville, N. C. The holder is adapted to contain a germicidal solution for antiseptically treating the brush. The invention provides a container or tube in which the brush is carried and locked, the means for locking the same being also employed as a support and guard for the container when the closure therefor is removed.

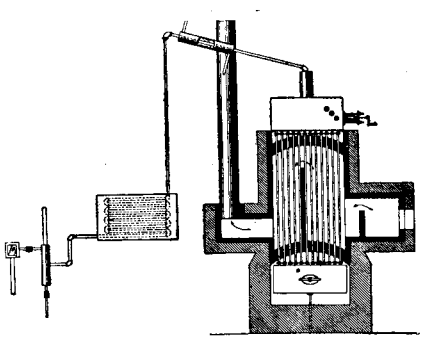
BROOM AND SOCKET THEREFOR.—H. J. EDLUND, 368 S. Union St., Burlington Vt. The purpose in this instance is to provide an arrangement whereby a single socket may be used for a large number of brooms. Another object is to provide an arrangement of broom and socket whereby the broom may be quickly applied and removed merely by back and forth action.

Machines and Mechanical Devices

CALENDAR WATCH.—J. E. HAGEL, Los Vegas, Nev. The inventor provides a ring capable of attachment to the ordinary dollar watch in such position that it will encircle the dial and will be rotable on the watch case, the ring bearing on its outer face the days of the months in sequence to permit any predetermined day to be brought into register with one of the numbers of the dial to indicate the day of the month.

AUTOMATIC DAVIT.—R. TJADER, Darien, Conn. Among the objects of the invention is to improve davit construction in a number of specific and important particulars, among which is the provision of an inclined chair or support for each of the davit arms or quadrants, and whereby the quadrants may gravitate outwardly promptly when released.

STILL.—R. A. WAXLER. Address Eugene Sapp, 1611 12th St., Lawrenceville, Ill. Among the principal objects which the present invention has in view are: to provide for accelerating



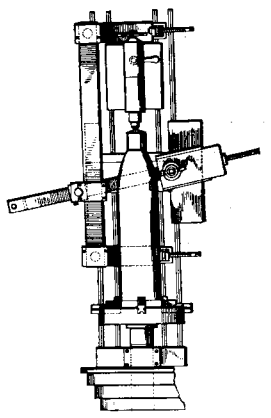
STILL FOR REDUCTION OF OILS

the vaporization of heavy oil that the lighter ingredients thereof may be separated therefrom; to provide means for preventing the injurious accumulation of mineral or base products; and to provide simple and efficient mechanical means for accomplishing the objects stated.

CAGE FOR BALL BEARINGS.—F. STARIN, 302 N. Main St., Springfield, Mass. In this case use is made of a cage ring and spaced retaining lugs extending integrally from the inner edge of one face of the said ring in an outward oblique direction relatively to the plane of the ring, each lug terminating at its outer end in an inwardly extending flange approximately parallel with the plane of the ring, the opposite edges of adjacent lugs being concave for receiving and retaining a ball between them and allowing for free rotation thereof.

TOBACCO FEEDING MACHINE.—J. G. ZOHUMINSKY, 307 E. 70th St., New York, N. Y. In the present patent the invention has reference to devices for use in shredding, macerating or comminuting the leaves of tobacco or the like preparatory to the manufacture of cigarettes or of smoking tobacco.

LATHE ATTACHMENT.—C. C. VERONEE, Box 174, Summerville, S. C. The inventor provides an attachment which may be applied to a lathe of the ordinary construction, by means of which accurate tapers may be turned, or by means of which curved surfaces, such as ends of shells, may be turned accurately. He provides a device in which means is provided

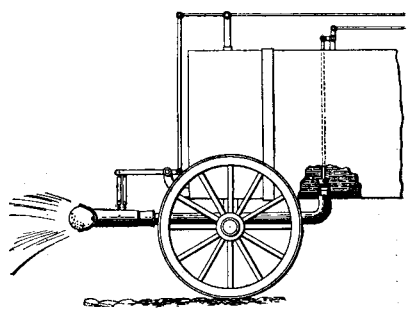


LATHE ATTACHMENT

for adjusting the device so that curves of different radii may be cut, as well as tapers of different angles.

Pertaining to Vehicles

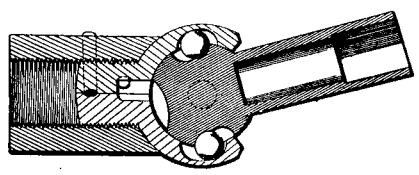
SPRINKLING HEAD.—E. PASSMANN, Box 514, Bay Saint Louis, Miss. This invention provides a type of sprinkling head having controlling means associated therewith, said head being adapted for application to sprinkling



SPRINKLING HEAD

carts and the like, or to garden hose. It provides a device having controlling means whereby a greater or smaller flow of liquid may be obtained, the nozzle proper being divided into a plurality of compartments which may be independently controlled.

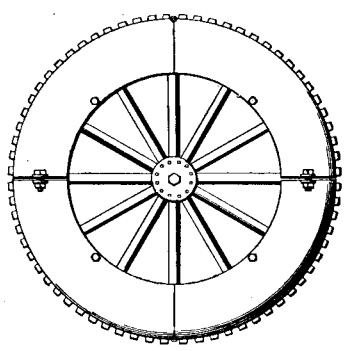
UNIVERSAL JOINT.—JAMES W. CAMPBELL, Detroit, Mich. The most important features of this invention are: The four anchors receive each an equal share of resistance from the drive to the driven member, while the universal mode as adopted in the old style is a



UNIVERSAL JOINT.

transmission of power from two points of resistance to a communicating member placed between the drive and driven, the driven also being provided with two anchors or points of resistance, therefore giving the device the advantage of double the efficiency of the much used "Cross Head" type. By internal lubrication the inventor overcomes the necessity of a grease case, which is so necessary in auto service for lubrication of the joint during high speed service and which is almost as costly as the joint itself.

TIRE PROTECTOR.—C. JORDAN, 168 Homewood Ave., Pittsburgh, Pa. This device is for use in connection with rubber tires for preventing injury and wear of the tires without impairing the resiliency thereof, wherein a sectional casing is provided substantially U-shaped in cross section for engaging over the



AUTOMOBILE SIGNAL

tire and having means for permitting the casing to be secured in place on the wheel, and wherein the casing is provided with openings on its peripheral surface for receiving tread blocks for engaging the roadway, the openings and the blocks being shaped to limit the outward movement of the blocks.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

© 1916 SCIENTIFIC AMERICAN, INC

Tested

Third and fourth generations of those who originally intrusted their property to the

Union Trust Company of New York

are continuing to place their faith in this Company.

This clearly indicates the complete satisfaction obtained by our clients for more than a half century. Our officers will be glad to confer with you, by interview or letter, in regards to any form of personal trusts and banking.

Union Trust Company of New York

80 Broadway, New York

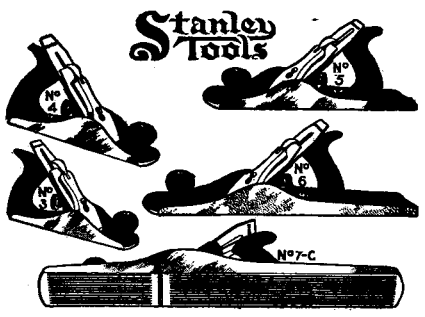
Branch 786 Fifth Avenue — *Capital and Surplus $8,500,000* — Branch 425 Fifth Avenue

Why The Federal Trade Commission is one of the most powerful agencies ever created by Congress is explained by Edward Mott Woolley in a feature article, illustrated with F. G. Cooper cartoons, in the November 18th issue of

Collier's

THE NATIONAL WEEKLY

416 West 13th Street, New York



Bailey Iron Planes

"Bailey" Iron Planes have been in use for nearly fifty years, and are the recognized standard for Planes of this type.

While retaining all the original features, many valuable improvements in construction have been added from time to time. Only the finest materials and the best workmanship are used in their manufacture.

Always insist that your order be filled with Planes made by THE STANLEY RULE & LEVEL CO., which carry with them a GUARANTEE backed by a Company that has been manufacturing Carpenters' and Mechanics' tools for over half a century.

For Sale by all Hardware Dealers.

STANLEY RULE & LEVEL CO.
NEW BRITAIN, CONN. U.S.A.

Valuable Books of Instruction and Reference

Scientific American Cyclopedia of Formulas—Concrete Pottery and Garden Furniture—Scientific American Reference Book—Experimental Science—Handy Man's Workshop and Laboratory

MUNN & CO., Inc., *Publishers*, Woolworth Bldg., New York

How the World's Largest Silent-Chain Drive Solved a Power-Plant Problem

(*Concluded from page* 435)

position as originally planned, in order to obtain a sufficient head of water over them in order not to draw air. The lowering of the wheels brought the waterwheel shaft very close to the floor of the power house, but by the use of a chain drive the sprocket wheels were reduced to so small a size that they did not cut into the engine-room floor to any depth. Previously to this time no silent-chain drive had been made for more than 1,250 horse power, and it was with some misgivings that plans were made involving the transmission of 5,000 horse-power.

The hydraulic tunnel is 26 feet wide, 26 feet high, and 1,300 feet long. When the plant is in operation, the velocity of the water through the tunnel is about seven feet per second, with a loss of head of about one foot. A temporary tailrace of timber and steel has been built to carry the water from the lower end of the tunnel to the concrete-steel penstocks in which are located the waterwheels. The wheels consist of four 48-inch wheels on a single shaft, there being two such sets.

The power house is built of monolithic concrete construction up to the roof. The entrance is through the roof. This construction was necessary, as at times of high water the power house may be submerged to a depth of eight feet above the operating floor. One peculiarity of this plant, however, is the fact that during periods of high water the level of the headrace rises about as much as the level of the tailrace, so that an approximately uniform head of water can be obtained at the wheels at all times.

The plant has now been in operation since September, 1914, and the only shutdown that has occurred has been due to ice trouble. The chains have given satisfaction. The operation of the chains is almost noiseless, and the sound made by the revolving armature of the generator is much more noticeable than the sound of the chain. In the drive there are eight chains, each 21 inches in width with a two-inch pitch. The driving sprockets have 71 teeth, and the driven sprockets 47 teeth. The distance from center to center of the shafts is 129 inches The linear speed of the chain is 1,765 feet per minute. The main shafts are 15 inches and the main bearings are 15 by 30 inches. Each sprocket is supported with a ring-oiling main bearing close to the sprocket at each end. From the first day on which the plant was started, chain and operating mechanism have run without difficulty of any kind.

Building a Front Door on the Philippines

(*Concluded from page* 431)

in the islands. American capital has hesitated to open its purse there because of the uncertain, undetermined attitude of the government toward the future political status of the possessions. The English controlled certain channels of trade before we went there and they continue to do so to-day, not because they understand the situation better than anyone else, but rather because they have found it an easy matter to succeed where Americans are handicapped.

But an agitation is on in Manila for the Philippine government to buy the roads owned and operated by the English, and government agents are now in this country, so it is claimed, trying to arrange with the federal government and other parties, for the acquisition of the property. Railroads are extremely popular with the Filipinos and no doubt they would be glad to burden themselves with bushels of bonds to own *all* the roads there. A Filipino will spend his last *centavo* for a ride on the cars, and will ape the American backwoodsman of other days by walking ten miles to ride one.

Despite the facts that politics are responsible to a large degree in holding back Philippine industrial development, more progress has been made in a couple of decades than the former rulers made in centuries. But this is not saying nearly as much as might be said under more favorable circumstances. For instance, Japan has accomplished more in the transformation of Korea, from an industrial standpoint, in a single decade than we have in two decades in the Philippines. We know the cause, but not the answer.

Flexible Magnetic Coupling Built Like An Accordion

(*Concluded from page* 442)

of the thickness. Three ⅛ inch disks will transmit the same torque as one ⅜ inch disk, but the three thin disks will deflect nine times as easily as one thick disk. Practice has demonstrated the correctness of this theory; and in the case of a 32-inch coupling recently built the force necessary to cause a deflection of a large part of an inch was much less than the end sliding friction in the bearings.

In aiming to secure extensibility, it is reported that flexibility has been secured to a much greater extent than in any of the usual flexible couplings. The flexibility, like the extensibility, is unaffected by the amount of torque transmitted.

While the new form of coupling has so far had its test solely in connection with rubber calendar work, wherein it has met with instant approval, it is not limited to this field of application. It is applicable to any form of drive where a truly extensible coupling is desirable.

Bringing Motion Pictures Into the Home

(*Concluded from page* 434)

this manner it is possible to run through the machine, without intermission, a number of plates equivalent to several hundred feet of motion picture film.

Still another form of Bettini apparatus is a projector which, instead of a square glass plate, utilizes circular sheets of flexible, non-inflammable material. The images in this instance are arranged in a spiral, and as a consequence the projection mechanism is greatly simplified. In fact, this particular model is intended for the use of children, and is considerably less expensive than the glass plate type. On the other hand it possesses the advantage of permitting its plates to be sent by mail, rolled up if necessary, without danger of breakage.

In all the Bettini projectors it is possible for the amateur-operator to stop at any desired image for any length of time, in order to study some striking photograph, without incurring the slightest danger of fire. This important feature is not possible with the usual projector which employs inflammable film. Still another feature is the running of the subjects backwards, affording no end of variety and amusing results. This is accomplished by merely shifting the glass plate upwards or downwards one row, which reverses the order of projection.

The vast and continually increasing variety of records available for phonographs has undoubtedly counted heavily in their popularization. So with the home cinematograph, its popularity is sure to depend upon a large and varied selection of subjects available, with other subjects continually being added. To this end Mr. Bettini has devised printing machines for making circular and square plates from standard motion picture subjects, so that in time the home projectors will have the world's best film subjects to select from, aside from those made by the members of the family with a Bettini camera.

NEW BOOKS, ETC.

THE MARVELS OF AVIATION. By Charles C. Turner, Lieutenant R. N. V. R. Philadelphia: J. B. Lippincott Company, 1917. 8vo.; 253 pp.; illustrated. Price, $1.25 net.

Lieut. Turner's latest work on aviation is addressed particularly to young people, and his own adventurous experiences, both with aeroplanes and balloons, put us in close touch with thrilling sensations; with him, we lose our-

LEGAL NOTICES

OVER 70 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

INVENTORS are invited to communicate with **Munn & Co., 233 Broadway, New York,** or **625 F Street, Washington, D.C.,** in regard to securing valid patent protection for their **Inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over seventy years ago.

All patents secured through us are described without cost to patentee in the **Scientific American.**

MUNN & CO.
233 Broadway Woolworth Building **New York**
Branch Office: 625 F Street, Washington, D. C.

Annual Subscription Rates for the Scientific American Publications

Subscription one year..... $4.00

Postage prepaid in United States and possessions, Mexico, Cuba and Panama.

Subscriptions for Foreign Countries, one year, postage prepaid..... $5.50

Subscriptions for Canada, postage prepaid 4.75

The Scientific American Publications

Scientific American (established 1845)..... $4.00

Scientific American Supplement (established 1876)..... $5.00

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

FACTORY WANTED

WANTED — ESTABLISHED stamped plated metal goods factory to make and sell patented article to pay 33⅓% net profit, revolutionizing present market. Address "Metal Novelty," Box 773, N. Y. P. O.

FOR SALE

SMALL MISSOURI FARM, $10 cash and $5 monthly, no interest or taxes; highly productive land; close to three big markets; write for photographs and full information. Munger, C-162, N. Y. Life Bldg., Kansas City, Mo.

INVENTIONS DEVELOPED

INVENTIONS DEVELOPED—The specialists who develop auto accessories, gasoline, vapor and steam engines, electrical appliances, automatic cigarette making machines, repeating rifles, weighing, vending and other intricate devices are at your service. They will handle your development, drawings and experimental work. Make any metal novelty. Advice backed by 30 years experience. Send drawings or sample. The Wm. Gent Machine Co., Box 172A, Cleveland, Ohio.

POSITION WANTED

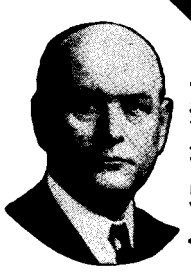
YOUNG MAN, MARRIED, accustomed to deal with foreigners, seeks position in some foreign country as demonstrator of American machines for machine shops. Address Position, Box 773, New York City.

HANDY MAN'S WORKSHOP AND LABORATORY

Compiled and edited by A. Russell Bond. 6x8 1-4 inches. Cloth. 467 pages. 370 illustrations. $2.00.

A compilation of hundreds of valuable suggestions and ingenious ideas for the mechanic and those mechanically inclined. The suggestions are practical and the solutions to which they refer are of frequent occurrence. It may be regarded as the best collection of ideas of resourceful men published.

Munn & Co., *Inc.* **Woolworth Bldg., New York**



DEAF?

Let Me Show You That You Can Hear!

Don't say that it cannot be done—. Had Mr. Bell said that, there would have been no telephones. I have shown over 265,000 deaf persons that they can hear distinctly and have thousands of grateful letters from them, mainly because I said to them what I now say to you—"My company does not want a cent from you until you *know* that the Acousticon will make you hear." Just send a line and say "I will try the Acousticon." We will immediately send you, charges paid, the

1917 Acousticon for No Deposit FREE TRIAL No Expense

After you have given it any test that you choose, it is entirely for you to say whether you will keep or return it—at least you will know whether you are among the hundreds of thousands of fortunate ones to whom it does restore normal hearing. And it will have cost you nothing to try—not a cent.

WARNING! There is no good reason why everyone should not make as liberal a trial offer as we do, so do not send any money for any instrument for the deaf until you have tried it!

The ACOUSTICON has improvements and patented features which cannot be duplicated. So no matter what you have tried in the past, send for free trial of the ACOUSTICON today and convince yourself—you alone to decide. Address me personally if you prefer. K. M. TURNER, Pres.,

GENERAL ACOUSTIC CO. 1308 Candler Bldg., New York

© 1916 SCIENTIFIC AMERICAN, INC

The people we meet are mostly neutral, as if a kind Providence had fixed it so that they could fade into the background.

And then along comes someone who flashes on your mind's eye and shocks you into the realization that this is a living person—an individual—no mere cog in the wheel of existence.

When such a man enters the office, be it ever so quietly, everybody knows he has come in. When he speaks, people listen, without eye-wandering, until he has finished.

PERSONALITY.

Is such a thing true of a cigarette?

Smoke one Rameses, and see. They call it "The Aristocrat of Cigarettes."

You know the saying?

"Nobody ever changes from Rameses."

Discard Toothed Gears

In all machinery where quick starts and sudden stops are essential, fibre friction transmissions are displacing toothed gears. They show higher efficiency, avoid liability of breakage from sudden shocks; practically noiseless. Cost is less, repairs cheaper and less frequent.

We make any size and type of friction to fit your requirements. If you have a transmission problem, investigate the use and design of friction drives. Our book "Friction Transmission" contains data and formulae which will prove valuable to you. Sent free on request by mention of occupation and firm connection.

THE ROCKWOOD MFG. CO.
1904 English Ave., Indianapolis, Ind., U.S.A.

Sh! Go Easy!

Equip your rifle with a Maxim Silencer. It doubles your chance of a big "bag" because it completely swallows the "bang" so that you

Shoot in Silence

—which often gives you a chance to shoot again. No recoil (no more sore shoulders) and a better aim. The

Maxim Silencer

fits any rifle. Ask your dealer for it and, at the same time, write us for free book of Maxim Silencer experiences.

THE MAXIM SILENCER CO.
94 Homestead Ave. Hartford, Conn.

Rives **AUTO-PEDAL NEVERSLIP** Pads

FITS ANY CAR

Made of Live Rubber
Complete on ANY CAR in a Minute
Dealers: WRITE FOR TERMS
Full Set $1
Geo. H. Rives Mfg. Co., Inc.
Dept. B. 2187 Woolworth Bldg., New York

selves above the clouds, to come whistling down from an altitude of eight thousand feet until, with much crashing and splintering of trees, we land in the midst of a pine forest. But narrations of this kind form only a small part of the book. In other parts, the reader learns just what the rear gondola of a Zeppelin in action looks like; he sees the powerful Maibach motors in the center of the car. the lookout to port, and the gunner ready with his machine gun to repel an aeroplane attack. In short, the beginnings, growth and achievement of all kinds of aircraft are set forth in picture and story; it is a volume to stir while it instructs, and a work that any boy should be glad to own.

THE MOTHERCRAFT MANUAL. By Mary L. Read, B.S. Boston: Little, Brown, and Company, 1916. 12mo.; 440 pp.; illustrated. Price, $1.25 net.

HYGIENE OF INFANCY. By J. H. Kellogg, M.D., LL.D. Battle Creek, Michigan: Good Health Publishing Co., 1916. 12mo.; 198 pp.; illustrated. Price, $1.25 net.

Even now but a pitiful minority of women have come to realize that efficient motherhood is not a natural endowment, but is the result of careful study and preparation. "The Mothercraft Manual" is the direct outcome of the work of the School of Mothercraft in New York City, and admirably sets forth the more significant principles and methods; it strikes the happy mean between extreme theories. It furthers not only the mere physical well-being of the infant, but also the mental progress of the child, with practical hints for the study of individual characteristics, a curriculum for babyhood, play interests, with a consideration of games and toys, handwork, and music and art. There are also suggestions for home nursing and first aid in the nursery, and a very extensive bibliography. Dr. Kellogg's "Hygiene of Infancy" confines itself to practical instruction in the care of babies, and is intended as a guide for young mothers, particularly as to the food requirements of the nursing mother and the infant, and the more common disorders which are prevalent in the first few years of the child's life. It is plainly and sensibly written, and the general application of its teaching would mean an immediate reduction in infant mortality, with a resultant physical improvement in the race.

THE SUBMARINE TORPEDO BOAT. Its Characteristics and Modern Development. By Allen Hoar. New York: D. Van Nostrand Company, 1916. 8vo.; 211 pp.; illustrated. Price, $2 net.

Mr. Hoar's work, while so written as to be understood and appreciated by the general reader, is not a mere popular and superficial description, but offers to technical men a source of reliable information regarding the inherent characteristics, design, construction and operation of the fighting submarine, with its present limitations and a conservative forecast of its future. The various means of defense against submarine attack are made the subject of a separate chapter, as are the tactical evolutions of the underwater craft. The illustrations are both plentiful and good, and three folding plates of Laurenti, German, and Electric Boat types of submarine exhibit plans and profiles, and give an intelligible idea of the prevalent practice in arrangement and distribution of the motive power, control, torpedo compartments, and living quarters; another folding plate shows stability curves for surface and submerged conditions.

HOMANS' FIRST PRINCIPLES OF ELECTRICITY. By J. E. Homans. New York: Sully and Kleinteich, 1916. 12mo.; 256 pp.; illustrated. Price, $1 net.

The man already versed in the subject of electricity, as well as the beginner, should find this well-arranged statement of principles very useful. It begins at the beginning, passes in review all the common electrical constructions and operations, and leaves the reader with a good fundamental knowledge of this very practical science. Particular care is taken to make plain all the little points that are usually left in obscurity, and there is an appendix of useful formulae and tables. Explanations are simply phrased, vital words are italicized, and the many diagrams constitute graphic descriptions that materially aid the reader toward a perfect understanding.

THE EMISSION OF ELECTRICITY FROM HOT BODIES. By O. W. Richardson, F.R.S. New York: Longmans, Green and Co., 1916. 8vo.; 304 pp.; with diagrams. Price, $2.75 net.

It is a well-known fact that electrical charges escape from the surface of bodies at high temperatures, whether the body has an atmosphere or is in a vacuum. Until the theory of ions was set forth, there was little to guide experimental investigation, but of late years much progress has been made. The knowledge acquired is indicated throughout the pages of Prof. Richardson's interesting monograph, and includes the author's own recent experiments on the electrons liberated by chemical action.

SOUTH AMERICA. Brief Outline of Study Suggestions with Bibliography. By Harry Erwin Bard, A.M., Ph.D. New York: D. C. Heath & Company, 1916. 8vo.; 68 pp.

The Secretary of the Pan-American Society of the United States offers in this handy little volume a syllabus and a bibliog-

RICHNESS THAT SHADES INTO MILDNESS

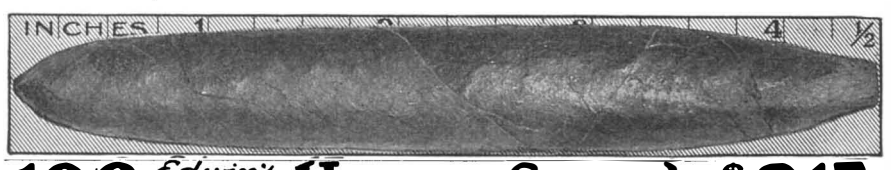
Accomplished pipe-smokers, when they first taste Harmony Pipe Blend, are a little surprised. Not at its rich, full flavor. Several other high-grade tobaccos give that.

But what they never have found in smoking tobacco, yet have always hoped for, is full-bodied richness that is delicately mild. Harmony gives just that flavor—it might be called "rich-mildness"—without even a trace of harshness or discord.

Liggett & Myers Tobacco Co.

HARMONY
A PIPE BLEND

If your dealer cannot supply you, enclose 15 cents in stamps, for this full-sized one-eighth pound tin, postage prepaid. Liggett & Myers Tobacco Co., 212 Fifth Ave., New York.



100 Edwin's GENUINE Havana Seconds $2.15
From Factory Direct To YOU By Ex. or Parcel Post Prepaid

Made of Imported Havana Picadura, from our own plantations in Cuba—leaves that are too short to roll into our 15c cigars. They're not pretty, no bands or decorations, but you don't smoke looks. Customers call them "Diamonds in the Rough." All 4½ inches long. Only 100 at this "Get Acquainted" price. Money refunded if you don't receive at least double value. When ordering specify mild, medium or strong. Your check accepted. Our references, Dun or Bradstreet's or any Bank.

To each purchaser of 100 Edwin's Genuine Havana Seconds, we will extend the privilege of ordering, for 60c additional, one of Edwin's "SAMPLE CASES" containing one sample cigar each of our 12 Best Sellers—all Bargain Values—priced up to $12.00 per 100. Include this in your order—it's the biggest sample value ever offered.

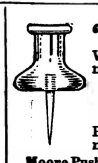
Largest Mail Order Cigar House In The World
EDWIN CIGAR CO. Dept. No. 20 "Get Acquainted" **2338-2342 THIRD AVE., NEW YORK**
When in New York SAVE MONEY by Patronizing any of the 100 EDWIN Retail Stores

LEARN TO BE A WATCHMAKER
Bradley Polytechnic Institute—Horological Department

Formerly Parsons Horological Institute

Peoria, Illinois
Largest and Best Watch School in America
(This entire building used exclusively for this work)

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.



"SYSTEM SIMPLIFIED"—FREE
We will mail to any professional or business man our new System Booklet, Key Charts, and free samples of

Moore Push-Pins

Push-less Hangers, and Maptacks, so absolutely necessary in the up-to-date office or home.

Moore Push-Pins, Glass Heads, Steel Points. } **10c** pkts.
Moore Push-less Hangers, 4 sizes. } Everywhere, or by mail.
The Hanger with the Twist, for heavy pictures.

MOORE PUSH-PIN CO., Dept. 37, Philadelphia

The Fourth Dimension Simply Explained

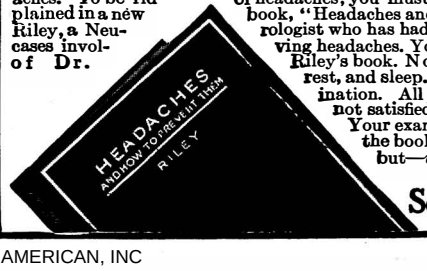
A collection of essays selected from those submitted in the Scientific American's Prize Competition. With an introduction and editorial notes by Henry P. Manning, Ph.D. 5¾x8¼ inches. Cloth. 251 pages. Illustrated. $1.50.

This work presents twenty essays from as many points of view, all of them interesting and no two quite alike. The reading of one essay does not involve the reading of the entire work, yet the entire book gives a comprehensive view of what the layman wishes to know about this subject.

MUNN & CO., Inc., Publishers **Woolworth Building, New York City**

"Headaches—How Prevented"

What is more exhausting than headache? Yet—a headache is *"only a symptom."* It is in the conditions back of headaches—the conditions by which headaches are caused—that the real danger lies. High blood pressure, auto-intoxication, eye-strain and worse disorders cause headaches. To be rid of headaches, you must get at their cause. How to do this is explained in a new book, "Headaches and How to Prevent Them"—by Dr. W. H. Riley, a Neurologist who has had years of experience in treating all kinds of cases involving headaches. You may get relief by following the teachings of Dr. Riley's book. No drugs. Only natural means—diet, exercise, rest, and sleep. We send this book for your FREE examination. All you do is ask for it. (See coupon.) If not satisfied with the book, return it at our expense. Your examination costs you not a penny. If you keep the book, you remit only $1.25. Not a large book, but—*worth its weight in gold to the headache sufferer.*



Send No Money—Use the Coupon

GOOD HEALTH PUBLISHING CO.
3011 Washington St., Battle Creek, Mich.
Send me "The Headache Book." I will return it in five days or send you $1.25.
(Write your name and address in the margin.)

© 1916 SCIENTIFIC AMERICAN, INC

This 1917 Magazine Catalog FREE!

WRITE FOR IT!

J. M. Hanson-Bennett Magazine Agency

—the largest in the world—furnishes all Magazines and Newspapers at **Lowest Possible Club Prices**, and gives the quickest, most accurate, and most reliable service.

Save Magazine Money!

Our 1917 Catalog (44 pages) lists more than **3000 Periodicals** and **Club Offers.** It's a **Big Money Saver** and is **Free** to you for the asking. The name **J. M. Hanson-Bennett** is the accepted stamp of reliability and promptness in the magazine field.

Local Agents Wanted

Send Us YOUR Name and Address **TODAY!**

ADDRESS

J. M. HANSON-BENNETT MAGAZINE AGENCY

Brooks Building CHICAGO, ILL.

Do You Want a Salary Boost?

Then write to us and learn what we've got to tell you. Learn what astonishing things have been done for 15,000 men and women by Harrington Emerson's great, new Course in Personal Efficiency. A course which opens the way to a successful future and greater power. One man says this course produced for him an increased business of $36,000 in one year. Another declares it to be worth $25,000 to him. Salary boosts of 50 per cent with more to come are common. Men declare that they are twice as efficient as they were.

Learn Personal Efficiency

You can get it right at home. During your spare hours you can learn those things which have done so much for others. "It's worth 100 times what it costs," writes one enthusiastic student. "Increased my capacity 200 per cent" says another. And still another: "I made $2,700 out of my small investment."

Write Today A postal or a letter brings the free book, "Where Is the Money Coming From?" No matter what you are doing now or what you are earning now—even if you are a $10,000 a year man or working for $10 per week—you need this book. Get it and read it. Don't pass up this opportunity. Write at once.

The Review of Reviews Company

30 Irving Place Dept. 2428 New York, N. Y.

Catalogue of Scientific and Technical Books

WE have recently issued a new catalog of scientific books, which contains the titles and descriptions of 3600 of the latest and best books published, covering the various branches of the arts, sciences and industries.

Our "Book Department" can supply these books, or any other scientific or technical books published, and forward them by mail or express prepaid to any address in the world on receipt of the regular advertised price.

Send us your name and address and copy of this catalogue will be mailed to you free of charge.

MUNN & CO., Inc., Publishers

Scientific American Office

Woolworth Building New York, N. Y.

raphy that will be most helpful to the student of South America, and particularly to any who contemplates visiting these attractive and promising lands. Without well-directed preparation, we lose much of the possible benefits of foreign travel, and the suggestions of the syllabus give us a solid foundation on which to build up the knowledge that will enable us to get the most and the best out of our journey. As Dr. Bard says, comprehensive Pan-Americanism is a new conception with most of us, and it is only by the earnest and systematic study to which his outline is a guide that we may really come into friendly intimacy with our alert southern neighbors; even political and commercial interests are dependent upon that intimacy and understanding.

Strategic Moves of the War, November 1st, 1916

(*Continued from page* 436)

territory now occupied by Mackensen's army belonged to Bulgaria. It has no great economic value, but as a strategic territory on which to assemble a Russo-Rumanian army and from which to launch a powerful attack against Bulgaria, with every hope of success, it was priceless. This may be the explanation of Mackensen's present activities.

However, all is not yet lost. The situation is bad, but far from desperate; and at last accounts we hear that the Rumanian defense is stiffening and the Teutonic offensive is weakening. Rumania may yet escape from the lion's jaws. I doubt very much if the said lion's jaws have sufficient crushing power at the present time to complete the destruction of Rumania before the Allies can come to her aid.

There never has been a time in this war when it was safe to make predictions. The unexpected seems to have a way of happening in spite of all efforts on the part of the wise ones to shape the course of events. Therefore I will refrain; but it would not surprise me to see the Rumanian army holding its own on all fronts and being able, in a comparatively short time, to again assume the offensive, not in a headlong rush as in the invasion of Transylvania, but in a slow and systematic way, the direct result of the chastening effect of former defeats, and with a determination to hold what is regained. In a few weeks they should win back their mountain passes, hold them and keep Falkenhayn out of their country. No invasion of Transylvania should be undertaken at this time. There is more important work to be done to the southward.

We may yet see Mackensen's drive checked before he advances much farther north. The country over which he has been advancing is comparatively level but the northern end of the Dobrudja is rough and hilly and well adapted to defensive warfare. The Rumanian army will probably be reorganized and placed under the command of either a French or Russian General. The air service will be placed on an efficient basis and in a few weeks the march to the south may begin. About this time something should happen in Macedonia, to the north of Saloniki, and, the funeral of Rumania may have to be postponed indefinitely.

We often hear the questions, "Why don't the Allies do something in Macedonia?" "Why do they stay so close to Saloniki?" The answer is simple. The Allies remain close to their base of supplies because they cannot trust the "benevolent neutrality" of the Greeks. The political condition which causes this distrust offers further evidence of Teutonic foresight, organization, and fixity of purpose now reaping their fruits. With the Allies, it is not so much a question of strategy as one of ethics. It has been suggested that had the conditions been reversed in every respect, the Greek Government would have been brought to terms many months ago and the army at Saloniki enabled to move northward in complete security. That is quite possible. There is no doubt that the Allies can move against the enemy in the north just as soon as they feel assured that they are not leaving an enemy to the south and west of their lines of communication and their base of supplies.

For the same reasons there is very little to report from the Macedonian front. A few of the Allied troops appear to be busy on the Struma and in the direction of Monastir but there seems to be no intention to attack or push forward on a large scale.

Nothing of importance appears to have taken place on the Somme front during the past few days. Both sides report artillery duels. Berlin reports slight success at La Maisonnette. Paris admits this in part, but reports all other German attacks repulsed. It is evident that both sides are either consolidating their recent gains or providing protection for defenses left exposed through the loss of advanced lines of trenches. No great activity may be expected on this front in the near future unless . . . the unexpected happens.

The unexpected again happened in a rather spectacular manner, a few days ago, to the northeast of Verdun. The flood found a crevice in the dike opposing it and in three or four days' hard fighting, with a report of comparatively small losses, the French troops recaptured territory previously surrendered to the Germans after a stubborn defense lasting over three months, during which terrific losses were inflicted on the assailants.

The war may be decided in the east, but it will be well to keep one eye on the western front.

Measuring the Human Voice

THE ordinary sewing room tapeline promises to bring about a small revolution in the musical world as the result of the discoveries made by a Minneapolis musician, who believes he has found an infallible means of determining the true qualities and possibilities of the human voice. By measuring the resonating cavities of the singer or would be singer, he has been able to answer with precision many of the questions which perplex the singer.

Four years have been spent in working out the theory that the human voice can be measured and properly catalogued as to its possibilities for future service. In that length of time the voices of 12,000 singers have been measured, many of them members of the prominent grand opera companies of New York City and Chicago. Exterior measurements of the resonating cavities of the head will give a true index of the kind and quality of the voice possessed by the subject, it is claimed. By this means it can be determined whether the voice has been developed or trained to its proper range, and whether years of study and work are to be crowned with success or failure.

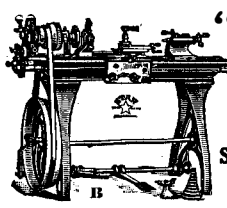
In many of the tests it was found that persons who had no idea of being singers had voices of unusual range and power. Three such discoveries were made among 100 persons tested in Minneapolis. The lung capacity of the individual has little to do with the power and range of the voice, as one frequently hears a deep bass voice from an undersized man, while a large man will be the possessor of a high tenor voice.

The deceptive qualities of the human voice are being gaged so accurately by the use of the tapeline that it is possible to tell whether the individual has a tenor, contralto, basso, or baritone voice without hearing the sound of the voice. If a person has been overtrained, the tapeline will make the secret known long before it is apparent in the singer's voice. Many good voices have been ruined by lack of ability to judge their proper qualities and train them in the proper manner.

Many weeks have been devoted to research work in the skull room of the Museum of Natural History in New York city, the investigations being later extended to thousands of New Yorkers. The voices of 1,000 boys and 300 girls in the public schools were measured by the tapeline, with results equally as accurate. These experiments furnished proof that 57 per cent of the women of America have soprano voices, and 43 per cent contralto voices. Among the men, baritone voices are more common, only 43 per cent have tenor voices.

ADVERTISING CLASSIFIED

LATHES AND SMALL TOOLS



"STAR" Foot and Power Screw Cutting Automatic Cross Feed **LATHES**

For Fine, Accurate Work.

Send for Catalogue B

SENECA FALLS MFG. CO.

695 Water Street

Seneca Falls, N. Y., U. S. A.

Friction Disk Drill

FOR LIGHT WORK

Has These Great Advantages.

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage.

Send for Drill Catalogue

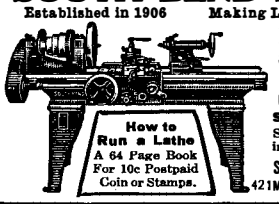
W. F. & Jno. Barnes Company

Established 1872

1999 Ruby Street Rockford, Illinois

SOUTH BEND LATHES

Established in 1906 Making Lathes for 10 years



For the Machine and Repair Shop

LOW IN PRICE

11 in. to 18 in. swing

Straight or Gap Beds.

Send for free catalog giving prices on entire line.

SOUTH BEND LATHE WORKS

421 Madison St., South Bend, Ind

GROBET SWISS FILES

Are the standard of excellence in files, and have been for over 100 years. We send postpaid as an introducer 48 files especially adapted for tool makers and machinists on receipt of $5.00 This is a chance to get a set of files you'll aporeciate and we'll get future orders.

MONTGOMERY & CO.

109 Fulton Street New York City

PHONES: MURRAY HILL, 7720 and 8882

Makers of Riverside Drive Park Models

MORGAN BROS. CO., Inc.

MODEL MAKERS

MINIATURE CONSTRUCTION

Landscape, Architectural and Mechanical Models Topographical Maps and Paintings for Schools, Colleges and Museums. Government Work a Specialty.

Office, 1650 Grand Central Terminal, New York City

YALE TRIPLEX BLOCK

Standard in Construction, Service and Safety. Steel Chain, Steel Parts and Steel Load line give safety and reserve capacity.

The Yale hoist book will help solve your problems

THE YALE & TOWNE MFG. CO.

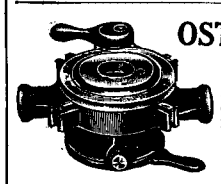
9 E. 40th Street New York

WELL DRILLING PAYS WELL

Own a machine of your own. Cash or easy terms. Many styles and sizes for all purposes

Write for Circular.

WILLIAMS BROS., 434 W. State St., Ithaca, N.Y.



OSTER DIE-STOCKS

6 sizes in one stock. Bulldog Die-Stock No. 102 threads six sizes of pipe from ¼ to 1¼". One of 11 splendid tools plain and ratchet. Catalog No. 29 free.

THE OSTER MFG. CO.

1967 East 61st St., Cleveland, O.

THE BRIDGEPORT CHAIN CO.

Specialists in Small Wire Shapes & Flat Stampings

Bridgeport, Conn.

INVENTORS SHOP SERVICE

We are specialists in high grade experimental and model work. Fully equipped to manufacture light metal articles. Expert assistance in perfecting inventions. Write or visit us.

Elk Manufacturing Co., Inc., 1926 B'way, N. Y.

MASON'S NEW PAT. WHIP HOIST

for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.

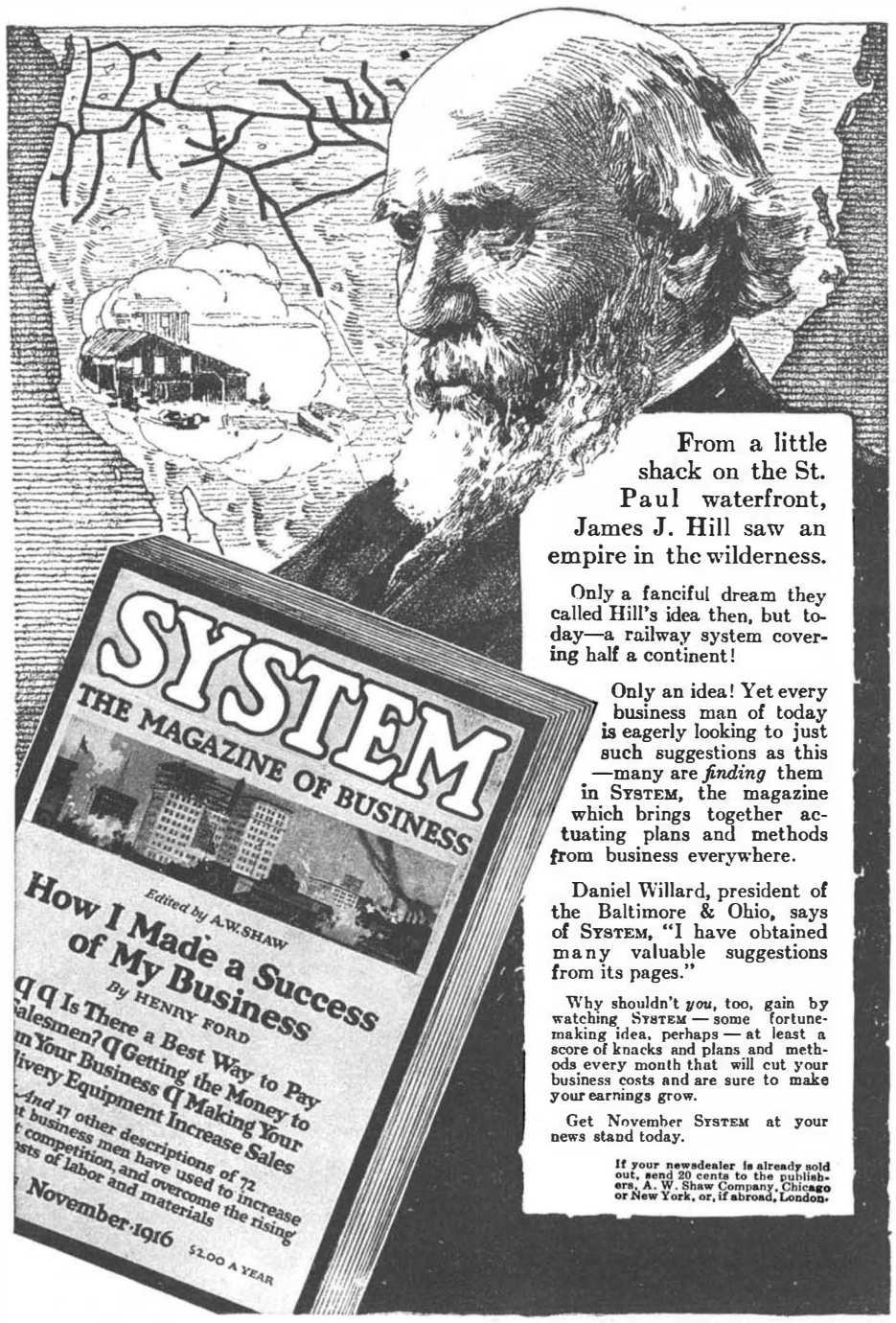
Manufactured by VOLNEY W. MASON & CO., Inc. Providence, R. I., U. S. A.

NOVELTIES & PATENTED ARTICLES

MANUFACTURED BY CONTRACT. PUNCHING DIES. LIGHT AUTOMOBILE STAMPINGS

E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

© 1916 SCIENTIFIC AMERICAN, INC



JUST PUBLISHED

Finger Print Instructor

By FREDERICK KUHNE

Bureau of Criminal Identification, Police Department, City of New York

Based upon the Sir E. R. Henry System of Classifying and Filing

A Text Book for the Guidance of Finger Print Experts and an Instructor for Persons Interested in the Study of Finger Prints

THIS volume has been prepared by an expert on finger prints, in response to the demand for an elementary and practical work of instruction for those desiring to take up the study of finger prints; a volume that a person of ordinary intelligence could understand and from which he could readily learn all of the details of the system. In this work, which is based upon the Henry System, the author has explained fully and clearly the method of taking, classifying, comparing and filing finger prints.

The finger print system is without doubt the best present-day means of making immediate and positive identifications and is daily coming into more general use. There is no department or business in which it is necessary to make identifications, that could not successfully make use of the finger print system. The simplicity of the system and the small cost at which it can be installed is a strong factor in its favor.

The finger print system of identification is now in use in many of the police departments in this country and abroad. The United States Government has adopted it and requires every private in the United States Army to have his finger prints taken on enlistment.

By furnishing the authorities with the finger prints of a lost child or other person, the identity of such person can be positively determined even though they be found dead and disfigured beyond recogn tion.

The finger print system will no doubt, sooner or later, be adopted by large corporations employing many hands, for identifying their employees; by insurance companies to positively identify the deceased and prevent fraud in the collection of insurance; by banks to prevent forgery and the withdrawal of funds by unauthorized persons; by institutions, firms, departments, etc., in which the identification of individuals is one of the requisites.

Finger prints is a very interesting and fascinating study. Everyone should have some knowledge of its uses and advantages. This can be obtained by a study of this comprehensive and authoritative volume.

6 x 9 inches, Cloth, 155 Pages, Profusely Illustrated, 11 Folding Plates

PRICE $2.00 net

MUNN & COMPANY, Inc., Publishers

Woolworth Building 233 Broadway New York

New, Original, Unique

Brother Cushman's

Post Mark Collection Book for the United States

FOR THE BOY OR GIRL A GIFT WORTH WHILE

This book is intended to encourage the desire for a wider knowledge about the Important and Historical Cities and Towns in the United States in a very unusual way. Every letter that goes through the mail bears some Post Mark and these can easily be collected in many ways. As collected they direct attention to many of the Historical, Patriotic, and Important Places in the United States. Teachers and parents will quickly grasp the educational possibilities of this book, and every one, young and old, who is fond of collecting will appreciate it.

Many spaces for Post Marks, under the various State headings, contain suggestions for the collector. For example—under Massachusetts will be found spaces marked as follows: "Capital of State," "Seat of Harvard University," "Old Whaling Port," "Centre of Witchcraft Agitation," etc. The Post Marks needed for these would be Boston, Cambridge, New Bedford, Salem, etc.

There are spaces in the book for over 2,500 Post Marks, the pages being arranged by States, each page accommodating 28 Post Marks. A number of original Post Marks are given with each book to start the collection. Size of book 8¼ x 10¾ inches, bound in heavy boards.

We will send a copy of this book in combination with a Subscription to The Outlook for Three Dollars and Twenty-five Cents

The Outlook for 1917

With the beginning of the new year The Outlook will be published in a new and more attractive dress, and on February first the yearly subscription price will be increased to Four Dollars instead of Three Dollars, as at present. The necessity for that change in price is due to the recent great advance in the price of paper. The new page will be larger and more beautiful typographically than the present Outlook, with new type throughout, which will be larger and clearer than that now in use. The new form of The Outlook will allow for better illustration, and, as heretofore, The Outlook will be edited in the belief that its readers desire a clear, concise, thoughtful, and interesting interpretation of current life.

Perhaps the general purpose of The Outlook cannot be better defined than in these recent words of Theodore Roosevelt:

"For six years I was steadily at the editorial council board. In all that time I never once heard it even suggested that the conduct of The Outlook should be shaped in any way save as sincere conviction and conscientious regard for the public good demanded it should be shaped Always the discussion was along practical lines. The editors, as practical men, discussed what the course of the magazine should be, but they discussed it always from the standpoint of practical men devoted to the service of lofty ideals."

OUR OFFER We will send The Outlook EVERY WEEK FROM NOW UNTIL JANUARY 1st, 1918, and a copy of the Post Mark Collection Book, carriage prepaid, to any address in the United States upon receipt of **$3.25**

Now is the time to send your order in, as this offer is good only until February 1st, 1917; after that the price of The Outlook and the Post Mark Book together will be $4.25

THE OUTLOOK COMPANY

NEW YORK

To Save Time and Insure Accuracy we suggest that you Fill Out and Mail This Coupon NOW

The Outlook, 391 Fourth Avenue, New York

Send me a copy of the Post Mark Collection Book for the United States and The Outlook every week from now until January 1st, 1918. I enclose $3.25 in full payment.

*Name*_____

*Address*_____

© 1916 SCIENTIFIC AMERICAN, INC

"Save When You Buy and After You Buy"

"GMC Trucks are not the lowest nor the highest price trucks. They are trucks of highest quality sold at prices which are reasonable and consistent with their high value.

"It is no longer necessary to pay in excess of GMC prices—for higher prices are as a rule the result of limited production or abnormal overhead. In no case do they indicate greater truck quality or assure greater truck service.

"GMC Trucks have firmly established that fact. By actual performance they have convincingly shown that from the standpoint of pulling ability—low upkeep and dependability, they are unexcelled.

"On the other hand, it is not advisable to buy low price trucks, for experience has also shown that it pays to invest an amount sufficient to enable the truck manufacturer to build into the trucks those qualities which mean service, long life and reasonable upkeep.

"If you buy a lower price truck than a GMC, buy it understanding that it does not equal GMC in quality. Don't expect GMC pulling power or low operating expense. Don't look for the dependable service or the durability of GMC Trucks. For trucks their equal *cannot* be built and sold at lower prices.

"In buying GMC Trucks you save at the start and later. You get trucks which have demonstrated their worth under every conceivable road and load condition—trucks which, with reasonable care and attention, will render years of satisfactory service, operate at lowest cost per ton mile, and require the minimum of repairs and replacements.

Let the experience of GMC owners, in a business similar to yours, act as your guide—let the records of the performance of GMC trucks in all lines of business give you an accurate idea of what you can expect if you decide on GMC Trucks.
See the nearest GMC dealer or write TRUCK HEADQUARTERS direct.

The GMC line is complete, ¾ ton to 5 ton capacity—worm and chain drive

GENERAL MOTORS TRUCK COMPANY

One of the Units of the General Motors Company

PONTIAC, MICHIGAN

Direct Factory Branches: *New York, Boston, Chicago, Philadelphia, St. Louis*

(121)

© 1916 SCIENTIFIC AMERICAN, INC