

When you finish reading a magazine bearing this notice, place a 1-cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers, sailors or marines. NO WRAPPING. NO ADDRESS.  
A. S. Burleson, Postmaster General.

# SCIENTIFIC AMERICAN

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

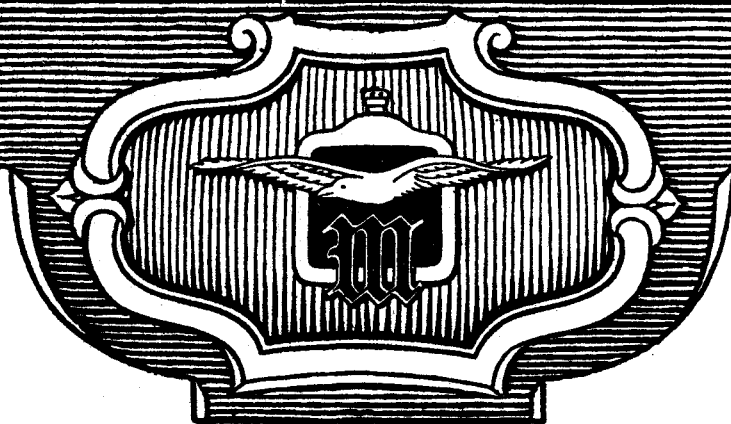


SALVAGED BOILERS ROLLED 21 MILES ALONG THE CALIFORNIA COAST [See page 601]

Vol. CXX. No. 23  
June 7, 1919

Published Weekly by  
**Scientific American Publishing Co.**  
Munn & Co., New York, N. Y.

Price 10 Cents  
\$5.00 a year



*The Annual*  
**Roll Call**  
**of WHITE TRUCK FLEETS**

**A**CCORDING to its annual custom, The White Company is now publishing its Roll Call of fleet installations (ten trucks or more) in national magazines and metropolitan newspapers.

Year after year this Roll Call grows. It is something more than a list of well-known concerns owning ten or more White Trucks. It represents a yearly progress in added trucks per owner—the most extensive growth of individual fleets ever published by a truck maker.

The rate of growth of the installations which comprise ten trucks or more is shown in the following summary for each year:

1910...54	1912...495	1914...1704	1916...5147
1911...194	1913...1001	1915...2601	1917...7436
TODAY...9227			

There are now 2,774 White fleets in active service, totaling 33,139 trucks, exclusive of all single truck installations.

*A copy of the 1919 Roll Call will be sent to anyone interested upon request*

**THE WHITE COMPANY**  
CLEVELAND

**For Automobilists**  
**WILLIAMS' SUPERIOR**  
**Drop-Forged Wrench Sets**



You will always find one of these Wrench Sets most convenient. And if you *should* meet with an accident, miles away from anywhere, when you are in a hurry to reach your destination before dark, think what it would mean to have just the right tools to work with.

Their cost is negligible, but there are times when you would give anything to have them. Why not add a Wrench Set to your equipment and be prepared for emergencies?

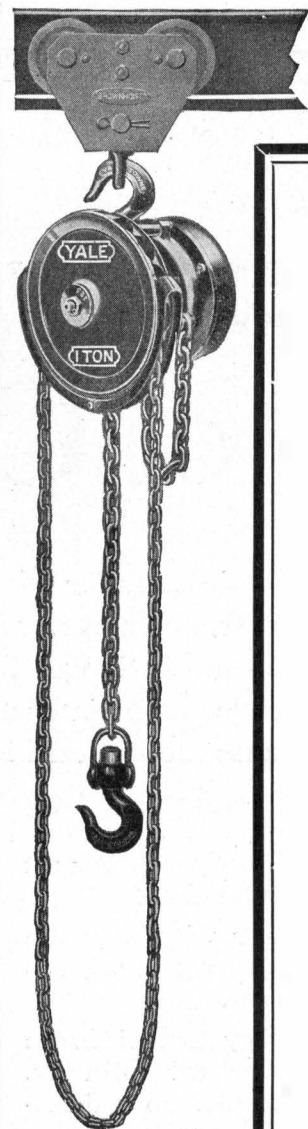
The reputation of Williams' Superior Quality is your guarantee of absolute dependability.

*Write for our booklet of Superior Wrench Sets, showing assortments of styles and sizes for all purposes.*

**J. H. WILLIAMS & CO.**  
**"The Wrench People"**

Western Office and Warehouse:  
 38 S. Clinton Street  
 Chicago, Illinois

General Offices:  
 28 Richards Street  
 Brooklyn, New York



TRADE **YALE** MARK

**The Yale Spur-Geared Chain Block and the 'Brownhoist' Trolley make heavy weights almost float.**

**U**SED on any overhead track and free from obstructions and delays, they hoist and move the heaviest load with safety, speed and little effort.

The sturdy YALE Chain Block—with its special steel suspension parts, mechanical efficiency and great wearing qualities—is the ideal hoisting device for any service. The trolley is the logical load carrier.

They produce *profits* from the start.

**'From-Hook-to-Hook-a-Line-of-Steel'**

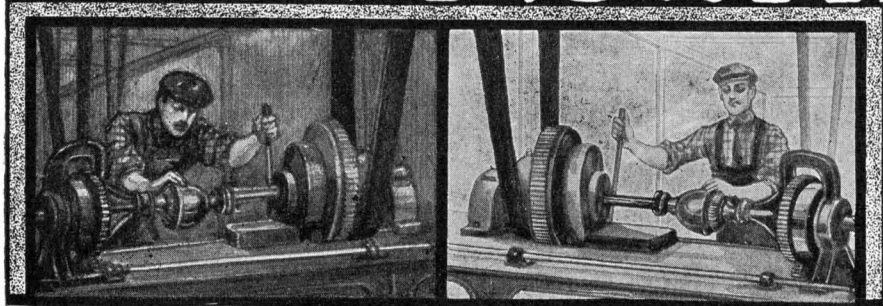
Ask your Machinery Supply House or write for Catalog 18D.

**For a Factory Locking Equipment use a Yale Master-key System.**

*Write for particulars*

**The Yale & Towne Mfg. Co.**  
 9 East 40th Street New York City

# MORE LIGHT!



## Light-Reflecting Factory Walls Pay You Sure Dividends!

More and better light gives every workman a chance to produce more and better work during the shortened working hours.

No need to cut out new windows or to install new expensive lighting systems, for the white, tile-like Cemcoat increases the natural or artificial light, reflecting it into every dark corner.

**Cemcoat**

stays white longer than other paints; it does not crack or peel.

Special formulas for special conditions such as acid fumes, etc.

Cemcoated walls are easily washed and always sanitary, thus promoting health and loyalty among employees.

**LAPIDOLITH**

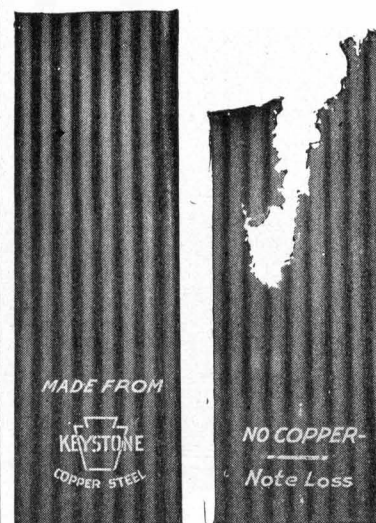
*makes old or new concrete floors dust-free and wear-proof by chemical action. Just flush it on. Used for years everywhere. Send for literature and free sample.*

Cemcoat brushes on as easily as paint, with the high gloss of enamel but is more durable than either because of its leathery elastic body.

Furnished in gloss or flat, white and colors, for either interior or exterior walls. Write for literature and testimonials on Cemcoat and Lapidolith—Sonneborn Standard products.

**L. Sonneborn Sons, Inc.**  
 Dept. 36, 264 Pearl St., New York

# Keystone Copper Steel—



The name is true, not fanciful, and states exactly the nature of the product—high grade *steel* alloyed with *copper*. KEYSTONE quality assures increased durability and rust-resistance for Black and Galvanized Sheets and Roofing Tin Plates. This is important to buyers and users.



**Apollo**

Galvanized Roofing and Siding Products as formed from APOLLO-KEYSTONE Copper Steel Galvanized Sheets give unequalled service. Demand KEYSTONE quality for Roofing, Siding, Cornices, Spouting, Gutters, Tanks, Flumes, Culverts, Silos, and all exposed sheet metal work. This Company manufactures Sheet and Tin Mill Products of every description and for every known purpose. Send for booklet.

AMERICAN SHEET AND TIN PLATE COMPANY, General Offices: Frick Building, Pittsburgh, Pa.

# Cheaper Transportation Instead of Cheaper Cars

Corporations require cars for the use of executives. They can afford to buy to the best advantage. They choose Packards for definite business considerations: longer life and higher second-hand value; ease of handling; lower maintenance cost; reliability; economy and safety; and because the Packard is professional through and through.



HERE are a good many men in a rut as to motoring possibilities.

They don't know what they are missing or what it is costing them to use a compromise car.

They never will know until they get their hands on the steering wheel of a Packard Twin Six, feel its sensitive response, its pick-up and get-away, its pep and go, its ease of control, its absolute smoothness and accuracy.

The Twin Six is a remarkable car to handle in traffic. It is a revelation to the man who now grinds and jerks along in congested city streets.

It can be throttled down on high gear as low as two miles an hour and most of its work is done on high. From two miles an hour it will, in a few blocks, pull up to better than a mile a minute. But with all its speed and power, it is not a racing machine; it has none of the limitations of the car

built for fast travel over short distance; and it doesn't make you pay for power you don't use.

One prominent industrial man says, "The Packard has added at least three hours to my potential business day."

Another says, "With the Packard I can live 20 miles farther in the country."

Another says, "I can cover more ground and keep to schedule by my watch. These days the Packard is more reliable than the trains."

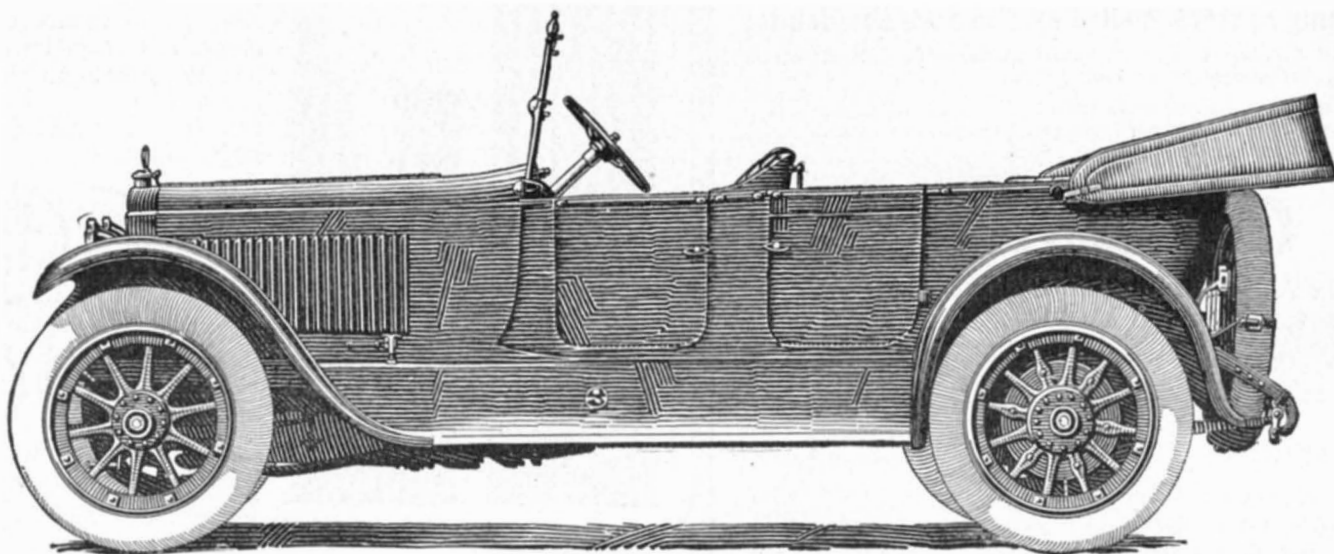
Another, "The Packard is one shining example of a motor car that an owner might elect to drive and care for himself."

There is a new science of transportation—that of motor-vehicle performance, maintenance and cost. It has to do with your car and its duty, however limited its use.

The Packard people are transportation experts; they have more to tell you on this subject than any other organization in the world. You can ask them to discuss your car problem without obligation. It is to your interest and profit to do so.

*"Ask the Man Who Owns One"*

PACKARD MOTOR CAR COMPANY, *Detroit*



SEVENTY-FIFTH YEAR

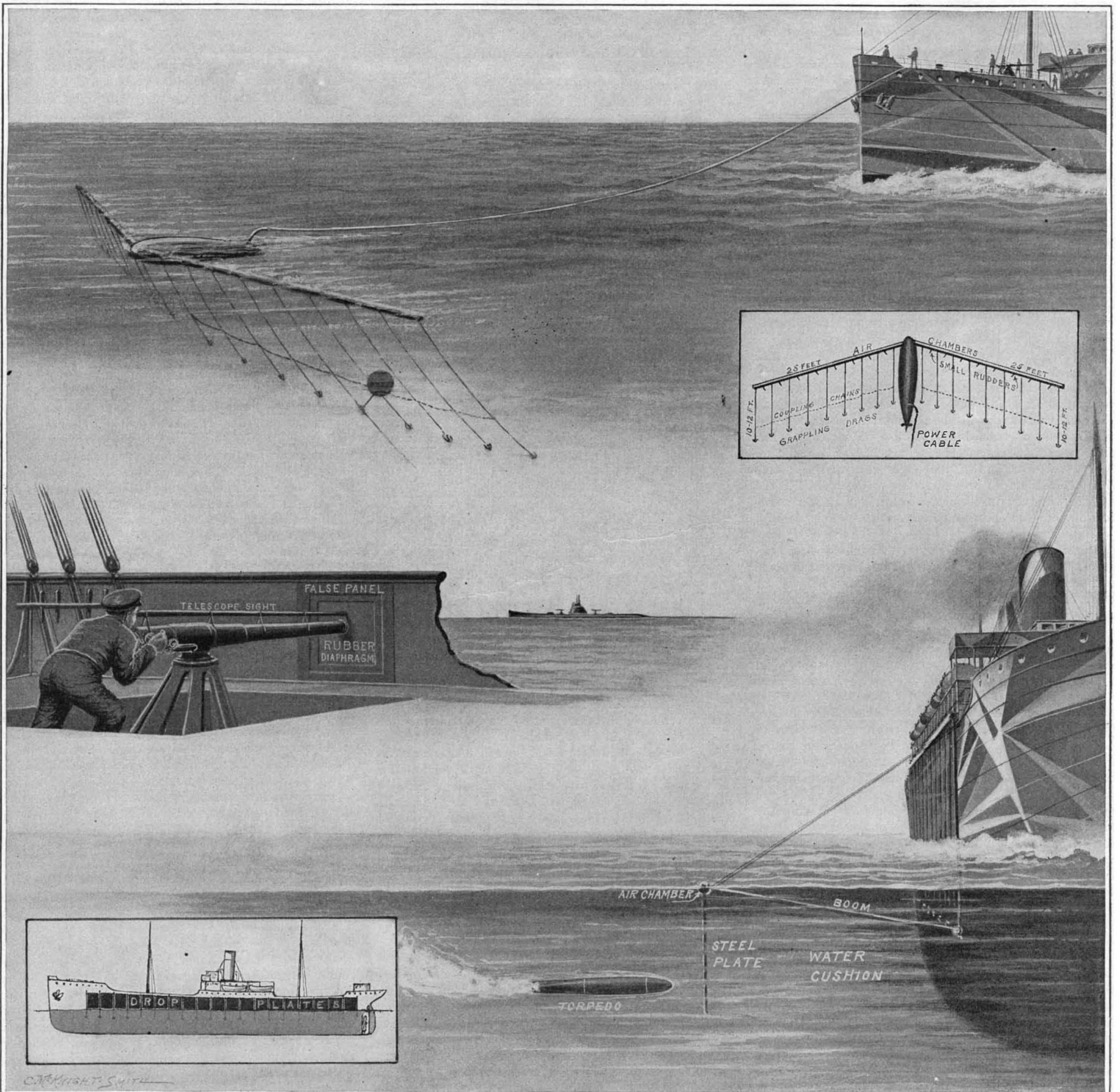
# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX.  
NUMBER 23

NEW YORK, JUNE 7, 1919

[10 CENTS A COPY  
\$5.00 A YEAR]



Copyright, Scientific American Publishing Co.

American "mystery" ships and their equipment for combating U-boats, torpedoes, and mines (See page 600)

# SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.  
Founded 1845

New York, Saturday, June 7, 1919

Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer  
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter  
Trade Mark Registered in the United States Patent Office  
Copyright 1919 by Scientific American Publishing Co.  
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.*

## Lessons of the Trans-Atlantic Flight

ONE week is a long lapse indeed in reporting the news of the trans-Atlantic flight. In last week's issue we were lamenting the loss of two brave men, Hawker and Grieve, who set out from Newfoundland in their single-engined Sopwith biplane, and who were not heard from for several days, thus giving every reason to believe that they had met with death somewhere in the tractless Atlantic. But before the last issue could even reach our readers, news came from Scotland to the effect that Hawker and Grieve had been rescued at sea by a Danish tramp steamer, the "Mary." Since then all the world has rejoiced in the rescue of these two intrepid airmen, who set out on what seemed a hopeless and fatal adventure.

After all, the Sopwith machine performed well, according to Hawker's story. It covered well over half the distance and was in the air about 13 hours before it was forced to come down because of engine trouble. It appears that the circulation system became choked and the temperature of the water rose to the boiling point. Still, despite the great heat of the cylinders the engine continued to perform without halt until the airmen alighted on the water in the path of the "Mary," which picked them up.

Somehow or other the Sopwith's flight, even if unsuccessful, has raised the stock of the single-engined plane to par or better. For it is now generally believed by flying men that Hawker and Grieve would have made the crossing had it not been for the clogging of the circulation system. So those who have been figuring on using single-engined planes are again in high hopes and dreaming of success.

Whatever may happen in the trans-Atlantic flight contest between now and the next few weeks, the fact remains that there is little of commercial value in any of the attempts. The successful crossing of our Navy's NC-4 illustrates better than any other attempt the magnitude of the difficulties. With numerous warships stretched out along the course of the NC machines, and with the very finest equipment possible, the Navy attempt has disclosed that the chances of making the flight are in the proportion of one out of three. True, the Navy's attempt has been seriously crippled by adverse weather conditions; but so has Hawker's, for that matter. Over so wide an expanse as the Atlantic Ocean, there are few days throughout the year when weather conditions are ideal for a flight over 1,000 miles. Adverse weather must always be considered in any trans-Atlantic attempt.

As for the machines, the land type of plane is, strange as it may seem, the best for the attempt. In fact, of all the machines entered in the *London Daily Mail* contest, only two are seaplanes up till the present writing. As the constructors have viewed it, and as the experiences of the NC-1 and NC-3 have proved, a machine, no matter how sturdily built it may be, has little chance of resuming the flight once it is forced down in a heavy seaway. It seems impossible, after one reads the description of the NC machines appearing in this issue, to believe that these stout craft could be so badly wrecked by the waves. Yet that is what has happened to two of them.

So it comes right down to a matter of using a land plane, which is lighter and makes a greater speed than a seaplane of equivalent capacity, and running the chance of getting across without coming down. In a word, the trans-Atlantic flight must be one big jump.

## The Naughtiness of Nations

A RECENTLY published report of the Census Bureau sets forth some rather curious figures as regards the number of prison commitments and of juvenile delinquents among the the foreign-born white population of the United States.

The list is headed by Mexico, with 2.3 per cent, figured on the Mexican population living in the United States. Next in order come the Irish with 2 per cent and the Scotch with 1.2 per cent. Austria follows with 0.82 per cent, England and Wales show 0.73 per cent, English Canadians 0.68 per cent. Lowest of all is Switzerland, with 0.31 per cent. Then, ascending the list, comes Germany with 0.38 per cent and Denmark with 0.39 per cent. Italy is very moderate, with 0.53 per cent. Russia is quite low, contributing only 0.47 per cent. France also is among the "small contributors," giving 0.59 per cent.

There are the figures. They bring some surprises and also some extreme contrasts. Thus the Irish were committed about five times as frequently as the Germans and the Scotch twice as often as the Italians.

What construction is to be laid upon these facts? What conclusions shall we draw from them?

The only conclusion of which one feels reasonably sure is that the figures can not be used as a measure of national character. Crime is not a thing to be spoken of lightly; yet, after studying the list one can not escape a feeling that among nations, as among school-boys, a certain degree of "naughtiness" may perhaps be indicative, not of perversity, but of the bubbling over of something not wholly bad. Slavish obedience to existing authority, uncritical subservience bred of bondage under a corrupt autocratic government, is hardly a trait to be admired. Yet a person transplanted from such a native soil to the more salubrious climate of our American democracy may give a spurious appearance of goodness, simply because he is now submissively following a good leader, just as before he unquestioningly submitted to evil influence.

In any case numerous factors enter and influence the statistical figures, which set forth only the resultant of many forces acting together. Only a complete analysis, showing all the contributing causes, would enable us to construe intelligently the statistical data.

In the first place the nature of the offense must be taken into consideration. Thus, for instance, three-fourths of the commitments among the natives of Ireland were for the less serious offense of "drunkenness and disorderly conduct." Under this same head the Italians, who showed up favorably in their total, contributed less than a third of all their offenses. On the other hand the proportion of commitments for assault was larger among Italian offenders than for any other nationality. This does not mean, of course, that the total number of assaults was greatest among Italians.

A factor which also probably has a bearing on the statistical showing, is the distribution of each nation among the rural and the urban population. For instance, of the Irish-born 84.7 per cent were living in urban communities, while the corresponding figure for Germans was 66.7 per cent, and for natives of Denmark 48.3. But on the other hand the Mexicans, who have the highest proportion of commitments, have also the smallest proportion living in cities; and Russia, for whom the percentage living in cities is largest, has a comparatively low ratio of commitments, namely 0.47.

## Another Field for Patent Relief

THE granting of a patent is, on both sides, a clear case of an agreement with consideration. In consideration of his having created something new, the Government grants the inventor exclusive rights over the thing created. In consideration of this grant, the inventor agrees that his rights shall hold for a limited period, after which his invention shall be thrown open to the free use of all. To make this limitation effective, he gives a full disclosure of his invention.

Now the Government requires no protection against the inventor, for the latter has no power to oppress the

public. The Government, on the other hand, has every power to oppress the inventor. It can, if it will, even abrogate the whole patent system and confiscate all inventions; that in spite of urgings from certain quarters it does not do this is simply because a majority recognizes such a course to be unjust and, in the long run, unprofitable. But in a thousand other ways the Government, through its legislative and administrative bodies, has power to harass the inventor. Moreover, the state does not, of itself, possess the will *not* to do this. Procedures which involve the dealing out of injustice arise automatically or accidentally; they cannot so be set aside, but can be negated only after a great deal of effort. So it behooves us to watch with the utmost care the progress of patent law and patent procedure, lest such injustices creep in.

Now the inventor wants to hold his invention under his control as long as he can; the public wants the right to use it freely as soon as possible. As the best compromise between these conflicting interests, it is decreed that 17 years, as the life of a patent, is just long enough to enable the inventor to build up a demand and a means of supply, and then to enjoy a period of profitable monopoly. This is recognized as a fair arrangement for all concerned.

Several decades ago a certain inventor invented a machine for cutting veneers 10 times as thin as they had ever before been cut. He spent a number of years in developing this machine to the point where a patent was in order, and several more in establishing it in the market. At this psychological moment solid furniture came in, and within an incredibly brief interval there were no veneers being made. The veneer came back, but not until after the expiration of this patent.

In the case cited the inventor was merely unfortunate. What would have been his state of mind, however, if the Government, at the moment when his investment of time and money in his patent was at a maximum, had (in good faith) sought to develop the lumber industry by a law forbidding the manufacture of any save solid furniture? Would he not have had a grievance? Would this grievance have been in any way lessened by the knowledge that the law was intended to serve a good end?

Right now there is a large body of American inventors in much the position here suggested. During the progress of the war materials had to be diverted from non-essential uses to essential industries. This was eminently right and proper; our only business, last year, was to beat the common enemy. But consider the feelings of a man holding a patent on—well, say fire-escapes, or a superior grade of fancy paper, or a mechanical toy of metal; a patent granted about ten or twelve years ago, was just getting well under way toward profitable exploitation when the war came along and cut off his supply of raw materials by government edict or even made it temporarily illegal to manufacture his article.

This man will feel much worse than the fellow who has been put out of business by the laws of supply and demand or by pure luck. He will feel that the Government has robbed him of two years of the term during which it had agreed to let him enjoy the exclusive rights in his invention. He does not claim that this should not have been done; he realizes that it had to be done. But he does claim that reparation is possible, in a manner so simple and so lacking in cost or injury to anybody else, that there is no excuse for not making it. Give him back his two years, he asks; add them to the term of his patent, so that it will expire in 1925 instead of 1923. He wants no recompense for the general disruption of his business, for this was a hazard of war that all suffered in common. But he does think that when the Government found it necessary practically to suspend the operation of his patent for two years, the least that could be done for him would be to give him back those two years.

There is a large number of patents in the building trades, as well as in a wide variety of non-essential industries employing essential materials, which were thus rendered inoperative during our participation in the big fight. Much has been said about relieving patentees of the defaults imposed upon them by the war. We believe that the group we have mentioned is quite as deserving of consideration. It is not a question of extending all patents indiscriminately for two years, but simply those whose holders can show that they have suffered the loss outlined. It seems to us that the scheme suggested for their relief should by all means go through.

## Electricity

**Physical Characteristics of X-Ray Screen.**—The qualities of screens used for X-ray work are now of considerable interest, owing to the many applications of X-rays, and some interesting notes on this subject are contributed by Mr. M. B. Hodgson to a recent number of the *Physical Review*. The author discusses in some detail the fluorescent effect excited in various substances, calcium tungsten being one of the best substances for the purpose. Spectrographs are also presented showing the effect of higher pressure on the Coolidge tube—which gives rise to greater exciting power but somewhat impairs definition.

**Electrically-Heated Quilts** have been used with good effect in British hospitals. These quilts are arranged with highly flexible resistance wire, which is introduced in two insulated layers of fabric, the inner of which is surrounded by heat-conducting material so as to facilitate conveyance of heat to the patient. Originally the quilts were used in order to supply warmth to consumptive patients, sleeping out-of-doors, and proved a great advance over the time-honored hot-water bottle. More recently they have been used in fever wards, etc., to promote perspiration. It is stated that a bed temperature of 90 degrees can be attained in less than half an hour and maintained continuously thereafter.

**Selenium Production in Germany.**—According to *The Electrician*, selenium, which is a large by-product in the copper industry, could easily be manufactured in much larger quantities if there were sufficient demand, and new uses for this material should be diligently sought for. In 1914, the output in Germany alone was about 30,000 pounds. The material at present is used mainly as a coloring agent in the glass industry, and it has some applications in medicine and in connection with certain photographic materials. It has also been used, as a substitute for sulfur, for vulcanizing rubber. Its unique property of alteration in electric resistance under the action of light should lead to promising applications in the future.

**Electric Heaters for Railroad Tracks.**—During the heavy snowfall last winter a somewhat novel form of electric heater was devised for use on certain British railways for keeping the points and switches free from snow and ice. The heaters consisted of a length of resistance wire wound on a porcelain tube. This latter was centered between insulating disks and placed in lengths of 2½-inch gas pipe. These tubes, continues *Electrical Review*, were about 1½ feet in length, and these somewhat rough and ready heaters were coupled to lengths of ordinary rubber-covered wire and laid under the points to be protected. As soon as the current was switched on the snow naturally began to thaw and very satisfactory results were obtained. Similar heaters have been in use on railroads in this country for some years, being brought out for service when the snow begins to fall. The heaters take 11 amperes at about 36 volts, and for ordinary work they are used three in series across a 110-volt circuit. It has been found necessary to use 18 heaters for the turn-outs, and these simple but efficient appliances have been employed in large numbers under pipe runs, near signal mechanism, and in the vicinity of the gearing for the turn-table pits.

**Wireless Amateurs** are again turning to their favorite hobby in large numbers. But it is hardly the amateur wireless of former days, when a cardboard tube, a few ounces of magnet wire, some binding posts and pieces of wood, and general odds and ends were worked into some sort of wireless set. No, indeed! The amateur of today wants apparatus which is quite comparable with commercial and Government equipment. The writer of these notes happened to be in an electrical store which is the rendezvous of New York wireless amateurs. A miscellaneous collection of wireless apparatus lay on a counter, and a salesman explained that it was pre-war apparatus which was being sold out at special prices. An amateur stood gazing at a loose-coupler, which would have been the pride of any amateur a few years ago. The salesman, seeing the interested look of the amateur, approached. "Would you like to buy that loose-coupler cheap?" he said. With a sudden look of scorn, the seemingly interested amateur replied, "Naw! I outgrew that stuff long ago. I was just looking at it as a matter of historical interest." And that is precisely the way things go with these ambitious young Americans who dabble in wireless.

## Science

**Another Expedition to the Mount Katmai Region** of Alaska, under the leadership of Prof. F. Griggs, has been sent north by the National Geographic Society, and was reported to have reached Kodiak Island the latter part of April. The party includes chemists, a petrographer, a zoölogist, a botanist and representatives of other sciences, and also motion-picture photographers.

**Proposed Airplane Explorations in the Antarctic.**—Plans are on foot in England for another antarctic expedition, which is expected to start in June, 1920. It is to be led by J. L. Cope, who was a member of the last Shackleton expedition. The party is to go south in the "Terra Nova," the vessel used in Scott's last expedition, and it is planned to make extensive explorations of the interior of Antarctica by airplane, including a flight to the south pole.

**Gravity Observations in Canada.**—A report from the Dominion Observatory, Ottawa, states that Canada has now a line of gravity stations right across the continent, covering more longitude than is covered by any other series of stations on the American continent. These, in conjunction with the gravity observations taken in other parts of the world, will furnish valuable data toward the determination of the figure of the earth. Mr. Wm. Bowie, of the U. S. Coast Survey, is now combining the Canadian observations with those of the United States, for use in a new publication on this subject.

**The British Daily Weather Report**, issued by the Meteorological Office in London, has recently undergone a notable expansion, reflecting the great increase in the work carried on by England's "Clerk of the Weather" in response to the varied demands that arose during the war. Since April 1st the report has been issued in three separate sections; viz., a British Section, an International Section and an Upper Air Supplement. All three sections contain weather maps. In the Upper Air Supplement there are maps of the British Isles showing the winds at various levels from the surface up to 15,000 feet, for afternoon, evening and morning. This is primarily for the information of aeronauts, but will prove of great interest to all meteorologists.

**More Information About Balsa Wood.**—An article on the remarkably light wood known as balsa, now extensively used in making life-rafts, certain parts of airplanes, etc., and also valuable on account of its heat-insulating properties, was published in the *SCIENTIFIC AMERICAN* of December 8th, 1918. Much new information regarding this wood has been gathered by Prof. W. W. Rowlee, of Cornell University, who was sent to Central America last year by a New York company to study balsa in its native environment. Professor Rowlee has just published in the *Journal* of the Washington Academy of Sciences an article on the botanical characters of the wood. The balsa tree belongs to the genus *Ochroma*. Formerly only two species were recognized, the one which was the source of the wood imported to this country being known as *Ochroma lagopus*. Professor Rowlee's investigations increase the number of known species to nine. He states that balsa is usually a second-growth tree, appearing promptly and abundantly where clearings have been made by natural or human agencies. It grows with astonishing speed, often attaining a height of 60 feet or more in five or six years. It is doubtful whether any other tree grows so rapidly. In its natural state the wood is very perishable, decaying with apparently the same rapidity as a cotton fabric. The balsa wood of commerce is made durable and waterproof by a special treatment invented by R. A. Marr. In tropical America this tree bears many names besides "balsa," which is merely a Spanish word for "raft," in allusion to the fact that rafts of this wood are used for transportation purposes on the South American rivers. In Nicaragua the tree is called "gatlillo," in Guatemala, "cajeto" on the west coast, "moho" and "lana" on the east coast; in Cuba, "lanillo;" in Jamaica, "corkwood" and "down tree," or, as the Jamaican negroes have it, simply "dum." Balsa proved its utility in the war, when it was not only used extensively for life-rafts and life-boats, but also in the construction of the 250-mile mine barrage across the North Sea, which included 80,000 floats made of balsa wood.

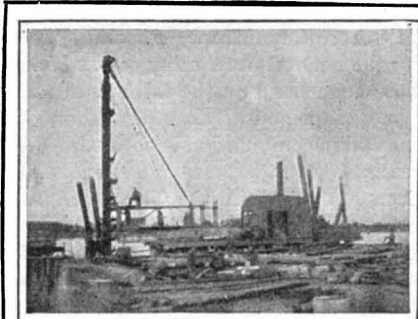
## Industrial Efficiency

**Scrap Iron and Steel of Panama.**—According to a statement made by the general purchasing officer of the Panama Canal, there is on hand on the Isthmus several thousand tons of scrap iron and steel available for disposition, and the monthly accumulation is approximately 300 tons. It is realized that there is but a limited demand for scrap iron and steel in the United States, therefore, the Purchasing Department of the Panama Canal, at Washington, desires to get in touch with export concerns that would be interested in securing supplies for shipment to Europe.

**Scaffolds.**—During the past year there have been reported a number of accidents which have occurred as a result of scaffolds breaking, collapsing, or falling. While these accidents are not frequent, they are as a rule of a serious nature. Construction of scaffolds of either unsafe or improper material is only courting a serious injury or death, and great care should be exercised to see that all scaffolds are constructed so that they will safely stand the load which they are expected to bear. It is very important that in constructing scaffolds nothing but sound, high-grade material be used, and that the work be carefully and thoroughly done.

**British Rules for Employment.**—The exigencies of war made it necessary in many trades and occupations to introduce employees who under the pre-war rules, practice, or custom obtaining in the trade could not have performed the class of work on which they were placed. These men are called dilutees. In order to facilitate the return to pre-war practices in this respect the Minister of Labor has laid down the following general principles for the guidance of employers in dealing with questions of priority of employment and discharge, as between skilled men and dilutees: (1) Where two workers are employed in the same department and on the same class of work, one a skilled man and the other a dilutee, and one must be discharged, the dilutee should go. (2) If a skilled man is unemployed (whether as result of discharge from a factory or as a result of demobilization) and presents himself for employment at a factory where dilutees are employed in the trade in which the applicant is skilled, he is entitled to claim engagement and should not be refused employment at his trade on the ground that there are no vacancies and that his engagement would involve the discharge of a dilutee. (3) Where in a single establishment there is more than one department in which workers engaged on the same class of work are employed, and it is necessary to discharge workers engaged on that class of work, no skilled man should be discharged while any dilutees working on that class of work in the same or any other department are retained.

**Limitations of Women Workers.**—We have often heard it said that women are not successful at work where micrometric measurements play an important part, or where great exactitude of some other kind is demanded. We are of the opinion, however, that this is a mistake, and that such failures as may have occurred in this direction have been due to improper selection of the workers. There is great diversity among men with respect to capacity for precision work, and differences still more marked may perhaps exist among women; but British experience has shown that excellent results may be had from women, even along these lines, if the problem is fairly and intelligently faced. In Great Britain it has been found that even in connection with operations requiring a remarkable degree of mechanical precision, specially-selected women, after a comparatively short training course, have shown themselves able to perform the work just as well as men who have had equal experience and instruction. It cannot be denied, *The Travelers Standard* continues, that women are inferior to men, on the whole, where strength and muscular endurance are important elements. The average woman is not as tall as the average man, nor has she so long a reach. These two factors affect her lifting power adversely, and they also diminish her "radius of activity"—that is, the distance at which she can still do things effectively without moving bodily from her station. Moreover, if a man and a woman have the same height, weight, and general physical development, the man can almost invariably exert greater strength, and maintain a muscular strain for a longer time, than the woman; and if greater reach, lifting power, strength or endurance enters in the cycle as a determining factor, the man will prove the larger producer.

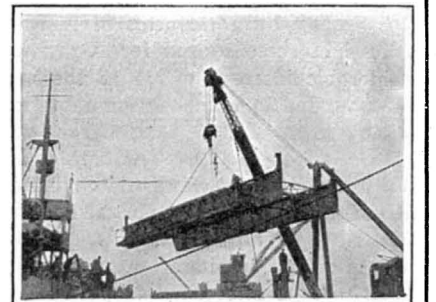


## A United States Port in France

### American Accomplishment in France a Model for Needed Reconstruction Work

By C. H. Claudy

Special Correspondent of the SCIENTIFIC AMERICAN in France



IT is only natural that, looking at the big job America has done in France, the American people should see only the big things and the details not at all, or as a confused mass rather than as distinct points. Thus, we know that we have transported and maintained more than two million men in France, but of the details of that transportation, that maintenance, we are as yet rather vague.

Yet some one had to think of the details in advance. Two million men require an enormous amount of maintenance. They must not only be fed and clothed, but the multitudinous impedimenta of an army must be supplied. Guns, ammunition and explosives are but a part of the problem. There must be shelter, hospitals, trucks, telegraph and telephone supplies, materials for all sorts of construction from a dugout to a headquarters, and these materials must be supplied not only once but many times over, as an army is wasteful, wears things out quickly and often has to abandon material in a forced march or a quick retreat.

Consequently, one of the first problems we faced was shipping, and one of the crucial points in the shipping problem was landing what we shipped, in France. To land a freight shipment means either the long, dangerous and inefficient method of lighterage from ship to shore, or it means docks.

Now, France had docks, of course, but by no means enough docks to take care of her own wants and those of America too. France had to be fed from without, and she had to receive the troops from England and the English colonies and all the freight needed to maintain them. With the best will in the world to aid America land and maintain her troops, France could not stretch one dock to berth two ships. Moreover, with all respect to French methods, America has her own way of doing things and it is emphatically not the continental way.

So the United States, through its engineers, proceeded to arrange its own docking facilities in France. By no means all docks used by America were American made. The total of 89 ship berths averaging 410 feet in length were not all American built. Many were acquired from the French. But all felt the influence of American labor-saving devices and had some American cargo handling devices installed. Otherwise, the tonnage of 40,000 daily, necessary for our Army, could never have been landed fast enough.

At one time or another America has used practically every port in France. We constructed new facilities or took over berths at Le Havre, Rouen, Cherbourg, Granville, St. Malo, Brest, Lorient, St. Nazaire, Nantes, Montoir, Donges, Les Sables, d'Olonne, La Pallice, La Rochelle, Rochefort, Pauillac, Blaye, French Bassans, Sursol, Bayonne, Cette, Marseilles and Toulon. Obviously, it is beyond the space of a single article to attempt even to outline the work done at each of these ports. But that done at Bassans, just outside of Bordeaux, is typical, not that it is a sample of the other work, but because it represents the work of the engineers

at their best. It is literally a slice of American efficiency laid down in France, and, it may be said, to the wonder of every French engineer who has seen the work grow from nothing to perfection in an incredibly short time, and in spite of difficulties which might well have daunted even United States Army Engineers.

The work at American Bassans, which is on the east bank of the Garonne river about three miles from Bordeaux, was begun in the late summer of 1917. It should be understood that the contemplated project was not only a dock, with berths for ten vessels, but included everything that makes a dock into a port—a powder

by American forestry troops proved the contrary, and, when the transportation difficulties were overcome, heavy piling and timbers began to be available in sufficient quantities.

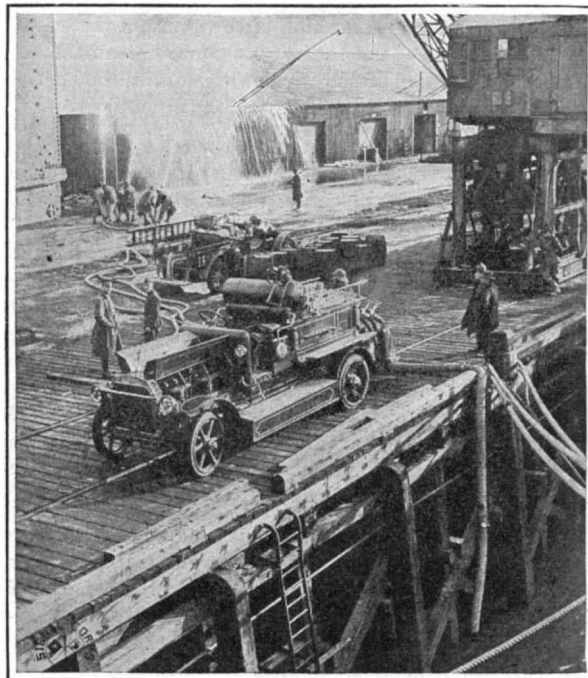
The site of American Bassans was occupied by barracks used by Indo-Chinese employed in a powder works. Those who first approached the site say it was recognizable from a long distance by the odor, the Anamites having no regard whatever for sanitation! But six weeks' work removed the barracks and the refuse, cleared the site, threw up dykes for a sand fill and saw pile drivers and barges constructed. Active work on the project itself started in November.

It is neither the policy nor the wish of the SCIENTIFIC AMERICAN to rake up past mistakes nor to offer criticism when the need for criticism has passed. It is, therefore, only as a matter of history and not at all as a stricture that mention is here made of the fact that there was a disagreement at the outset among the powers in control as to whether the dock should be built as quickly as possible with the available material—which meant light construction and light cargo-handling devices—or whether more time should be taken and preparations made to install on the completed dock the heaviest and most efficient type of gantry cranes. Such was the case and the decision was for speed and light cargo-handling devices. The work was redesigned for cranes with a wheel load of 20,000 instead of 70,000 pounds originally proposed and went forward very rapidly. In the midst the delayed steel I-beams began to arrive and the plans were again changed to allow two berths to be fitted with the heavy gantries originally proposed.

With no regard for Sundays or holidays, and in spite of labor shortage and the employment of troops never intended for labor troops, whose heart was at the front rather than at Bassans, the work went forward and in April, 1918, the dock was ready for the first vessel, which happened to be Morgan's "Corsair," converted from a private yacht to a patrol boat.

As completed at this time the dock was and is 4,100 feet long and 86 feet wide, built on 11,500 piles. Four million five hundred thousand feet board measure of lumber was used in its construction and on the dock itself are 3.53 miles of track, 12 split switches and 9 double split switches. There are eight classification sheds, all 66 feet wide, six of them 312 feet in length and the other two 204 feet long. The open and covered storage area has 4,250 cubic yards of concrete floor construction, resting on a dredged fill of 46,000 cubic yards, held in place by a retaining wall containing 3,267 cubic yards of concrete and a dyke containing 9,000 cubic yards of embankment and a concrete apron of 725 cubic yards. In the river yards are five miles of tracks including 21 switches and four double slip switches, a work involving another 20,000 yards of excavation and embankment.

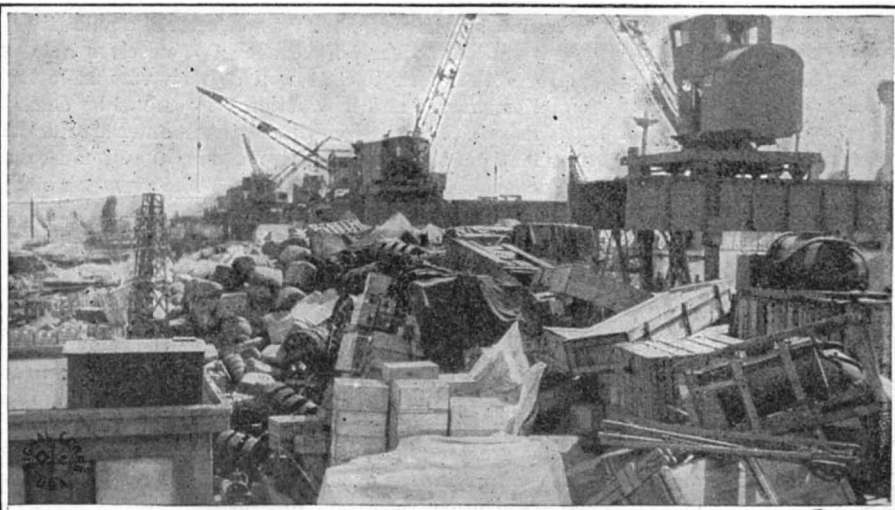
The departure yard, located half a mile northeast of the docks has 20 miles of tracks and 108 switches, four of



Fire fighting equipment on American docks at Bassans

dock, receiving yards, departure yards, warehouses, water supply, sewerage, railroad tracks, cargo handling devices, everything necessary to get the freight off the vessels, store and sort it, and ship it away into France where it was needed.

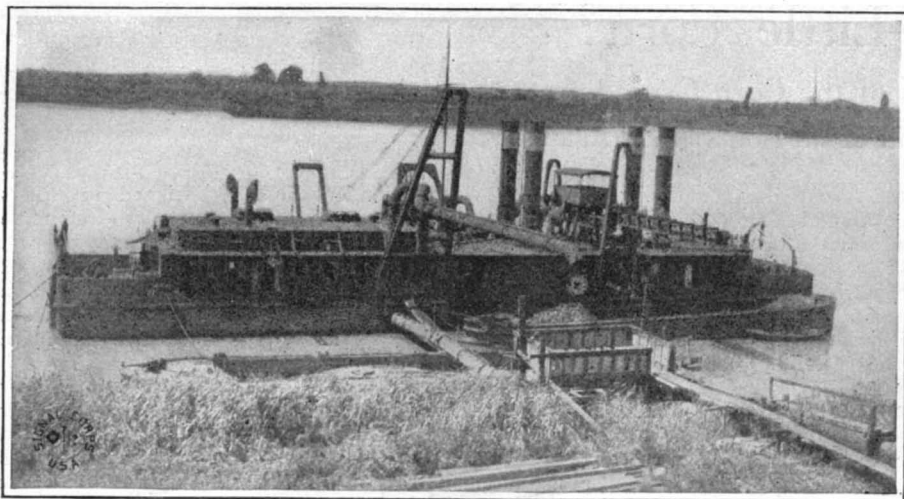
From the outset the work was beset by the natural difficulties inherent in trying to construct a huge engineering work 3,000 miles from home. Material was difficult to get from America and much that did come through was, sometimes, in the case of heavy timber, in such poor condition as to be unavailable for use. France had, or thought she had, no timber available, but the first forestry operations undertaken in France



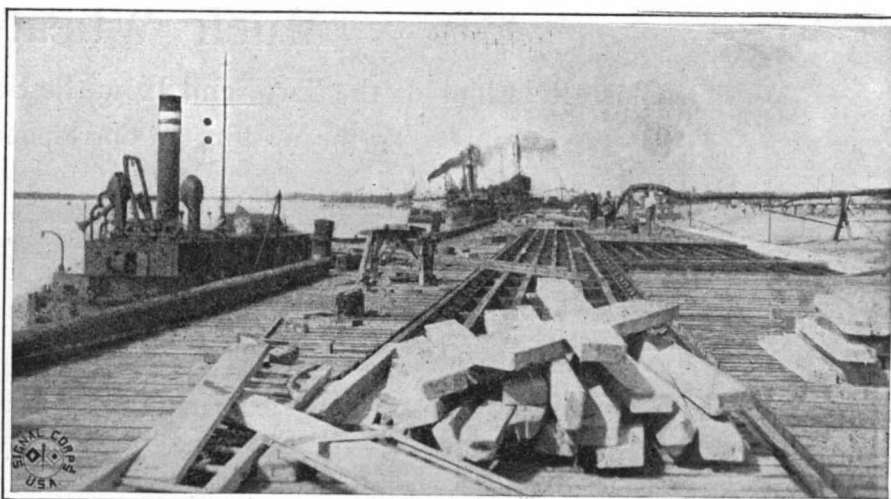
Ships were unloaded at Bassans faster than the goods could be cleared



General view of American yards at La Rochelle, with a daily capacity of 80 carloads



Sand-sucker dredge at Bassans



New berths in French port at Bassans

which are of the double slip type. The receiving yard, a quarter of a mile southeast of the dock has six and a half miles of track and 34 switches two of which are double slip.

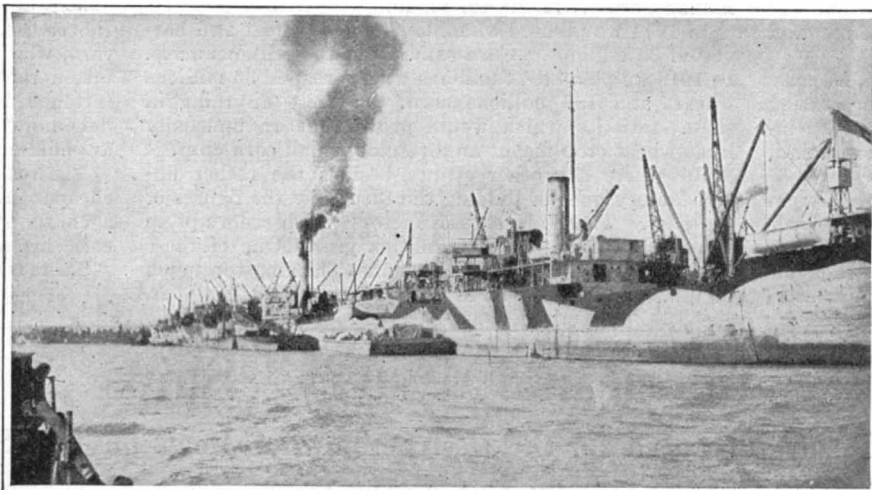
At the completion of the project there were but two heavy gantries installed, the dock not being strong enough to support the immense wheel load, required should the cargo-handling devices all be of the originally planned character. But conditions had now changed and for the better; the material necessary to make the dock strong enough for these most efficient of cargo-handling devices was now available. A board appointed to consider the matter went into it very exhaustively and finally decided upon the strengthening of the dock and in September of last year 3,200 additional piles and half a million feet of lumber were added to the dock, so that the entire 10 berths could be equipped with the heavy type gantries. This made a total of 40 of these big cargo-handling devices, or four to a ship. Some of them are five and some 10 tons capacity, but it was rare indeed that any of them could work to capacity, inasmuch as most freight is bulky rather than heavy.

The completion of the installation of the heavy gantries gave the Bassans project an unloading capacity of 12,500 tons per day or enough to care, alone, for an army of 500,000 men. Indeed, the unloading capacity of the cranes exceeded the capacity of the available forces to carry off the freight as it was lifted from the vessels, and, as one of the pictures shows, freight congestion on the dock itself has more than once been the measure of speed of unloading.

It is difficult to convey a picture, even with the aid of the photographs, of the feverish activity of this entirely efficient plant in action. In no other port in France is there the same capacity to unload and certainly, without it, the army must have suffered for want of the average of 50 pounds per day per man which is necessary to keep a fighting force in France supplied with food, clothing,

ammunition, arms, equipment and miscellaneous supplies.

The reader will not consider the picture of freight congestion as typical of the operations at Bassans. The sunken railroad tracks, the storage area and the switching arrangements are such that save upon exceptional days, the dock was kept clear of freight even with the forty gantries working all at once. Having been most carefully planned, there was little if any delay in getting the unloaded freight into either trucks or cars and if the



Lighters at work at American Bassans

S. O. S. was able to function so that the army, first of offense and now of occupation, could be fed and clothed and supplied, it was largely if not entirely because of the efficiency of this slice of American means and methods laid down in a port which, famous the world over as a port, had nevertheless, up to that time, seen nothing to compare in speed with the American method of freight handling.

Too much attention must not be given American

(Continued on page 612)

### Killing Weeds with Live Steam

As a means of killing weed seeds, fungous growths and insects in the soil, tobacco growers have hit upon a plan of sterilizing the ground with live steam before the seeds are sown. Tobacco seedlings are very sensitive and especially susceptible to root-rot. This fungus attacks the roots of the seedlings and subsequently seriously affects the vitality of the plant. For some years surface burning, or building a fire on top of the prospective beds, was practiced in various sections. This was not entirely successful, however, and the new plan of killing fungous growths, weeds, and insects by steam has been carried out.

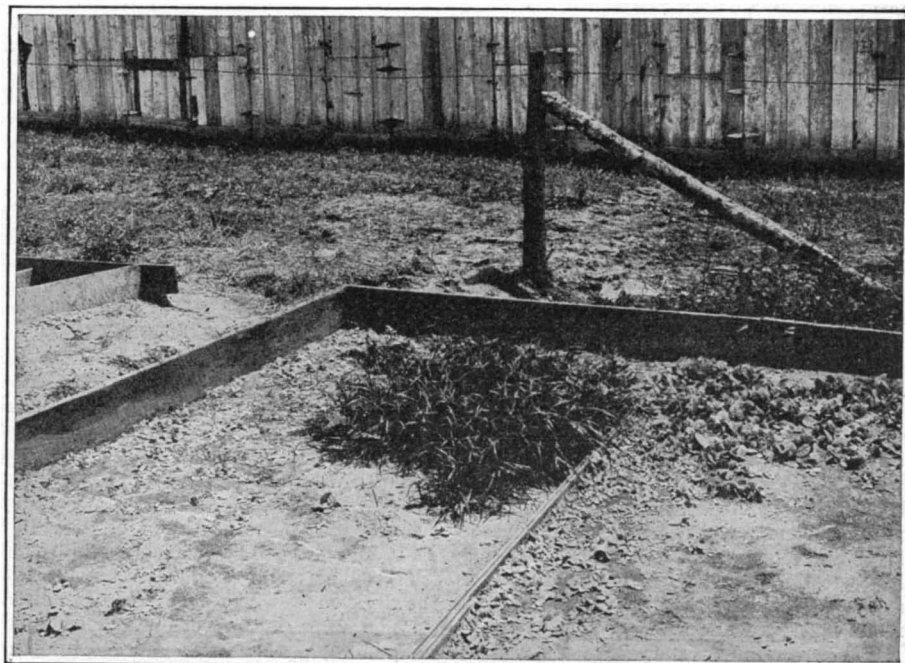
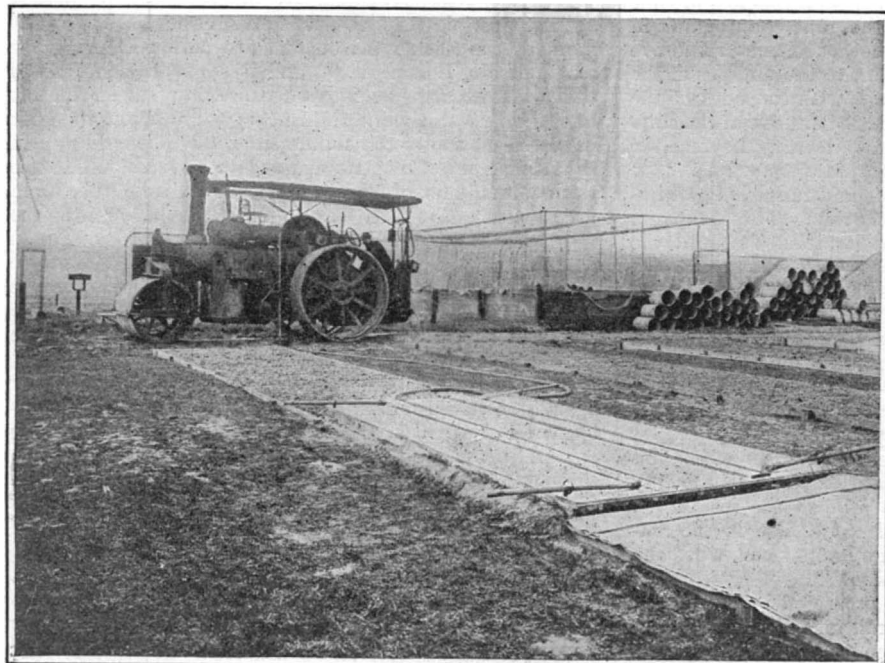
Experts of the United States Department of Agriculture have estimated that the amount saved in weeding the beds about pays for the cost of sterilization. Not only that, but the new plan has also been suggested for use with other seedling beds. This plan, in short, kills the weeds before they can come up.

Steam sterilization of the seed beds simply means that a portable boiler is set up near where the work is to be carried on, while an inverted pan, of metal or wood, is placed over the beds, after they have been prepared all ready for seeding. Steam under pressure is turned on for half an hour, which accomplishes the work. In some places farmers are buying boilers for their own use, renting them, or owning them in common with other farmers. An

ordinary threshing-machine boiler, or in fact any boiler of 20 horse-power or more—depending somewhat on the size of the steaming pan—is suitable. It is essential that there be enough pressure to force steam into the soil.

A pan having an area of about 72 square feet is regarded as about the right size. Wooden pans are cheaper than those of galvanized iron. The pan simply consists of a wooden frame with boards nailed across the bottom, and of course very strongly reinforced so as to

(Continued on page 613)



Apparatus for sterilizing ground against weeds with live steam, and an example of its work. The plot at left of partition, showing heavy growth of weeds was not treated; that at right was

## Much Wheat—Little Corn?

Close Relations of the Two, and How the Size of the Corn Crop Affects the Price of Meat

By the Washington Correspondent of the SCIENTIFIC AMERICAN

WHEN the United States Government undertook to feed the world with wheat its most effective step was the provision of a guaranteed price for the wheat—\$2.26 Chicago.

When the armistice came along and there was the less necessity for wheat, the price had still to stand because it was a covenant between government and individual. And it's human to take advantage of opportunities, so farmers all over the land planted wheat and yet more wheat and then still more wheat, in the comforting assurance of a high price regardless of the size of the crop or economic conditions or demand.

There is only so much land. If all of it were planted in wheat, obviously there would be none left for corn or cotton or tobacco or any other of the big crops. Of course the character of the land and the climate have an automatic check on over-planting. Wheat won't grow on all farm land, nor is the yield big enough in all climates to make it worth while even at \$2.26 per bushel. But there is much corn land on which wheat might be grown, at least so think many who are timid about the price of meat, and it has been a matter of some moment and a good deal of wonder to many who study food economics whether or not the record wheat planting of this last winter and this spring may not so reduce the corn acreage and yield, that meat (which depends largely on corn for its growth) will sky so high in price that no one will be able to buy it save motion picture actresses and millionaires.

Nobody really knows anything about it, yet, because no statistics have been gathered about the corn planting this year. But there are certain straws which are indications and they are, luckily for our peace of mind, very comforting straws.

It should first be explained to the non-agricultural reader that winter wheat is normally about two-thirds of the total wheat crop, and that there are two sets of statistics about it while only one is usually made for spring wheat. Winter wheat may be, often is, winter-

killed. So the acreage planted is one thing, and the acreage harvested another. Corn and spring wheat are usually harvested in about the same amount in which they are planted.

Department of Agriculture statistics for 1919 show that of the 49,261,000 acres planted in winter wheat, 48,933,000 will probably be harvested. This is the greatest acreage of wheat ever harvested in this country. The harvested figures for 1918 are 36,704,000, for 1917, 27,257,000 and for 1916, 34,709,000 the great difference between 1916 and 1917 being caused by a severe winter-killing. In 1915 we harvested 41,308,000 acres and in 1914, 36,008,000 acres.

Now look at the corn figures: In 1918, 107,494,000 acres; in 1917, 116,730,000 acres, the greatest corn acreage ever reaped in this country. It was great because there was so much winter-killing of wheat and winter-killed wheat fields were plowed under and spring-planted in corn. But the figures for years before that are almost unvarying. In millions, they run from 1910 to 1916 in the amounts of 104, 105, 107, 105, 103 and 106 millions acres, regardless of the much greater fluctuations in the wheat areas harvested. Now compare with the wheat areas planted (remember, the wheat figures here given are winter wheat figures, not total figures). Beginning in 1914 and running to 1919 the figures, in millions, are 37, 42, 39, 40, 42, 49.

In 1914 we planted 37 millions acres wheat and harvested 36 millions. Corn came from 103 millions acres. In 1918 we planted 42 millions wheat, reaped 36 millions wheat, and 107 millions corn. Is there anything in these statistics which would prove that an unusually large wheat crop meant an unusually small corn crop?

But there are other straws besides the rather unsatisfactory ones of judging the future by the figures of the past. There are certain factors which seem apt to increase the planting of corn this year. One of these is the campaign in the south against planting too much cotton. There was a large carry-over of cotton last year.

Hence the educational campaign designed to divert some acreage from cotton to other staples—and none grow better in the south than corn, its other great crop. Corn is rather late this year because of the backward spring and so reports of corn probabilities are slow in coming in. But in at least three states, Michigan, South Dakota, and Arkansas it is known that the corn acreage has been increased over last year.

Of the total corn crop, 75 per cent is used as fodder and probably 60 per cent or more is used for food for meat animals (as distinct from horses, mules and oxen). It is because of this use of corn that the corn statistics are so interesting to those to whom the price of meat is an object. If too little corn, they argue, there will be higher prices of meat.

But here comes in a funny little kind of food economics. The prospects of a bumper crop of fodder usually increases the price of meat animals at the time of the prospect. The prospect of a poor crop decreases the price of food animals at the time of the prospect. If it were to be known that corn were to be very scarce the price of hogs, for instance, would decline. The reason is simple enough. If a man has 100 hogs and thinks he can't get corn to fatten them, he offers them for sale so the other fellow can do the worrying. So do all the other hog owners. They glut the market with half-fed hogs. When the supply is greater than the demand, prices fall. *Par contra*, if the owner knows he is to have plenty of corn, which means cheap corn, he will hold his hogs and fatten them later, knowing he can get more for corn-fattened hogs than for the corn and the lean hogs, uncombined. So that prices rise because hog raisers are holding hogs.

The reaction is equal. The high price now means a cheaper price when the hogs are fattened and sold, and a cheap hog market today due to prospects of lack of corn, means a high-priced hog next winter.

There is no apparent falling off in the price of hogs now.

(Continued on page 614)

## American "Mystery" Ships

Cleverly Protected Decoys Prepared for the Destruction of U-Boats on This Side of the Atlantic

By Eric A. Dime

DURING the last year of the war stories about the British "mystery" ships percolated through the news channels and gave the reading public a slight idea of the means employed by England in combating the German submarine warfare. Naturally very little was reported about the construction of these ships. All we knew about them was that they were merely decoys designed to lure the prowling "subs" into a trap. The vessels looked like ordinary slow-going freighters, but when the U-boats came within a reasonable range of the mystery ships, hatches would suddenly open and behind them guns would bark at the enemy.

When the United States declared war on Germany, our naval authorities realized that American shipping along America's shores might be menaced by the Hun's sea prowlers. And surely enough that is just what happened. Across the Atlantic came the wasps of the sea and they dealt their death stings to several of our merchant vessels close to our shores.

Of course fighting craft from our navy were constantly on guard along the coast, and warships and U-boat chasers were supplemented by two other vessels that looked for all the world like ordinary cargo steamers, carrying provisions from our shores to the ports of Europe. The two innocent-looking vessels were the American "mystery" ships and they were constantly patrolling our waters from the rock-ribbed coast of Maine to the Florida Keys.

Our Navy Department knew that the British decoy ships had experienced some success in combating the U-boat menace, and as soon as we entered the war, it was deemed advisable to employ the same methods in local waters. Now since the German navy has been nicely tucked away at Scapa Flow, where it can do no harm and since German militarism has been knocked off its pedestal of power, it is possible to lift the veil of secrecy, which kept the public in general in the dark on naval matters while we were fighting the Huns.

The American mystery ship was designed as a decoy ship for combating the submarine warfare, by Warren S.

Fisher, recently attached to the Naval Intelligence Bureau, and his plans were submitted to the Navy Board three weeks after we declared war on Germany. Mr. Fisher's decoy represented new ideas, superior to the British decoys in the fact that instantaneous action of gunnery was assured and greater protection was given the ship in course and action.

The guns on the British ships were concealed by false structures built about them, and these structures necessitated loss of time, in folding, preparatory to action and that incurred in securing the range and proper sight. The American designed system obviated this loss of time by the novel method of having the guns countersunk in pits that would allow them to be concealed just above deck, behind false panels. In front of the muzzles of the guns were rubber diaphragms flush with the sides of the ship and painted the same color as the outside of the ship.

On top of the guns were sights extending beyond the barrels and slung in the rubber diaphragms. This made it possible for the gunner to swing and range his gun immediately upon observing a submarine. Thus prepared the decoy vessel could move along leisurely until the U-boat came within a satisfactory range of fire, and the gunner on the decoy could get his aim at the enemy before the latter realized what was to happen. The strongest glasses on the U-boat would reveal nothing but the flat side of the decoy, the sight protruding through the rubber diaphragm being too small to be seen, or if seen at all it would be mistaken for a rivet-head or other innocent-looking speck by the U-boat commander.

This arrangement would give to the decoy the first shot in action. It would be a surprise shot to the enemy and a straight hit would possibly finish the sea pirate. The discharge of the gun would cut a hole in the diaphragm which would be replaced by a new one, when the ship should be ready for a new action.

The decoy ship in action was protected by a series of false steel plates flush with the rail and buoyed when in the water and reaching from ten to twelve feet below the surface. Air chambers extending along the tops

of the plates kept them afloat. These plates were attached to the ship's side by rigid steel ribs, which, when released, dropped away from the side. They extended a distance of from 20 to 25 feet from the ship's side—a sufficient distance to explode a torpedo without damaging the vessel. The wall of water between the plates and the ship's side would serve as a cushion in the event that a torpedo exploded against a plate.

If one plate were struck it would not affect the others as they were constructed independently of each other, being connected only by chains to form alignment. It was essential to have some sort of protection for decoys against possible torpedo attack from the U-boat at the moment the deck guns opened fire on it. During the sea fights in European waters, it sometimes happened that when an armed ship opened fire on a submarine the latter would not only return the salvo from its guns mounted on top of the submersible, but it would launch simultaneously a torpedo against its adversary. Hence the commanders of our decoys had to take this extra precaution. The idea was to drop the plates into the water as soon as the deck guns opened up on the enemy. The ship carried extra plates, so that if one or more were destroyed by a torpedo charge, they could easily be replaced by others. It was not the intention to keep the plates in the water while the ship was running because they would have offered too much of a drag.

Another invention, designed to protect the decoy against anchored mines, was also offered the government by Mr. Fisher. It consisted of a torpedo-shaped device operated from the bridge or bow but independent of the ship itself. It carried its motive power in the form of an electric motor installed in a water-tight compartment of the apparatus, and the electric current necessary for power and control was supplied by an attached cable from the ship itself. A propeller, somewhat similar to a torpedo propeller, forced the mine-catcher through the water. Where the cable, connecting the ship with the device, was attached to the latter it was carried

(Continued on page 614)

## 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.

### Clouds Formed by Airplanes

To the Editor of the SCIENTIFIC AMERICAN:

In a recent letter from my brother, Capt. Ward S. Wells, M.C., 60th Infantry, 5th Division, A. E. F., he mentions the observance of rather strange and wonderful phenomena which I think worth passing on to you. They strike me as being quite unusual and perhaps worthy of record, so I am sending the following quotation from his letter.

"The first part of October last we spent several days in the Bois de Hess waiting to take over a part of the front line in the Argonne. The shell holes from the first great Verdun battle were so thick that there were no patches of ground large enough to accommodate even a pup tent and from any of the war pictures you can imagine what was left of the trees.

"There were two or three days of rain, when came a wonderfully clear and beautiful morning, with not a cloud in sight. At the time, some miles ahead, there was going on an especially terrific bombardment.

"Our attention was first drawn to the sky by the sudden appearance of several strange and startling clouds—long graceful, looping ribbons of white. These were tapering to a point at one end and at the other where they dissolved into nothingness 60 degrees across the sky, were about as broad as the width of a finger held arm's distance from the eye. On close observation we noticed some distance ahead of each cloud point the tiny speck of a chasse plane. Apparently the churning of the air was all that was needed to upset the delicately balanced meteorological conditions and precipitate this strange cloud formation. Before, I had seen ships leave their tracks in the clouds, similar to those of little sea animals in the wet sands at the shore, but never before had I seen a plane writing in white upon the blue slate of the sky.

"But that is not all that I have to tell you. From 9 until 12 that day it was our uncanny privilege to see sound waves. Great rings were continually floating upward and across the sky from the north. It made you dizzy watching these arcs at times for they were very numerous, their centers were at different points along the northern horizon and of course their radii were of varying lengths. As they would meet and merge one would almost expect to see these big rings flatten out when they bumped into each other. They were absolutely definite affairs and were discernible by being darker than the rest of the sky. When they crossed one of the above described clouds there was apparently a refraction of light although this may have been an optical illusion. It was exactly like passing a piece of crooked window glass over the cloud.

"You may skeptically smile when you read this letter, but I assure you that we were all in our right minds at the time and I have not had enough New Year's egg-nog today to develop a creative imagination."

EVERETT D. WELL.

Nashua, Iowa.

[The phenomenon of visible sound waves reported in the second part of the above letter, is described in a note published in the SCIENTIFIC AMERICAN of November 16th, 1917, page 343. In that note we pointed out—we believe for the first time—the identity of this phenomenon with that of the flashing arc seen in volcanic eruptions, as first described by Perret. The observation of clouds formed in the wake of an airplane is, so far as we know, novel. Perhaps some of our readers can bring forward other examples of this, as well as striking instances of the occurrence of the more familiar phenomenon of the visible sound wave.—THE EDITOR.]

### Sub-Chasers for Lifeboat Service

To the Editor of the SCIENTIFIC AMERICAN:

While not acquainted with the Atlantic coast, I have lived most of my life on the brink of the North Pacific and would like to cite a few facts and make a suggestion or two.

We have here a wild rough shore, with winds from the southwest that often in the winter time reach the velocity of 100 miles an hour. In the summer months they blow from the northwest and sometimes as high as 90 miles per hour.

In view of these facts, the present coast guard life boats, 36 feet only, in length, and with small power, are totally inadequate to meet the situation. In many cases they are unable to cross the rough bars, at the

entrances of our harbors and get to sea at all. And in less stormy weather when they do get out are too small to tow in the vessel in distress, and also too small to take off but a very limited number of the passengers or crew.

In case it becomes necessary to go some distance from their station, the slow speed of these boats makes them very tardy in arriving at their destination.

On signing the Peace Treaty our Government will find itself with a great many 110-foot sub-chasers on its hands. These boats have been described as well built, fast and seaworthy. Why could they not be worked over somewhat, under the supervision of a competent naval architect and make excellent coast guard boats?

With decks fore and aft raised and heavily crowned, steel water-tight bulkheads, steel deck house and pilot house, large ventilating stack, to insure good ventilation when everything is battened down and a pair of heavy towing bits, these boats should be able to go anywhere, regardless of weather conditions and do real work in saving lives and property.

In putting these boats into this service the Government might receive the benefit many times of the expenditure of their cost, even at war-time prices.

Of this much I am positive; that we need just such a boat here at the entrance of Coos Bay, and I wish the picture on the front of your issue of the SCIENTIFIC AMERICAN of January 25th, 1919, showing one of these boats taking off wounded soldiers from the stranded "Northern Pacific" could be placed on the desk of every official of the Coast Guard Service at Washington.

It might cause them to awake to the fact that standard equipment of 50 years ago, even with a gasoline engine added is not sufficient for present necessities.

CLARENCE A. PENNOCK.

Marshfield, Ore.

### An Absurd Figure

To the Editor of the SCIENTIFIC AMERICAN:

In your issue December 7th, 1918, I note an article entitled "The Saving Grace of War," dealing particularly with by-products of manufacturing industries. On the article, as a whole, I want to congratulate you, and hope it will be followed by other articles of similar tenor. In the distilling business what might be termed "by-products"—that is, the feed recovered, is now becoming the principal product, and I have no doubt same will apply to other lines of manufacture.

In the article above alluded to on page 464, you say:

"One company is distilling from this waste of the vats 500,000 gallons a day of alcohol, which is identical with that obtained from the best grain and which bears no resemblance to the ill-smelling wood spirits. This product releases cereals for food and provides a valuable fuel for the arts of peace and war. This cooking liquor can also be condensed to the consistency of molasses. The light brown compound which results is much in request by the foundries, which just now are overwhelmed by Government contracts. They are paying from 13 to 15 cents a gallon for it to mix with the sand of their molds. Its adhesive qualities insure the firmness of the impression and lower the percentage of defective castings. As a binder in core making it is unexcelled."

The quantity stated, namely, 500,000 gallons (presumably daily) must be a mistake on the part of your contributor, as there was not that much ethyl alcohol produced even during the war when it was needed so badly for munitions. It is well to bear in mind that every time one of the big guns is fired, it requires the use of one barrel of alcohol.

JAMES THOMPSON.

Louisville, Ky.

### A "Sharp" Horse Shoe Wanted

To the Editor of THE SCIENTIFIC AMERICAN:

The most urgent want of horsemen at the present time, is a horse shoe which will enable a horse to be driven or ridden safely on tarred automobile roads.

In this country a competition was started offering \$500 for the best horseshoe for this purpose. There were 850 shoes submitted, but none fulfilled the conditions. The least unsatisfactory was one having a rubber bar at the back, the next one having rope embedded in the shoe, the third just the plain smooth flat shoe!

This competition shows that nothing has yet been invented.

In my opinion if a shoe should be made which, *always*, however much worn, *has a surface like a sharp file*, the problem would be solved.

Is there any file made which self-sharpens as it is used, something, perhaps made up of two substances in sharp angled crystals, one soft and the other hard.

This subject is of immense importance, not only to horse owners and breeders, but even for the preservation

of the horse species, as nobody will keep horses, if they cannot stand up and work on tarred roads.

Already the pleasure horses in this town have been almost reduced to nothing.

This is the London "Season" and whereas, till some ten years ago, the parks were so packed with horse pleasure carriages that the horses had to be constantly stopped in the congested traffic, now, yesterday, in Hyde Park at the most fashionable hour, besides myself, who was driving an American speed wagon with a pacer, there were only three other horse drawn vehicles in the Park; this was because the roads are so tarred that it is dangerous to drive horses with the present horse shoe.

If you would kindly publish this letter in your paper perhaps we horse owners may hear of some remedy for our trouble, and be able to prevent our horses from falling and breaking their legs.

WALTER WINANS.

London, England.

### Rolling 45-Ton Boilers for a Distance of 21 Miles

IT is one thing to rescue the boiler plant of a stranded ship from the clutches of the sea and quite a different matter to move the salvaged boilers to a point where they may be put into service again.

Late in the fall of 1917 the steamship "Bear" went aground on the northern coast of California. It was impossible to haul the vessel off the sands and the only alternative was to salve as much of its cargo and fittings as possible. Thanks to the activities of the U-boats the ship's plant represented a high market value. There were six boilers in the vessel each worth about \$5,000 and after the smaller stuff had been taken out of the ship the boilers were removed. The plan was to take them to Eureka, Cal., whence they were to be shipped to Shanghai and be installed in another hull. But here were the boilers on a desolate coast, with no means of transportation at hand, and Eureka the nearest port lay some twenty-five miles to the north. It was no small task to move them. They were 12 feet long and 13 feet 8 inches in diameter and they weighed 45 tons each.

The first suggestion was to ship them by sea and it seemed like a reasonable suggestion. They did not have to be loaded on a ship because they would float if their tubes were sealed and so the tubes were closed with wooden plugs. But it proved a very difficult job to launch the big steel boilers. Efforts were made from time to time, but without success and almost a year elapsed before that plan was abandoned. The only other alternative was to roll the boilers along the coast to Humboldt Bay and that was no simple task. A roadway would be required for the boilers to roll upon. In places the rocks came down to the water's edge and a passageway would have to be blasted through them. There were two rivers to be crossed. The boilers themselves were of such large diameter in proportion to their length that they would be very unwieldy. Nevertheless a Eureka company contracted to perform this strange moving job.

Timbers were laid along the beach to keep the boilers from sinking into the sand and a donkey engine was set about a quarter of a mile from the boilers. A ¾-inch line was attached to the frame of the donkey engine and laid along the roadway. The line passed under a boiler and thence back over it to the winding drum of the engine. As the engine wound up the line the boiler was rolled along the roadway, but it showed a tendency to swing off to one side or the other. However, this difficulty was overcome by pulling the ground line to the side by means of a team of horses. For instance if the boiler headed off to the right the ground line would be hauled to the right so that the bight of the line would be shifted toward the right end of the boiler and bring it back into alignment with the roadway. The team was hitched to a block on the line and as the boiler rolled up to the block it was loosened and slipped ahead. The movers became expert at correcting the rolling of the boilers and were able to do this without stopping the engine. In this way the boilers were rolled, one at a time, in stages of a quarter of a mile, for a distance of 21 miles.

There were frequent delays while the roadway was being prepared. Often work was interrupted by tide and storm. In some places the movers had to wait for low tide before they could roll the boilers around a rocky point that reached down to the water line.

The Bear River which was the first stream encountered did not bar the rolling process. A ford was found and the boilers were successfully rolled through it. At the next river, the Eel, no convenient ford was to be had. Here the boilers were loaded on a barge and towed, one at a time, to a spot two miles away where they could conveniently be landed and rolled again. At Humboldt Bay the boilers were all loaded upon a single barge and towed to Eureka bringing this unique moving operation to a successful conclusion.

# When Freight Cars Bump

## Recent Tests of Draft Gears, and the Resulting Developments

By Prof. J. Hammond Smith, Department of Civil Engineering, University of Pittsburgh

IN the early days of railroads, car couplings and draft gears did not receive much consideration. In those days the engines and cars were light and moved at comparatively slow speeds. But in the development of railroading, the tendency toward heavier engines, cars, car loadings, and higher speeds has been decidedly pronounced. And as a result, lack of adequate shock absorbing devices between cars is the cause of enormous losses in broken and damaged cars, as well as damage to the lading of merchandise which shifts with each impact. This annoying and destructive effect is felt in all classes of traffic, including the passenger service. Therefore the scientific study of principles, and the application of improvements in car couplings, and shock absorbing devices, are of prime importance. Recently, these problems have been receiving very earnest attention from the railway engineering societies, and especially from some of the foremost railway-mechanical engineers of the country.

Louis E. Endsley, Professor of Railway-Mechanical Engineering, at the University of Pittsburgh, has devoted special attention to couplings and draft gears for all types of cars. In order that better data for the designing of draft gears might be available, tests to determine the impact between cars in switching service have been successfully completed. Fig. 1, is a plan view diagram showing the application of the apparatus used in determining the relative velocities and impact forces between cars when switched together at speeds up to eight miles or more per hour. A stretch of track with a uniform downward grade from A toward D, so that the cars would just stand on the track without shifting downward, when the brakes were off, was selected. The string of cars, B, C, D, etc., were coupled together, but before each test, the slack in the couplings and draft gears was taken up; so that the cars stood on the track with practically no stress on the couplings between them. Impact, as in switching, was produced by allowing car A to run down the track against car B at velocities measured by means of a stop-watch. A diagram of the impact recording apparatus (a photograph of which is shown at D, in Fig. 3) is shown adjacent to car B, which was to be tested for impact received from moving car A. This instrument was mounted on a rigid stand at suitable height and distance from the track. E is a chronograph cylinder, rotated at constant known speed by a storage battery motor, having its axis parallel to the track, and on which paper for receiving the autographic record was mounted. A guide bar F, parallel to the axis of the cylinder, carries the pencil block P, which was connected to the car at a point on the outside sill, by means of a link G, which was also parallel to the axis of the cylinder.

This apparatus is therefore capable of showing the relation between time and the velocity of car B, at any instant; and since the variation in velocities during the hundredths of seconds may be determined, accelerations can be determined with accuracy. J, E', H, in Fig. 1, represents a record from cylinder E developed, H J being the circumferential line traced by pencil P, before impact. At impact, car B is thrown to the left and as its velocity increases, the pencil is drawn away from the zero line H J, thus forming the raised portion of the curve as shown at E'. Since the maximum slope of the curve, between J and E', is a measure of the maximum velocity of car B, and since the weight of car B, with its load, is known, its kinetic energy may be determined by the formula:

$$K = \frac{1}{2} \frac{W}{g} v^2,$$

In which K = kinetic energy of car in foot-pounds, W = total weight of car with loading in pounds, v = maximum velocity of car in feet per second, as determined from the autographic record, and g = gravity acceleration, taken as 32.2.

Thus, when car B, with load, weighs 248,000 pounds, and the maximum velocity is 2.4 feet per second:

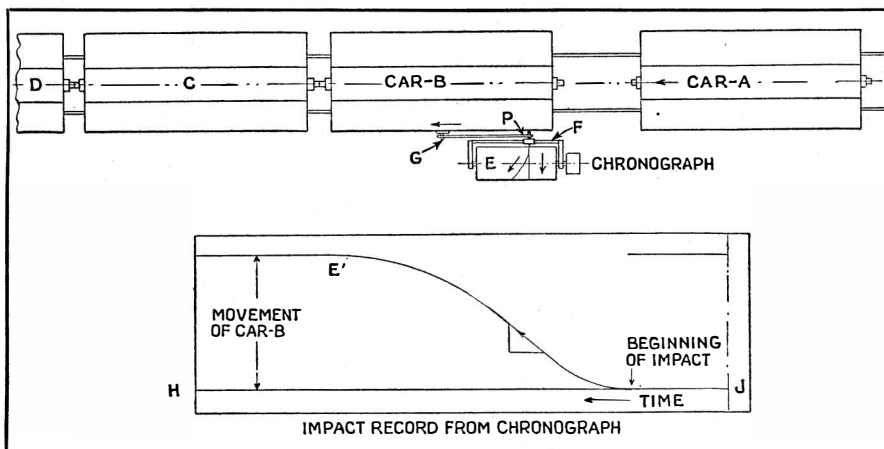


Fig. 1. The apparatus for measuring switching impacts between cars, and a sample record

$$K = \frac{1}{2} \frac{248,000}{32.2} (2.4)^2 = 22,100 \text{ foot-pounds.}$$

The kinetic energy of car A may be determined by means of the same formula. For example, using data from the same test as that considered above:  $W = 248,000$

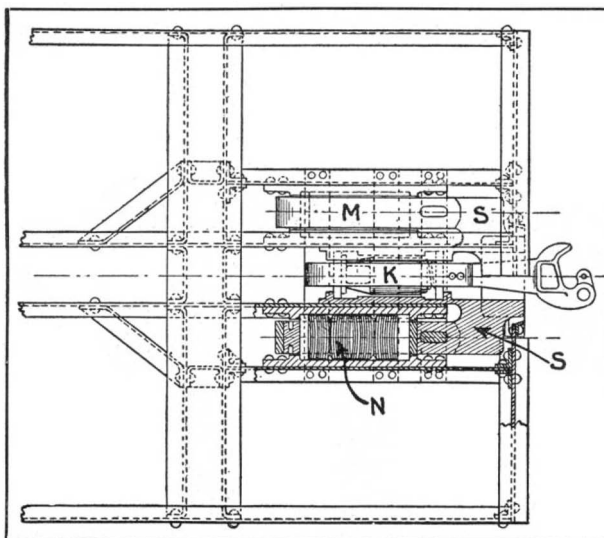


Fig. 2. The newly designed draft gear, with primary and secondary elements for withstanding heavy impact

pounds, and  $v = 5.55$  feet per second, from which K, for car A, is found to be 116,500 foot-pounds. If no kinetic energy had been dissipated during impact, one-half of car A's kinetic energy would be transmitted to car B, (since the two cars were of equal weight) but from the

above computations, we find a loss of  $116,500 - 22,100 = 94,400$  foot-pounds. This energy must have disappeared in the form of friction. Some of it was absorbed in the draft gears, some by the shifting loads, and the remainder was used up in straining and destroying both cars A and B.

Impact force on car B, may be determined by means of the formula:

$$F = \frac{W a}{g}$$

In which F = force in pounds on car B, W = weight of car B with load, in pounds, a = acceleration of car B, in feet per second, and g = gravity acceleration, taken as 32.2.

Now in order to find the maximum force F, it is necessary to substitute the maximum value of acceleration a. This may be obtained from the autographic record E', Fig. 1, by finding the largest difference in velocities of car B at successive intervals of a hundredth of a second. For example, if the total weight of car and load is 248,000 pounds, and the maximum value of a is found to be 91.4, substitution in the above formula gives  $F = 702,000$  pounds.

In these tests, the maximum force of impact was always found to take place before car B had moved more than one inch from its position before impact. The damage from impact would be just as great as if car B stood alone, if it had one inch of slack in its coupling next to car C.

There are many types of draft gears, but all may be placed in either one or the other of the following classes: (1) Draft gears in which springs are used to absorb and distribute, and thus alleviate the sudden shock. (2) Draft gears having friction devices supplemented by springs, for absorbing a part of the impact energy.

These types have single primary shock absorbing units, which are capable of absorbing shock up to the limit of their capacity, which is usually not over 200,000 pounds, with a movement of two and a half inches. But when the shocks are heavy, as in rapid switching service, where the pressures, with ordinary car construction, with no absorbing medium, may reach approximately 1,000,000 pounds, draft gears having single absorbing units have been found inadequate. Great loss in damaged cars and damaged shipping is the result.

A new design of draft gear, by Professor Endsley, contains features intended to overcome the defects of the older types. In addition to the primary shock absorbing element, as used in the older types, he employs a secondary element to take the heavy shocks after the primary element has reached the limit of its movement. As shown in Fig. 2, the primary draft gear K, is centrally mounted in the floating gear carrier S, in which are mounted the twin secondary draft gears M and N, the stops of which are rigidly connected to the sills of the car. The springs and friction members of the secondary gear are under initial strain, so that the shock first produces movement in the primary gear until it is nearly closed, when movement begins in the secondary gears. The primary gear will close at approximately 200,000 pounds, and the secondary gears under a pressure of 500,000 pounds. Thus, the heaviest shocks, whether they be tensile or compressive, may be dissipated without injury to the car, and with a minimized injury to the contents of the car.

Fig. 3, shows the laboratory apparatus used in testing draft gears and car sills. The draft gear to be tested is mounted within the heavy sills C, carried by the front end of the 30,000-pound car B, which is free to roll on a straight level track. The impact is produced by a 15,000-pound pendulum hammer, shown at A. The autographic recording device, shown at D, is the same as represented in Fig. 1, at E. The axis of the cylinder being parallel to the car track, and the tracing pencil connected to the car by means of a link G.

In making tests, the car is first moved toward the hammer, which is hanging in

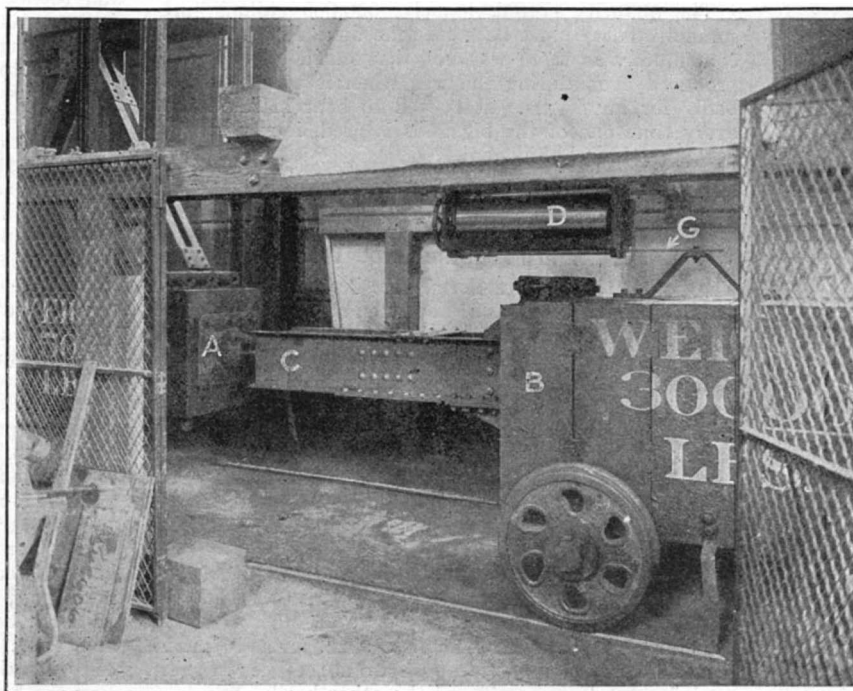


Fig. 3. Apparatus used in testing draft gears and car sills. D—Impact recorder

(Continued on page 615)

# Stefansson in the Arctic

## A Summary of What Was Done in the Five Years of the Canadian Expedition

By John G. Holme

AN area of approximately 250,000 square miles, or about one-fourth of the theretofore unknown region north of Alaska, was explored by Vilhjalmur Stefansson, head of the Canadian Arctic Expedition, who has returned to civilization after spending a little more than five years north of the Arctic Circle. The purpose of the expedition was to explore as much as possible of the unknown area, gather scientific data on marine and terrestrial life, meteorological conditions, ocean currents, and incidentally map and survey imperfectly known islands within easy reach of the expedition. In scientific circles throughout the world, the keenest interest, of course, was centered on the old question of whether the Polar Basin extended over this area of approximately 1,000,000 square miles, or whether a land complex existed west of the known limits of the Canadian Arctic archipelago.

This question remains unanswered, although Stefansson did discover three islands of considerable size. But all of them are within or adjacent to the archipelago area. Stefansson, accompanied by two white companions, Andreassen and Storkersen, made a remarkable ice trip across the Beaufort Sea in the spring of 1914, going almost due north from Martin Point, and following a line between meridians 141 and 142 west to about 74 north latitude, thence in an easterly direction to Norway Island, off the northwestern coast of Banks Island, a total distance of about 700 miles. In the following spring, Stefansson with three companions, Andreassen, Storkersen and Thompson, made another ice journey over the Arctic Sea, this time starting from Cape Alfred, the northwestern point of Banks Island. The explorer went northwest by north, more than three hundred miles, then made a loop in a southeasterly direction to the southwestern point of Prince Patrick Island.

On both these extensive ice trips and on subsequent ice excursions covering lesser distances, such as his trip in 1916 from First New Island to Cape Isachsen, Ellef Ringnes Island, and thence to Second New Island, Stefansson took frequent soundings, observed the ocean currents, ice drifts and prevailing winds. The result of this data, the explorer states, perhaps indicates the existence of land westward in the unexplored region, but these indications cannot, of course, be regarded as proof.

On the 1914 trip from Martin Point, a line of soundings was run from the Alaskan coast northward between meridians 141 and 142 West to about 73 North and thence east to Norway Island. The continental slope north of Alaska was found to be of a steep and probably uniform grade, while west of Banks Island, there were three well marked terraces between the depths of 200 and 1,200 meters. The continental shelf extends 40 to 50 miles off shore. Once the continental shelf was passed, Stefansson found no bottom at 1,386 meters. On the 1915 trip from Cape Alfred to Prince Patrick Island, Stefansson found McClure's Strait between Banks and Prince Patrick Islands, under 500 meters, while the continental slope off Land's End, Prince Patrick Island, resembled that west of northern Banks Island. Soundings taken between the islands of the northern archipelago ranged from 50 meters in Hassel Sound to 450 meters in Melville Sound between Melville and Victoria Islands.

The drift of the "Karluk" from Camden Bay, Alaska, to the vicinity of Wrangell Islands confirmed the westward drift north of Alaska, near shore, but

Stefansson's observations 200 miles north of Alaska showed a marked tendency of the ice to move eastward. He found a strong current to the south or southwest, west of Banks and Prince Patrick Islands, quite as strong as the westward current along the Alaskan coast. Stefansson found no evidence of any current west and north of the new islands. The prevailing currents in Melville Sound appeared to be toward the east. The prevailing winds north of Isachsen land was found to be north or north by west, the next strongest being south by east. Several places in the archipelago showed marked local magnetic disturbances, the most pronounced being in southern Banks Island. The ship's compass, carried by the expedition, became entirely unreliable a mile off

finish in 1852, completed the north coastline of Victoria Island, and mapped the coastlines of Emerald Isle and Fitzwilliam Owen Island, off Prince Patrick Island. Both the shores of Hassel Sound between Ellef Ringnes and Amund Ringnes Islands, were rectified, and the average width of the sound proved to be over 15 miles, instead of five miles as had been represented. Large parts of the coastline of Banks Island were remapped.

First New Island was sighted by Storkersen on June 18th, 1915. This is the largest of the islands discovered. The coast where the explorers landed was low, but mountains were seen in the distance toward the east. The party penetrated 20 miles inland, and from a height of 2,000 feet, observed still higher hills at a distance of

50 miles north and east. Stefansson followed the south coastline about 100 miles, then started toward his winter quarters at Cape Kellett, Banks Island. In the following spring, 1916, Stefansson skirted the northern coast of First New Island, charting the coastline, and with four white men set off across the ice toward Ellef Ringnes Island, touching its northwestern tip, and continuing in a northeasterly direction. In June, Second New Island was found. The explorers returned by the way of Hassel Sound, establishing the non-existence of King Christian Island, supposed to lie south of Ellef Ringnes Island, and found Third New Island, east of First New Island, August, 1916. The mythical King Christian Island proved to consist of several small isles such as may be found anywhere in the archipelago region. Former explorers had taken these isles to constitute one large island.

The location of the three large islands is about as follows: First New Island lies northeast of Prince Patrick Island. Its northern tip, Cape Mamen lies in 78° 30' N. and 108° W.; southeastern tip, Cape Mackay, 77° 50' N., and 110° W.; southern tip, Cape Beuchat, 77° 15' N., and 113° W.; southwestern tip, Cape Murray, 77° 55' N.,

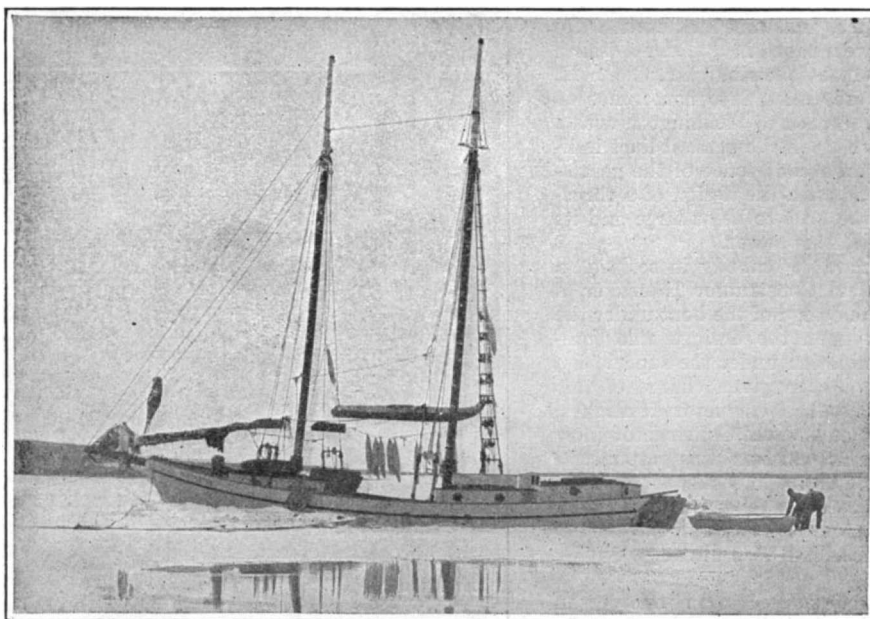
and 114° 30' W. Second New Island lies North of Ellef Ringnes Island, and West of Axel Heiberg Island. Its salient points lie as follows: southwestern corner, 79° 50' N., and 102° W.; northern corner, 80° 12' N., and 100° W.; southeastern tip, 79° 40' N. and 99° W.

Third New Island is the smallest of the three. Its southern tip lies approximately in 77° 9' N., and 107° W., and its northern tip in 77° 55' N., and 108° W. Stefansson also found a small island off the northeastern tip of Victoria Island in the summer of 1917.

All the new islands were covered with vegetation, and supported Arctic life except Second New Island which is barren for geological reasons. Here Stefansson found

only Hutchins geese. The other islands had reindeer in considerable numbers. On Banks Island, not visited by white men since McClure was there in 1853, there were no muskoxen, although McClure reported having seen them there in large numbers. Stefansson believes that Eskimos have killed off all these animals of late years.

The Canadian expedition was one of the most elaborately equipped exploration ventures ever launched, the Canadian Government sparing no expense in making it complete for Arctic investigation. Stefansson left Teller, Alaska, June 27th, 1913, at the head of a party of 13 scientists, sailing on the whaler, "Karluk," commanded by Captain Robert Bartlett. Stefansson is an anthro-



The "North Star," Stefansson's most valuable ship, in the ice

shore, and Stefansson believes this may constitute a great danger to whalers.

The newly discovered islands as well as the Ringnes Island displayed indications of rising. Stefansson reports observing raised beaches, sea-shells on the land, while elevated drift wood on Banks Island appeared to prove that this island had recently begun to rise. Melville Island also showed evidences of rising.

In addition to discovering three fairly large islands and many smaller ones, Stefansson proved the non-existence of the so-called King Christian Island, which he found to consist of some small islands. With the aid of his companions, he mapped the northwestern coast of Prince Patrick Island which McClintock had been unable to



Chipman and Cox taking observations



An unofficial attaché of the expedition

(Continued on page 615)

# America Flies the Atlantic

## The Design and Development of the NC-4 (Navy-Curtiss Flying Boat)

THE genesis of the plan of the Navy Department to provide able, sea-keeping airplanes for deep-sea work is to be found, so far as the Navy Department records are concerned, in a memorandum by Rear-Admiral D. W. Taylor, Chief Constructor of the Navy, bearing date of August 25th, 1917, which reads as follows:

"The United States Motor (Liberty) gives good promise of being a success, and if we can push ahead on the airplane end, it seems to me the submarine menace could be abated, even if not destroyed, from the air.

"The ideal solution would be big flying boats or the equivalent, that would be able to keep the sea (not air) in any weather, and also able to fly across the Atlantic to avoid difficulties of delivery.

"Please think it over very carefully, particularly as to the method of procedure to develop something as close to the ideal as possible."

A few days later than this, Commander G. C. Westervelt, Naval Constructor, who had just returned from abroad, where he had received every opportunity to examine what was being done in the design and construction of airplanes and seaplanes of large sizes, and J. C. Hunsaker, assistant for aeronautical purposes to the Bureau of Construction Repair, were called in by Rear-Admiral Taylor to discuss this subject. On September 10th following, Mr. Glenn H. Curtiss and two of his technical assistants were called into conference at Washington, and shortly after that, Mr. Curtiss returned to Washington with a tentative suggestion for a large flying boat drawn upon the general lines indicated by the Chief Constructor. As the result of a conference of the gentlemen mentioned above, it was decided to go ahead with the design of a three-engine flying boat of about 1,000 horse-power, the boat to be as large and its radius of action as great as could be produced with this power.

After a number of features which it was desired to embody in so large a boat had been worked out under Assistant Naval Constructor Hunsaker, a contract was made with the Curtiss people for the design of the boat under the supervision of the Navy Department. Work upon the designs was commenced early in October and was carried to completion under the supervision of Naval Constructor Westervelt, to whom had been given charge of this work, with whom were associated Assistant Naval Constructor Hunsaker, representing the Bureau of Construction Repair, and Naval Constructor (now Commander), H. C. Richardson. Commander Richardson was responsible particularly for the boat hull, a most important feature in a successful flying boat. The use of a short type of hull, with the tail supported upon it by means of an auxiliary outrigger construction, was the suggestion of the Curtiss people and was based on a small flying boat which had been already built by them.

Speaking of the details of the design it cannot be ascribed to any one person or organization; wherever an idea of value was picked up or was brought to the notice of the designers, it was studied and, if found useful, adopted; in fact the widest catholicity of spirit was used throughout the whole enterprise. The Navy is showing a commendable generosity in giving credit wherever it is due, as for instance, in respect to many of the most important structural details such as the ribs, wing posts, compression struts and wing beams, which are generally similar to those of the Handley-Page night bombing airplanes, definite information regarding these details having been obtained by Naval Constructor Westervelt during a recent trip to England.

Early in the development of the enterprise, the first large flying boat was designated as the NC-1, in which N stands for Navy, C for Curtiss, and the figure 1 indicates the first of a series of boats of this class. It was in December, 1917, that a contract was arranged with the Curtiss people at Garden City, New York, for the construction of four NC boats, and because of their great size, the Navy Department erected a special building at Garden City for the building and assembling of the boats, two of which can be assembled at one time in the building.

The first design called for a boat of 25,000 pounds gross flying weight, with the following dimensions:

Span 140 ft.; area 3,370 sq. ft.; loading 7.5 lbs. per sq. ft.; weight 25,000 lbs.; load 25 lbs. per B. H. P. (normal power); fuel 8,250 lbs. or 15 hours; crew 1,000 lbs. or 5 men; margin 750 lbs. or 1.5 hours; useful 10,000 lbs. maximum.

When the design had reached the point where it was possible to estimate its resistance and speed, it was found that the three Liberty engines would not develop sufficient power to obtain the desired results, and the weight and dimensions were accordingly cut down to the following:

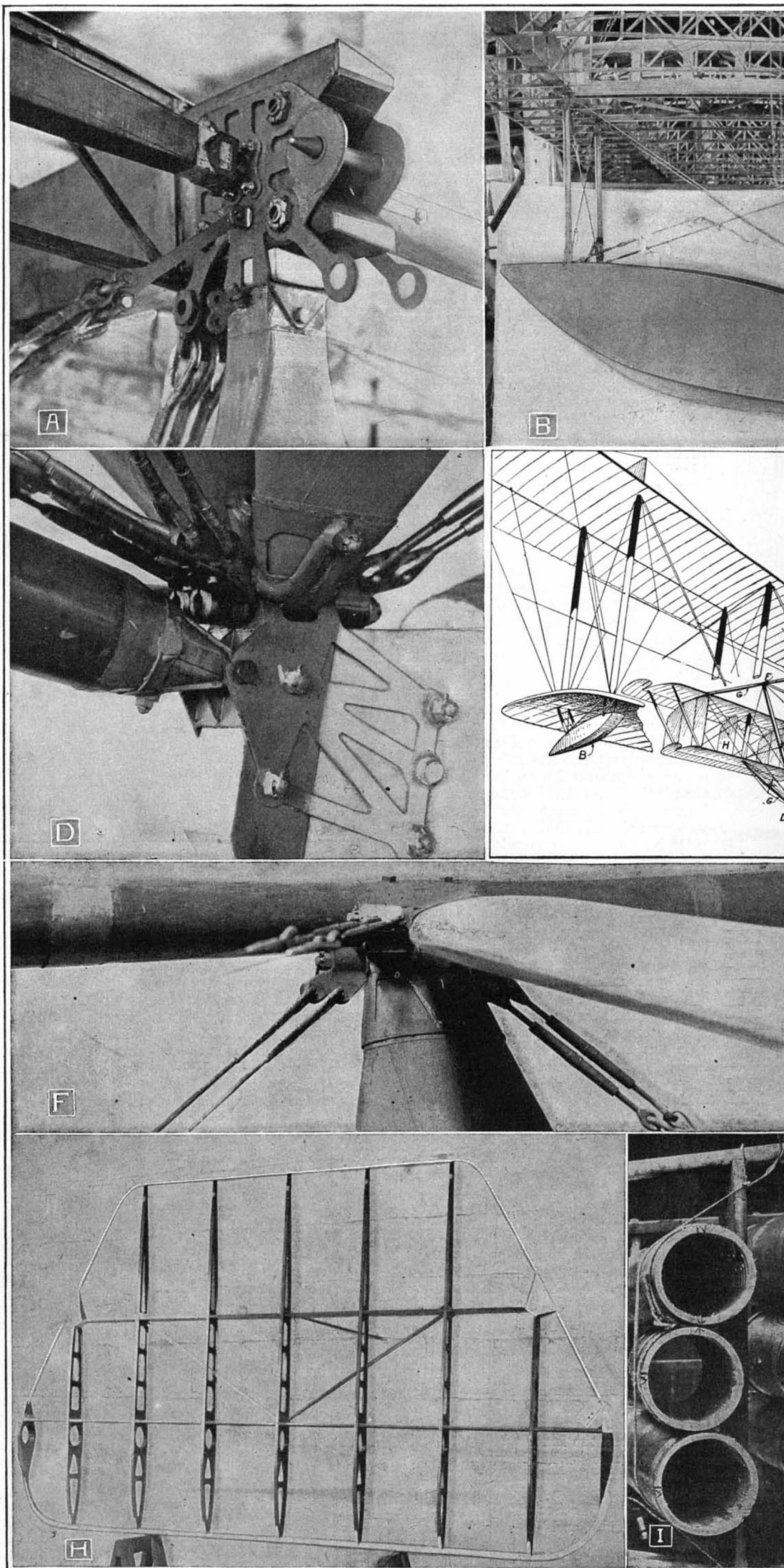
Gross flying weight 22,000 lbs.; span 126 ft. 0 inch; chord 12 ft. 0 in.; gap 13 ft. 6 in.; length overall 68 ft. 3½ in.; length of hull 45 ft.; total wing area 2,380 sq. ft.; engines, 3 Liberty; weight (empty but including water) 13,000 lbs.

The four NC boats have been worked out and completed upon the latter design.

Because of the great size of these craft, it was early realized that if they were to be built without serious delay, it would be necessary to construct them on the assembly basis. Under this system the different elements were given to manufacturers who already were turning out a product of a somewhat similar nature, or a product requiring workmen of qualifications similar to those of workmen ordinarily employed for work of the nature contemplated. After the various parts had been completed, they were to be shipped to Garden City and there assembled into the complete flying boat.

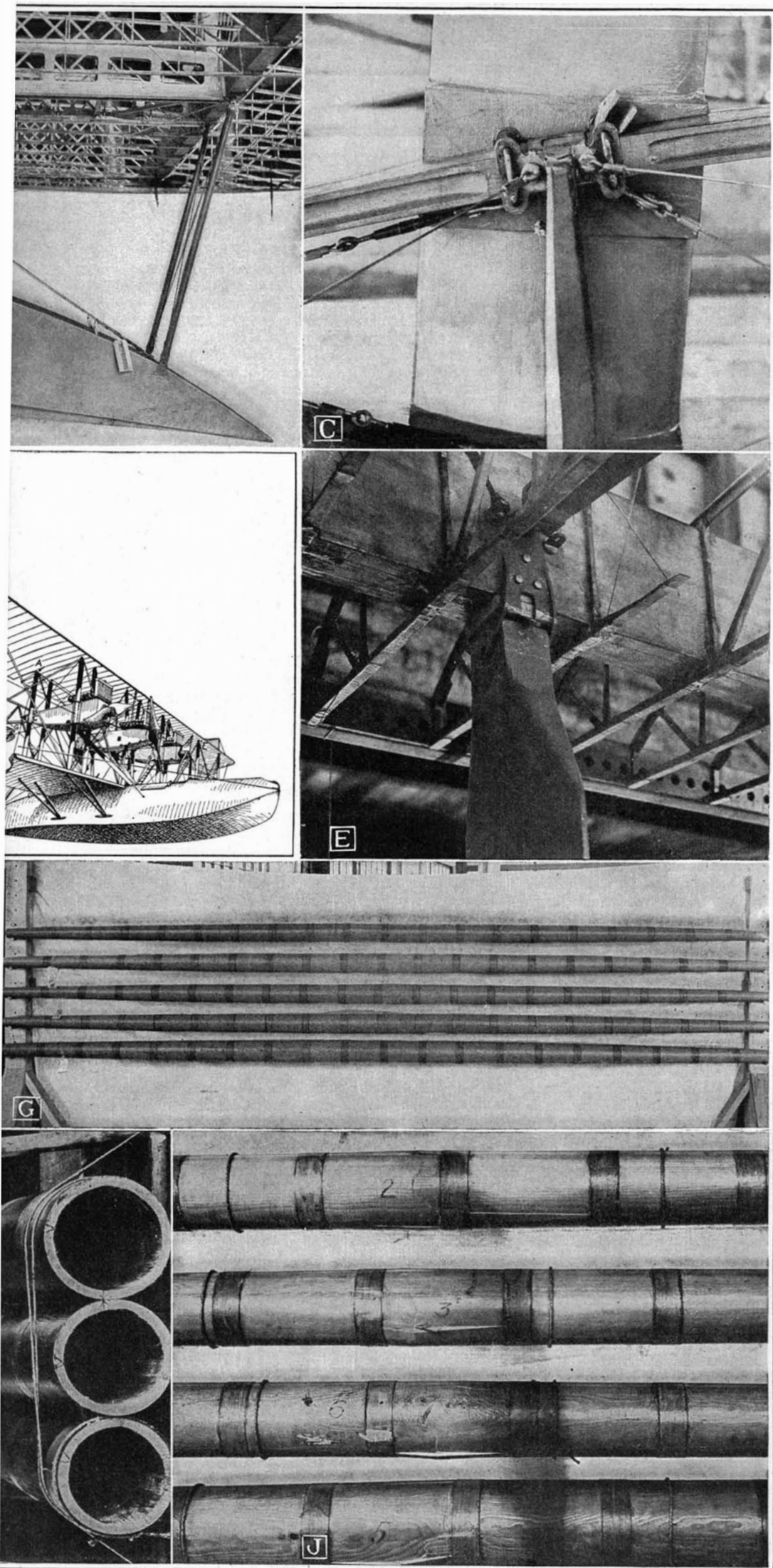
### The Boat Hull

Inasmuch as Chief Constructor Taylor in the memorandum referred to called for the construction of a flying boat that should "be able to keep the sea (not air) in any weather," it can be understood that the boat hull is one of the most important, if not the most vital, element in this deep-sea aircraft. For it can be readily understood that a boat capable of supporting on the water, and in rough weather at that, a gross flying weight of 28,500 pounds, the ultimate weight, is called upon to meet difficult conditions. It must be very



A. Wing hinge assembly. B. Trussed wing ribs; pontoon attached below. C. Attachment of nacelle to vertical strut and upper wing beam. D. Assembly at center of outrigger spars which carry the hull. E. Framework of the rudder. F. Outrigger spars, showing the hull structure. G. Framework of the rudder. H. Framework of the rudder. I. Outrigger spars, showing the hull structure.

DETAILS OF AN NC-4



nt. D. Junction of outrigger spars and boat. Center Sketch: Key drawing of an NC flying boat. E. Junction of elevator and rudder. G. Hollow wooden spars which form the three-sided outrigger truss. H. Light shells. J. Outrigger spars after being tested to destruction.

#### NC FLYING BOAT

strong and yet extremely light for its strength; and such it is. Two strong longitudinal trusses are incorporated in the structure of the hull and through them, largely, are the heavy dynamic stresses due to landing in rough weather, distributed throughout the boat. The cross-section of the immersed portion of the boat shows a V-section, which runs right up into the stem and serves, in landing, to cushion the impact of the seas. Contrary to popular belief, the hull is not a great obstruction to swift passage through the air. That is to say, its head resistance is not great. This is due to the fact that its form was designed to present the minimum air resistance when in flight, and in this respect it is believed to compare favorably with the resistance of the landing gear for an airplane of the same weight and size. Furthermore, the hull was designed with a view to securing a positive vertical reaction when the machine is in flight. As a matter of fact, the wind tunnel tests of a model of the boat showed an actual lifting effect of several hundred pounds at full speed.

#### The Wing Structure

As will be noted from our illustrations, the wing ribs are built in the form of trusses with vertical and diagonal members, and the beams are of hollow box-girder construction. The maximum depth of the wings is about 14 inches. Their chord is 12 feet. The struts are of hollow built-up sections and show a careful attention to stream-lining. Those who are familiar with the Handley-Page construction will see many points of broad resemblance.

#### Special Details

It is scarcely necessary to say that in the hands of our Naval constructors and the staff of the Curtiss Company, nothing in this powerful machine was left to mere guesswork. Just as in bridge design a skeleton strain sheet is drawn up with the maximum stresses indicated on every chord, post, diagonal tie, etc., so in the NC's the stresses were accurately determined and care was taken that nowhere should the elastic limit be exceeded. In order to handle the stresses that accumulate at the panel points, or points of intersection of struts, ties, etc., some very nice metal work designing was necessary, as will be seen by a study of the details shown in Figures A, D, and F. To provide against crushing or brooming up of the ends of the struts or posts, the steel pockets which received them are first lined with soft sheet copper, which, yielding under pressure, allows the end of the post to adjust itself with a fairly even distribution of pressure.

#### The Tail Outrigger

So large are these airplanes that one does not realize that the tail of the machine is as large in itself as some of the small fast scouting land planes; and to carry it far to the rear of the boat and the planes, and hold it firmly in place and in line, called for some very nice designing. The outrigger posts or beams were constructed by several of our best yacht builders, who have had experience in the construction of hollow masts for racing yachts. These beams are hollow and are heavily wrapped at intervals to add to their strength. The thinness of the shell is shown in Figure J, where several beams which have been tested to destruction, see Fig. J, are shown cut in two with the severed ends presented to the camera.

#### Fourth Engine Added

The first of these flying boats was completed in October, 1918, approximately one year after the commencement of the design and it was first flown on October 4th. It was apparent at once that the boats would be successful beyond the expectations of the designers. It was understood that had there been time to build and install geared-down engines for these boats, their performance would have been materially improved, but it has been impracticable to produce engines of this type of sufficient power, under the stress of war work, and as yet no such engines had been made available. Hence it was necessary, upon the approval of the trans-Atlantic project, to materially modify the engine arrangements and install a fourth engine. This was necessary to secure sufficient gasoline capacity to carry the boats over the longest stretch of the proposed trans-Atlantic flight, namely, from Newfoundland to the Azores. The work of testing out the boats and preparing them for their flights was done at the Rockaway Beach Naval Air Station, where special hangar and handling arrangements were provided. The station is on a narrow peninsular, on one side of which is the Atlantic Ocean and on the other the smooth water of Jamaica Bay, which latter affords water landing in any weather, while the nearness of the ocean makes possible the carrying on of ocean sea tests with minimum difficulty. It should be mentioned that outside of the long flights made in the trans-Atlantic attempt, on November 24th of last year one of these boats broke the world's record for passenger-carrying by making a trip with 51 persons on board.

#### Seaworthiness Must Be Improved

When Admiral Taylor in his memorandum called for special attention to seaworthiness, or the ability to keep the sea as against keeping the air, he laid his finger, as the event was to prove, upon a most important element in a trans-Atlantic flying boat. For the record of the trip shows that such is the uncertainty of the weather that for a boat to get through without risk to its freight or passengers, it must be prepared to come down and take whatever comes its way upon the surface of the water. NC-1 and NC-3 were put to this test, and so far as information has been given out, it looks to have been quite a severe test, one of the boats sinking while it was being towed to port and the other, pluckily navigated by Commander Towers, though it succeeded in reaching port, was so badly wrecked that it had to be dismantled and sent home. The damage in the case of one boat seems to have been due to the inertia of the center pair of engines proving too much for the strength of the struts which carried them. Perhaps it would have been better to have given additional stiffening to these struts when a second engine was added. The other plane seems to have been wrecked badly by the seas striking against the wing pontoons and against the under side of the wings themselves. In fact, its commander speaks of ripping the canvas covering, presumably to allow the seas to pass through, and preventing the heavy spanking which, of course, would have set up severe stresses throughout the whole framework of the plane, etc.

(Continued on page 616)

# World Markets for American Manufactures

Edited by LYNN W. MEEKINS

*A department devoted to the extension of American trade in foreign lands*

## Progressive Venezuela

FOURTEEN years ago the agent of an American manufacturer of farm implements stopped in Venezuela on his way through South America. Visiting Caracas, the capital of the republic, he met the president and was invited to inspect the chief executive's farm not far from the city. This trip resulted in the sale of several mowing machines, but hardly any other business was done by the agent in Venezuela. Consequently, his company decided that other markets were more promising. A number of American firms handling various lines had similar experiences, and up to five years ago the volume of our trade with Venezuela was comparatively small.

It has been more difficult for American exporters to sell goods in Venezuela than in other countries largely because of its customs regulations. Great care must be exercised in making out consular invoices, which have to be in Spanish. It is necessary to list each item exactly as it is described in the Venezuelan tariff law and fines are imposed for the use of ditto marks and abbreviations and for all errors. Especially noteworthy is the fact that making shipments with drafts attached to documents gives no security, for the consignee named in the consular invoice can obtain goods from the customhouse without presenting invoice or bills of lading. In recent years the establishment of branches of American banks in Venezuela has helped to overcome this obstacle. Import duties are levied upon gross weights, which must be marked upon all packages in kilos. (A kilo is about 2.2 pounds.) That means the lightest possible packing.

## Trade Leaping Over the Hurdles

The barriers just mentioned have not prevented our sales to Venezuela from more than doubling since 1914. With the high market price of coffee in Venezuela at present, there is every prospect for materially increasing trade with that country. We buy most of our southern neighbor's chief product and naturally we should like to keep our high place in Venezuela's import business. In this connection the following statement of a commercial agent of the Venezuelan Government, sent to the United States upon a special mission, is encouraging: "Venezuela is more interested in developing trade with the United States than with any other nation. We have a very cordial sentiment for your country and my Government desires the extension of commerce."

This envoy will recommend changes in the customs regulations that will make it easier for the American shipper to deliver his merchandise in Venezuela. He is conferring with the principal business men of the United States in order to learn the reasons for their failure to give his country more serious consideration. One great need is a rapid passenger and freight service from New York and New Orleans to La Guaira, the principal port of Venezuela, about 2,000 miles from each. In the past it has been possible to make the trip from La Guaira to Europe, a much longer voyage, in the same time as that to the United States. American capital for the development of agriculture, cattle raising, mining and other industries will be very helpful in stimulating the sale of our manufactures in Venezuela. "We want your business men to communicate with ours and to study not only the riches of our soil and the opportunities in our trade, but the peculiarities of our commerce and of our psychology," said a recent visitor from Caracas.

## What We Can Sell and How We Can Sell It

The principal groups of buyers in Venezuela are the Government, the petroleum and coal development companies, the large importing firms and the retail merchants. There are less than 600 miles of railways in the republic. More lines are needed to move agricultural and mineral products to the sea and to open extensive tracts for immigration. The Government is also interested in modern machinery for road building and improvement, such as graders, rotary sifters, stone crushers and other equipment. The expanding highway system will require numerous bridges, owing to the many rivers that must be crossed. Existing bridges are said to be narrow and inadequate and these must be replaced with better structures. One of the best bridges in Caracas was constructed by an American company. Public improvements of this sort are paid for by taxation and not by bond issues. Generally speaking, the Government requires credit for six months or longer. It is reported to be in a good financial condition at this time.

Two American corporations have opened petroleum wells in the northwestern part of Venezuela and another American company holds a valuable coal concession in the Maracaibo district. These and additional enterprises import large quantities of such commodities as preserved foods, iron and steel manufactures, and lubricants. Until December, 1917, approximately half of the import trade of the country was controlled by German and neutral houses which were then placed upon the Enemy Trading List of the United States War Trade Board. They handled everything from pins to gas engines, advancing money on crops and on agricultural products stored with them, which they purchased or sold abroad on commission. On the contrary, they bought from foreign manufacturers on a cash basis, selling to the Venezuelan retailers on their own terms.

## Dealing Direct Brings Best Results

Besides being the capital and largest city, Caracas is the center of commercial activities in Venezuela. Practically every company engaged in business in the republic maintains its principal office in Caracas and all general agencies should be located there. Somewhat more than a year ago an important American mercantile firm established a branch house in that city. Large stocks were carried from the start and business has increased with startling rapidity because this branch can sell to smaller merchants much more cheaply than they can import for themselves. On the other hand, one of the American banks in Caracas will take orders for goods and deliver them at the purchaser's warehouse with cost, freight, insurance and duties paid.

The standing of Venezuelan firms is high and excellent results have been attained by many American manufacturers who have granted them agencies. This is especially true of distinctive American products. There is no question that the most effective manner of expanding our sales in Venezuela is direct representation, through either an American branch house or a responsible native merchant. The Chamber of Commerce of Caracas, composed of the most substantial business men in the capital, will supply credit information to American exporters. It is essential to attend to the registration of trade marks before sending goods to Venezuela. This affords protection for a period of 30 years.

## Shoemaking a National Industry

Imports of shoes from the United States are insignificant because of the very high duty, \$274.10 per 100 pounds gross weight, which protects the local industry. Upper leather and shoe findings are purchased abroad, but the soles are made in Venezuela. American-made shoes bring from \$12 to \$20 per pair in Caracas, while domestic footwear, made to measure, of the best quality of leather, costs only \$7. Italy, France and Great Britain manufacture most of the hats sold in Venezuela. Spain supplies most of the hosiery. Good shirts, made locally, were to be had for \$1.50 during the war; this price will probably decline to \$1 in a few months.

An American firm has sold fair quantities of wearing apparel and other merchandise in Venezuela by parcel post. This method is growing in favor, primarily because no consular invoices are required and there can be no customs fines for mistakes in documentation. Our parcel post business is likely to suffer, however, from European competition, because the rates from Great Britain, France and Italy are lower than those from the United States. A Venezuelan law that requires the painting of the fronts of all houses in La Guaira and Caracas each year in May, just before the national Congress meets, is a factor influencing the steady importation of colors and varnishes. In 1918 more than three-fourths of these materials came from the United States. Cold-water paints are losing ground in favor of those mixed with oil. Importers accept paint in both paste and powder form, as well as ready mixed in packages similar to those used in the United States.

## Increasing Our Sales Force

MOST young Americans have a desire to see the world, but those who go abroad usually do not remain very long in foreign climes. The good old United States is the best country in the universe to live in and to work in. The result is that comparatively few American citizens take up their permanent residence abroad. This has naturally limited our foreign trade, for all our goods won't sell themselves—some will, but even those generally have to cope with a fair amount of competition.

Until American manufacturers can train adequately a sufficient number of young men to represent them in other countries, they would do well to pay attention to the more or less direct aid to be secured from the Americans who are now abroad and from the foreigners who are at present in the United States. For instance, an American missionary in India became interested in the agricultural development of his district and was instrumental in the introduction of American implements and machinery. Eventually he was appointed agricultural director of the important native state of Gwalior, about as large as West Virginia. Thousands of dollars' worth of business has come to American manufacturers from Central India because of this man's efforts.

The average American tourist starts out with the idea of pleasure before business, and little or none of the latter. When some American manufacturers go abroad, however, they derive a great deal of pleasure from attending to just a little business. The head of a nationally known confectionery firm, during his travels through China, saw the natives chewing betel nuts. "Why not American gum?" he pondered. Now Oriental jaws are trying the American product—and finding it delectable. Then there was the watch manufacturer who took a trip to South America for his health. His itinerary comprised a circular tour from New York to Buenos Aires, over the Transandean Railway to Valparaiso, up the west coast to the Panama Canal and thence back to New York. He stayed in Buenos Aires for several days and visited the principal jewelry stores. The watches that he saw were the ancient hunting-case timepieces that used to weigh so heavily in our pockets. American watches of up-to-date design are being sold in the Argentine capital today. The American manufacturer was told that they weren't desired, but he was sure that they would find favor—and they did. The same thing happened in Valparaiso.

## Those Who Come to See Us

Correspondingly, there are two class of foreigners in this country whose services may be enlisted. A young Brazilian, pursuing his studies at a western university, is devoting a part of his spare time to plans for the establishment of a 5-and 10-cent store in his native city upon the completion of his course. Most, if not all, of his stock will be purchased from American manufacturers. More than that, he will carry back to Brazil a liking for hundreds of our goods, and his father, who owns a large department store in Sao Paulo, will have to import them—for his son and for the people whom his son tells about them. Those educational institutions located in or near industrial centers should give their foreign students, at frequent intervals, the opportunity to visit factories where they can see how American products are made.

The other class is composed of foreign merchants who come to the United States to make their purchases or to seek agencies. There are more foreign buyers in this country just now than ever before and they have journeyed hither from all parts of the world. In one week visitors from 16 different countries registered at one travel bureau in an inland city. The manufacturer who desires foreign representation should exercise every effort to communicate with these travelers, and he doesn't have to try very hard, at that. The Bureau of Foreign and Domestic Commerce has seven branch offices that will keep him posted if he expresses an interest in the matter; so will scores of commercial organizations. These foreign visitors are usually trained men. It is the head of a firm or the occupant of an executive position of some sort who generally comes here. What is more, the house that he represents is likely to be of considerable size or it could not pay his expenses, travel being costly nowadays. Instead of being cordially welcomed, many such visitors experience hard sledding in the United States. More than a few manufacturers are not even friendly and fail to display the slightest interest. Needless to say, this lack of attention will be the occasion of deep regret later on. It is bad enough to disregard Opportunity's knock, but it is infinitely worse to slam the door in its face.

An exporter of many years' standing said that he never did business with a firm unknown to him personally. Although impracticable in most cases, there is no question of the high desirability of personal touch between the manufacturer and his customers and agents. So the American firm unable to send a representative abroad should cultivate the good-will of foreigners visiting the United States, and it should investigate opportunities suggested by Americans residing in foreign countries.

# Mechanical Equipment of the Farm

*Latest developments in agricultural machinery and practical suggestions for the farmer*

Conducted by HARRY C. RAMSOWER, Professor of Agricultural Engineering, Ohio State University



Loading the hay on a movable rack and shifting the load forward so that the rear half of the wagon may be loaded

## A Movable Rack For Loading Hay

ANYONE who has had experience loading hay after a hay loader knows that it is not an easy task to fork the hay to the front of the wagon and properly place it. Two men are required on the load if the work is to proceed as it should. The device shown on this page illustrates an effective way of overcoming this difficulty.

A movable rack half the length of the wagon rack is mounted on a track made of two-by-fours spiked or bolted to the rack frame. This movable rack has four flanged wheels which ride on this wooden track and which carry a steel frame with floor and standards. As shown in the illustrations this rack is locked in position at the rear end of the wagon rack and loaded to the full height. By means of a rope which runs to the top of the front standard the rack is unlocked and permitted to move to the front of the wagon. If unlocked while the team is walking the load will usually run to the front when the team stops. Some rigs are provided with a rope and pulley connected to the front standard on the wagon, to draw the load forward should the wagon be stopped on an up-grade. After this portion of the load is run forward the rear half of the load is put on.

The idea is to eliminate the second man on the load. The experience of a number of farmers indicate that there is a real saving in labor and the rig is especially appreciated by the small farmer who endeavors to do the most of his work himself. On the other hand, the large farmer can use two wagons, keeping one in the field at the loader, while the other is being drawn to the barn, only one man being required in the field.

Another advantage of this rig is found in unloading the hay with the customary hay-fork. As all who have had experience know, with a load put on in the usual way, there is tendency for the hay to hang together to such an extent that even though the fork is set well to one end of the load, a layer reaching from one end of the rack to the other is lifted into the mow. This frequently results in broken ropes or in stalling the team. When this device is used the load easily pulls apart at the middle and is carried up in a neat and satisfactory manner.

A number of farmers have rigged up a home-made device of this kind and have always been pleased with its use. Harry Smith, a farmer, of Osborn, Ohio, made the rig here illustrated some years ago and like it so well that it has been put on the market. If the testimony of users can be relied upon, the scheme will pay for itself in a few years through a saving in labor.

## Bean Harvesting Attachment For Farm Tractors

By Charles Alma Byers

WHERE beans are grown on a large scale, as in California, the harvesting of the crop naturally constitutes a con-

siderable task. It is, of course, done very largely by machinery, and improved methods are constantly being sought. And now, in the actual cutting of the crop, the farm tractor is to be introduced. This is made feasible by a harvesting attachment, which is shown in the accompanying illustration, recently invented by C. J. Gardner, a farmer-mechanic, of Huntington Beach,

runner may be raised or lowered, to place the knives at any required elevation, while a bar parallel with the knife assists in the windrowing. It has been found in practice that either one, two or three runners may be used, each harvesting two rows of beans, and naturally these runners may thus be spaced so as to operate at various distances apart.

The invention may also be used for the harvesting of peas, onions, garlic and similar crops, and is likewise adaptable to furrowing, bordering, weed-cutting, and so forth. The knives are, of course, removed for some purposes, and the beak-shaped runner may thus be used as a sort of double-edged plow.

## Grain Binder Troubles

AT least 90 per cent of the troubles encountered in the operation of a grain binder are confined to the binder head. The head contains the most delicate and complicated parts and both their construction, and functions should be thoroughly understood by the operator.

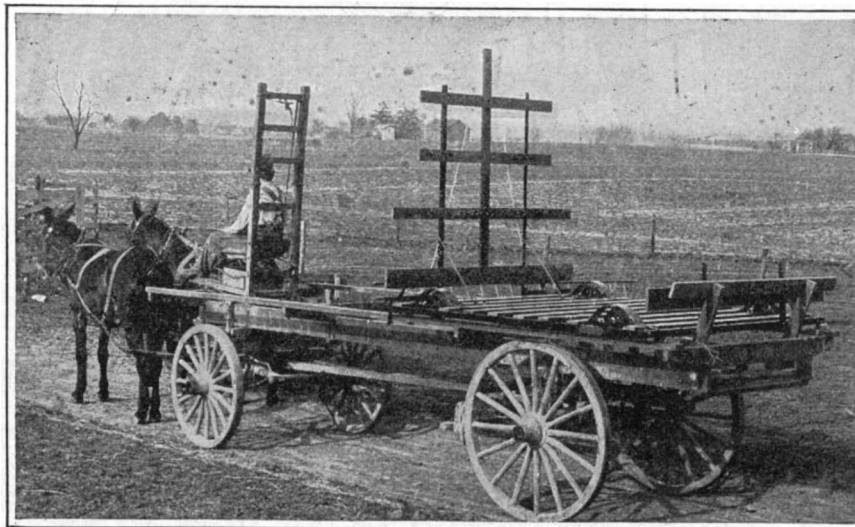
To completely master the common troubles listed here it will be necessary to examine a binder if the reader is not already familiar with one. The compressor arm mentioned is the arm against which the grain is forced by the packers, the trip arm is that part against which the grain is packed, pressure on which operates the compressor spring and the trip spring, which, in turn, releases the dog in the clutch at the front of the binder head, thus throwing the tying mechanism into gear. The trip arm and the compressor arm may be one and the same piece or each may be separate. The twine disk is the revolving, notched disk which receives the twine from the needle. One end of the twine is always held by the disk. The twine-disk spring controls the tension with which the twine disk holds the twine. The bill-hook is the tying device proper, across which the needle places the twine. The bill-hook spring controls the tension with which the bill-hook grasps the twine.

In order to increase the size of the bundles it is necessary to move the compressor arm out on its support bracket. To increase the tightness with which the bundles are bound it is necessary to tighten the compressor spring and sometimes the trip spring. The twine tension should never be tightened for this purpose.

Some of the common troubles are listed as follows:

1. *Loose Twine Disk.* The twine disk should hold the twine so tightly that a pull of about 50 pounds is required to draw it from the disk spring. If this spring becomes loosened, two conditions may be met with: (a) A band may be found clinging to the bill-hook with a loose knot in the end, while the free end has the appearance of having been cut squarely off. The trouble here is that the twine-disk spring was so loose that it released one end of the twine but the other end was placed

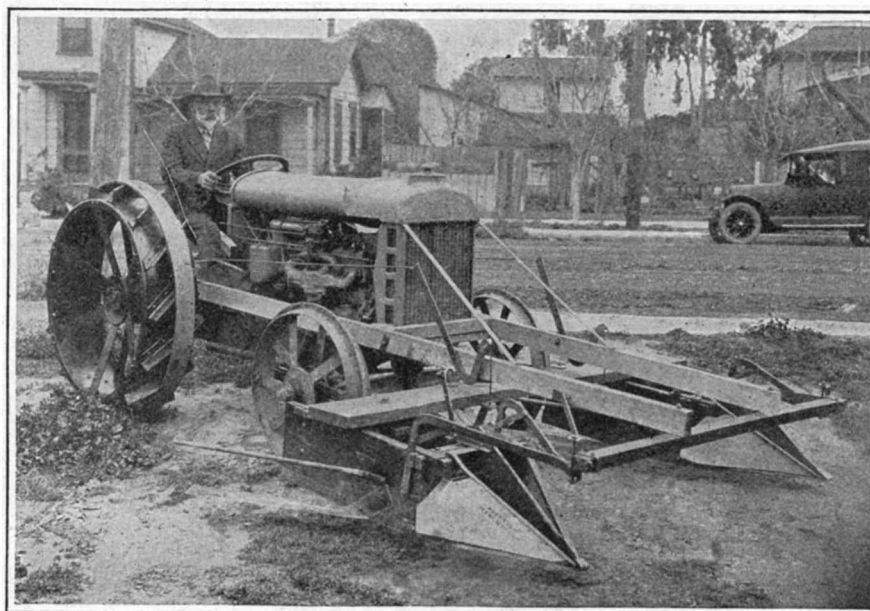
(Continued on page 616)



The one-man rack for loading hay

Cal. The attachment, which is fastened to the front of the tractor for pushing, cuts either two, four or six rows of beans at the same time, and in addition to cutting them leaves the crop thrown into windrows. The invention consists of a beak-shaped runner, to each side of which is bolted a rearward and outward extending knife. By means of levers, operated by the tractor driver, this

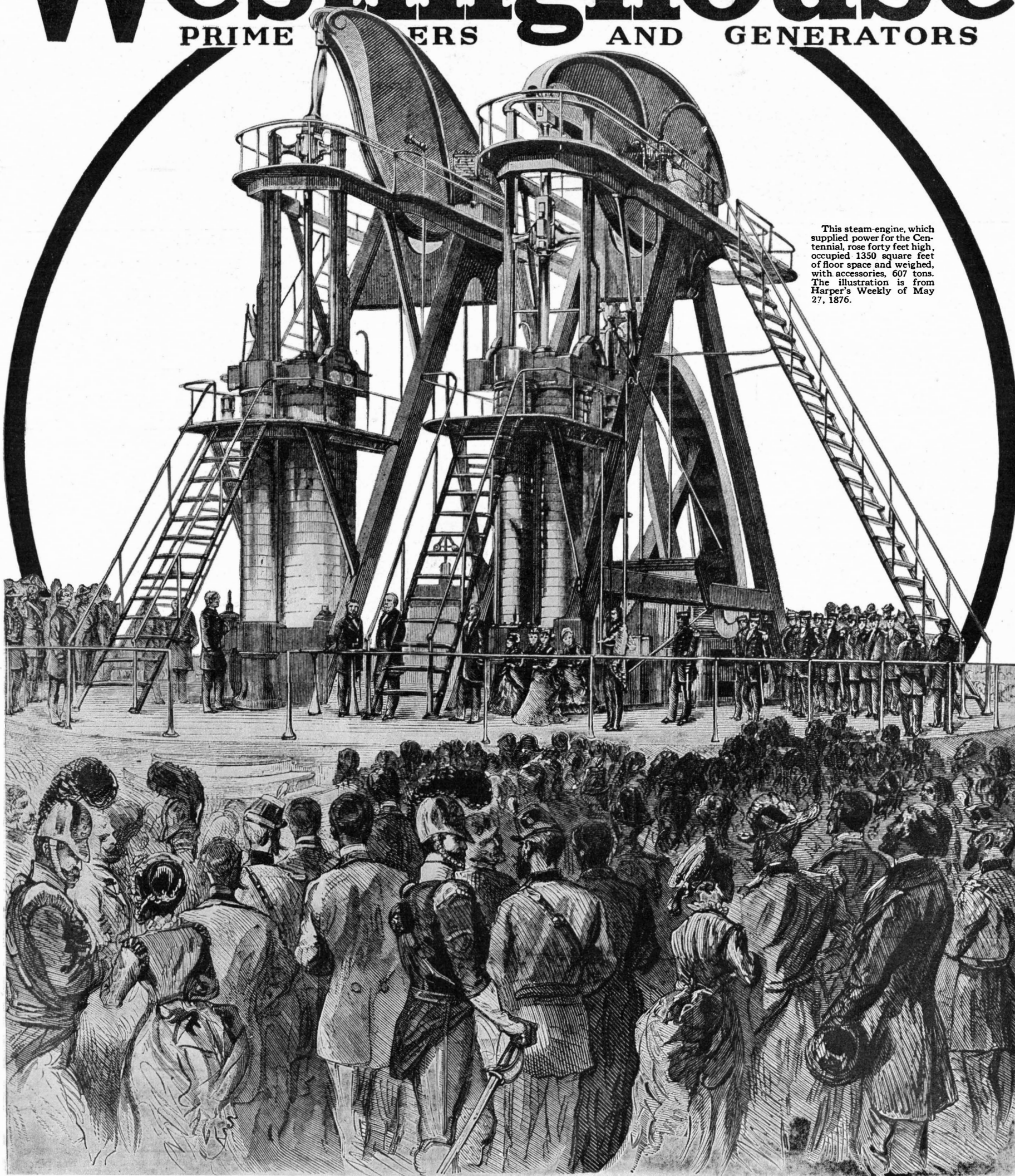
at the front of the binder head, thus throwing the tying mechanism into gear. The trip arm and the compressor arm may be one and the same piece or each may be separate. The twine disk is the revolving, notched disk which receives the twine from the needle. One end of the twine is always held by the disk. The twine-disk spring controls the tension with which the twine disk



A bean harvesting attachment for cutting four rows of beans

# Westinghouse

PRIME MOTORS AND GENERATORS



This steam-engine, which supplied power for the Centennial, rose forty feet high, occupied 1350 square feet of floor space and weighed, with accessories, 607 tons. The illustration is from Harper's Weekly of May 27, 1876.

OUR CENTENNIAL—PRESIDENT GRANT AND DOM PEDRO STARTING THE CORLISS ENGINE.—FROM A SKETCH BY THEO. R. DAVIS.

# Westinghouse

## PRIME MOVERS AND GENERATORS

### Dwarfing the Giant's Might

When President Grant started the mechanism, and the mammoth Corliss engine in Machinery Hall began to throb with life, crowds at the Philadelphia Centennial witnessed what the world in 1876 proclaimed the crowning glory of steam-engine development.

Today, scarcely more than two score years later, Westinghouse Steam Turbines, in size but pigmies beside the "grand mechanical monument" of 1876, are producing five times the power from the same fuel—power that lights great cities, turns the wheels of countless industries, drives ships across the seas and performs various other important tasks.

With all its great size—it occupied 54,000 cubic feet of space—the Centennial giant delivered 1400 horsepower. A Westinghouse Turbine of the same capacity would require but 115 cubic feet.

This advantage alone makes the steam turbine one of the out-standing achievements of the past quarter century. Because of it, the public annually saves millions of dollars.

To the ship-owner, this economy of space means more cargo—to the shipper quicker service and lower rates.

To central stations and electric transportation companies it means greatly decreased investment in real estate and buildings or less expensive expansion—to those who use electric light, heat or power, it means cheaper current, to those who ride in electric cars and trains, low fares.

The steam turbine, moreover, has cut the world's fuel consumption by millions of tons a year, with incalculable savings in labor and transportation, and effected other economies.

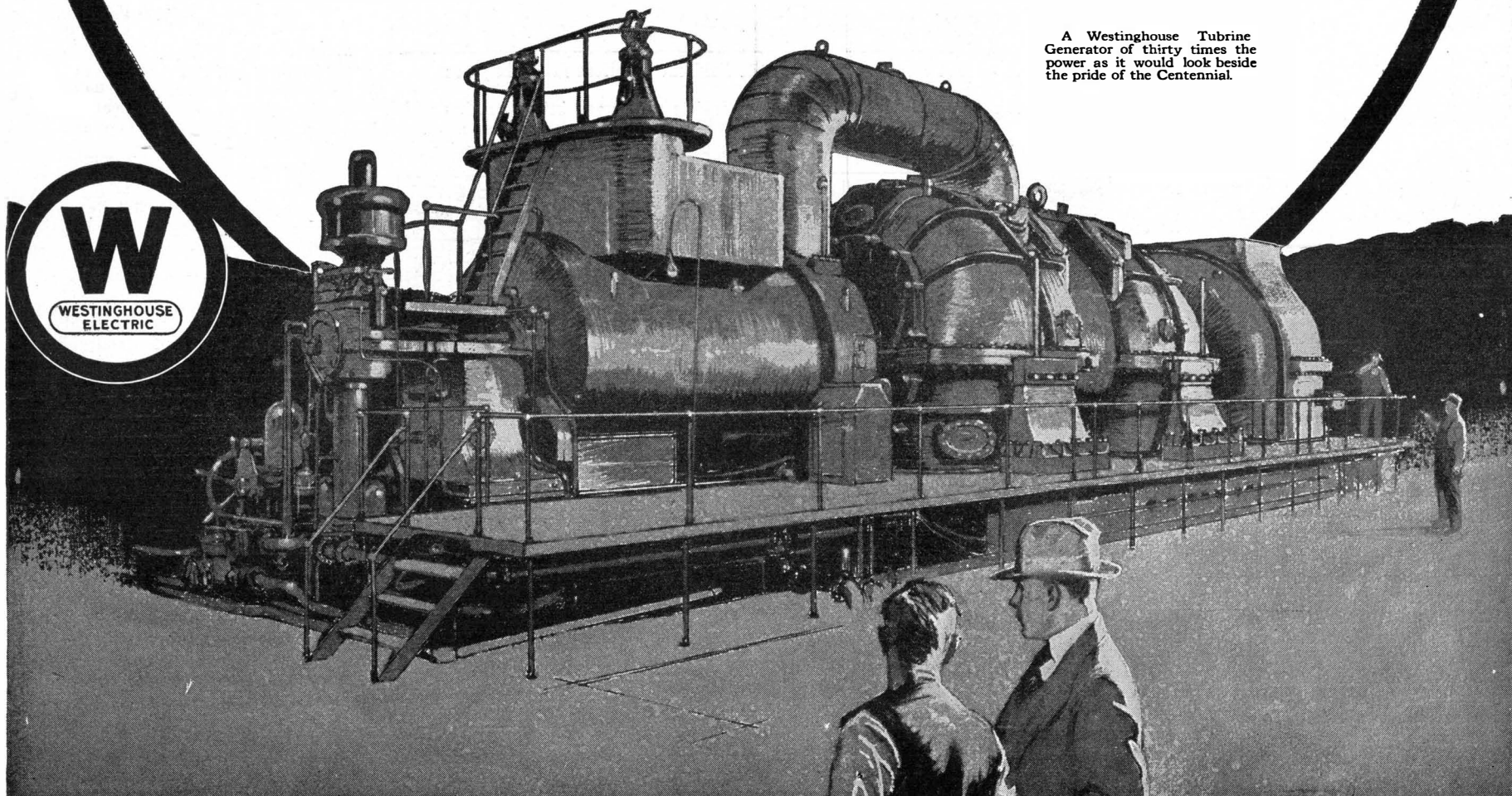
Westinghouse brought the Parsons steam turbine to this country in 1895, when it was still crude and imperfect, and through years of costly painstaking development, raised it to its present high degree of reliability and efficiency.

One important result is the Westinghouse Turbine-Generator for producing electric power.

Today Westinghouse Turbines and Turbine-Generators are made to develop from  $\frac{1}{2}$  kilowatt to 70,000 kilowatts. Already they have accomplished a revolution in electric power-plant practice and they promise to do likewise in the designing of ships.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY  
East Pittsburgh, Pa.

A Westinghouse Turbine Generator of thirty times the power as it would look beside the pride of the Centennial.



# Inventions New and Interesting

*A Department Devoted to Pioneer Work in the Arts*

## Plowing and Harrowing the Ground at One Operation

WITH a view to simplifying the preparation of soil for planting, particularly new ground which has not yet been broken, a Los Angeles inventor has worked out the interesting machine shown in the accompanying illustration.

Briefly, this machine consists of a powerful gasoline motor which drives a set of augur-like members, through a series of chains and belts. The augurs are provided with sharp teeth. As the machine is slowly pulled over the ground, the whirling augurs break the soil and pulverize it, so that the farmer can start planting without further preliminaries. Despite the fact that this machine has been made up from an automobile power plant and in other respects is more or less of an improvisation, it is reported to have done good work in the demonstrations.



Novel type of plow invented by a Los Angeles man and tested with good results

## Simple Clamps for Putting Derailed Cars Back on the Rails

IT is often the simplest ideas which prove the most efficient; and many of these simple ideas are the result of everyday experience with one's work.

Such is the case with the invention of Wm. Gakle, wrecking master of the New York Central Lines, residing in Chicago, Ill. As a result of years spent in wrecking work, Mr. Gakle has evolved a simple yet highly efficient ratchet clamp for clamping car replacers, which is shown in the accompanying illustration. This device, it will be noted, consists of a steel bar ribbed on the bottom and having cast teeth on the top, and with a hook on one end which engages with the rail or replacer, as the case may be. The slide block is a solid piece of steel, with a pawl on the bottom, while flanges are provided on each side of the block for supporting it in place. Ears are cast on the block for attaching the operating lever. The last-mentioned member, when operated, works a pawl which steps the block toward the hooked end of the bar, while another pawl engages with the rack and locks the adjustment. The ratchet clamp may be used for attaching car replacers to the rails, as shown.

Heretofore the practice has generally been to spike rerailers on the ties. In many cases this practice only results in the destruction of much track without getting the car or cars back on the track. Again, the wood of the ties is sometimes so soft that the replacers cannot be spiked. But with the clamps holding the car replacers on the rails, little trouble is experienced.

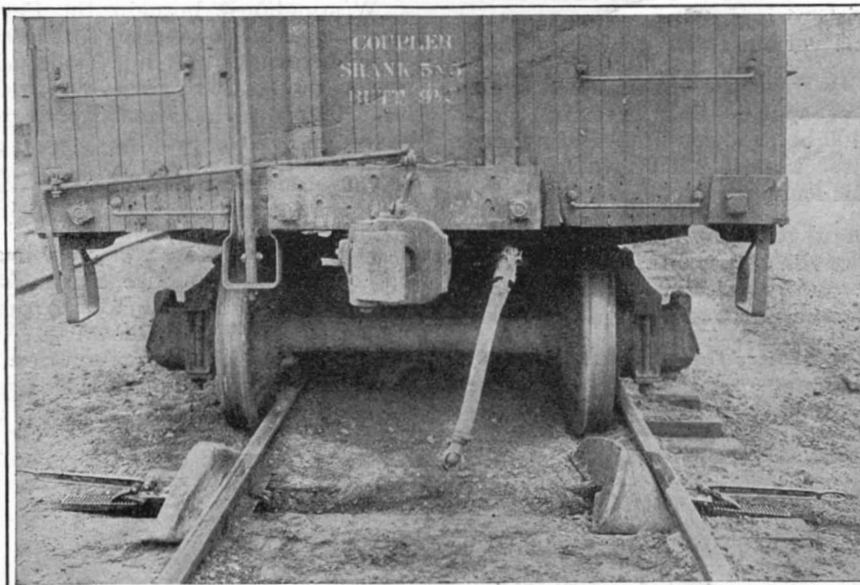
## A New Idea in Gang Drills

WHILE there is nothing new in gang drilling, it has remained for Aaron Hill of Los Angeles, Cal., to develop something new in this branch of labor-saving machinery. The result is a gang drill which is especially adapted to boiler shops, structural steel fabrication, and ship-plate work.

The drill spindles of this new gang drill are chain-driven, and by virtue of the almost direct application of power, require a comparatively small horse-power consumption for the operation, thus permitting a larger number of drills to be used. Also, the use of a chain drive makes for greater flexibility and strength, so that the gang drill can be used on any type of work. Still another feature of the chain drive is the elimination of power losses or chatter. The spindle sprockets engaging the chain are staggered, to distribute the load over the several chains provided; and the web of the drill carriage forms a lubricated run-

gered, to distribute the load over the several chains provided; and the web of the drill carriage forms a lubricated run-

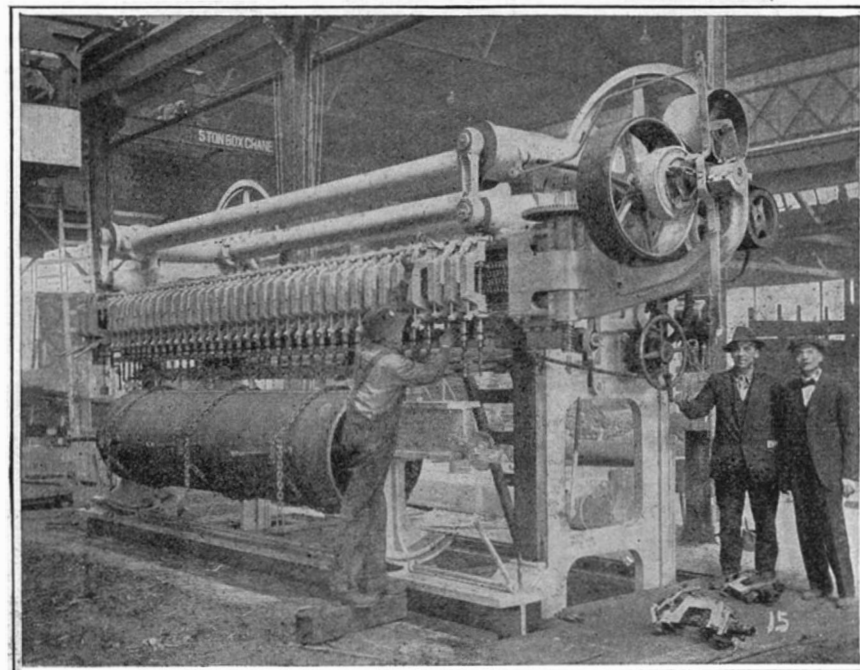
Another radical departure in drill design are the drill heads, arranged as independent detachable units. Each unit



Simple ratchet clamps which serve to hold car derailleurs firmly in place

way for those roller chains and serves to prevent the chain from slipping off the sprockets while in regular operation.

consists of a small bridge casting which straddles the chainway, and is machined at each end in order that it may slide



This gang drill, with fifty detachable and adjustable drill units, represents a new idea in that class of machinery

easily along the carriage rails. In many other respects this new gang drill is unique.

According to its inventor, it will reduce the cost of labor to an average of 50 per cent, compared with the present method of punching and assembling. It will drill an average of 50 holes of about one inch in diameter and one inch thick metal in less than three minutes' time. It requires only one man of average intelligence and a helper to handle the work. The setting of 50 drills to any ordinary assemblage desired and spacing each drill unit to a small fraction of an inch will take about 8 minutes' time. It eliminates all objectionable features such as warping, dishing, stretching and crystallizing of the metal. It feeds automatically; it lubricates the drills individually and stops lubricating when machine is not in operation; it stops automatically when drilling is done and releases the clamp, all automatically.

## Notes for Inventors

### Safeguarding Roll-Film Exposures.

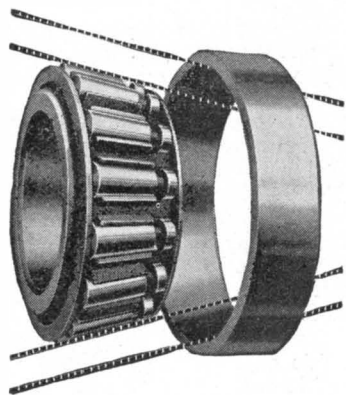
—There have been so many inventions of late bearing on the prevention of double exposures on roll film, that it seems but a short time before some make of camera will incorporate this feature. Such a device is absolutely necessary in most cases, because one of the most frequent mistakes made by the amateur photographer is to forget to turn the film, thereby making a second exposure on the first. Most of these inventions take the form of a locking device engaging with the film winding mechanism in such a manner that when the first exposure is made, the shutter is locked. To make another exposure the operator must turn the film key, thus bringing a fresh section of film into position and unlocking the shutter. Others merely indicate that the exposure has been made, and it is necessary for the operator to wind the film and then reset the indicator.

**Sanitary Dish Mop.**—It has remained for Willard Reid of Evanston, Ill., to make dish-washing somewhat more pleasant than it generally is. This he does with his water-supplied dish-mop, which consists of a mop with a handle and a rubber tube connecting with one or two water faucets, so that the mop receives a continuous supply of clean water. If the tube is bifurcated and connected with two faucets—for hot and cold water—it becomes possible to adjust the water supply for quantity and temperature. Much time and labor is saved by such a device.

**A Tricky Ball.**—By making a hand ball with a plurality of plane faces, so that the ball in striking a rigid surface rebounds in an uncertain and unexpected direction, Jacob Abrahamson of Asbury Park, N. J., has introduced a real novelty in hand balls. Indeed, such a ball makes any hand-ball game far more interesting than heretofore, because of the element of uncertainty which calls for greater skill on the part of the player.

**Plant Protector.**—Taking advantage of the spread of amateur gardening, let alone the regular truck farms and other farms, John J. Stevenson of Muskegon, Mich., has patented an interesting form of plant shield. This device consists simply of a one piece sheet of flexible material with an outwardly curved rim at the top. To protect a young plant, the shield is placed around the stalk and pressed into the ground, thus protecting the stalk and roots against insects and worms.

# TIMKEN TAPER



You can always recognize a Timken Bearing by its taper—tapered rollers revolving about a tapered “cone,” within a tapered cup. To the taper is due two things that have given Timken Bearings their supremacy in passenger car, truck and tractor:

1. Resistance to wear — because a tapered roller bearing resists end-thrust,

the sidewise pressure of the vehicle's weight as it rounds a curve just as well as it does the steady downward pressure caused by gravity.

2. Take-up for wear — because when the surfaces of cup, cone and rollers become slightly worn, a part turn of an adjusting nut brings them together again and the bearing is as good as new.

## *plus* Timken Tubing

“At the rate you’re piercing those bars and rolling them into tubes,” said one tube-mill visitor, “you ought to have enough soon to make bearings for all the cars in the world.”

Other visitors to the Timken plant at Canton have thought the same thing when they passed by the bins of stock tubing housed in long sheds. Millions of pounds of tubing there are here of all diameters from three-quarters of an inch to six inches.

Here is enough raw material at hand to make up cups and cones

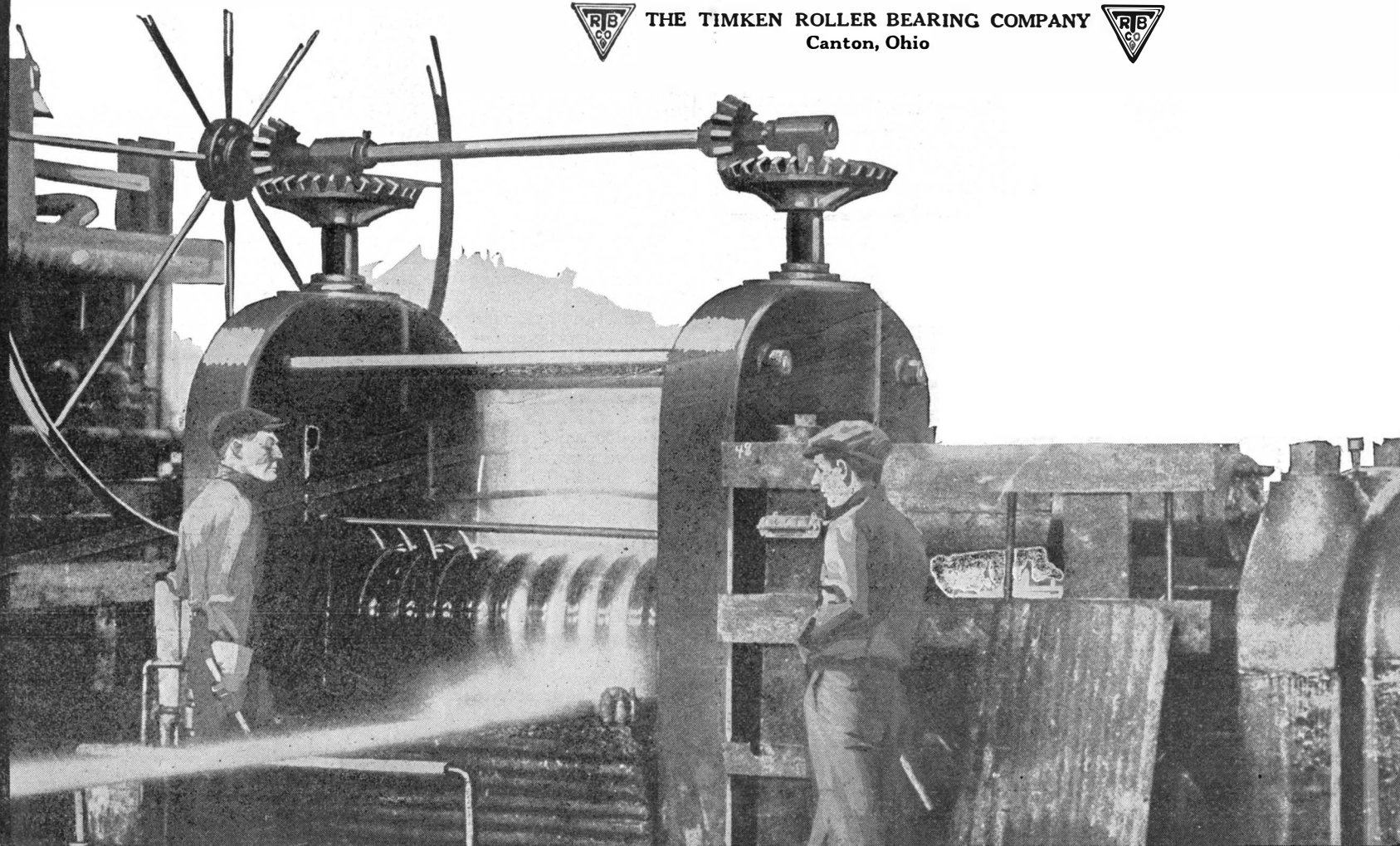
for any order of bearings of any size, and constantly this pile and that is being replenished from the tube mill.

The careful control, not only of the material in these tubes, but of every process involved in piercing, rolling and straightening is essential to the maintenance of Timken quality.

It is one of the many things that are added to the principle of Timken Taper to assure the resistance of Timken Bearings to the effects of wear.



THE TIMKEN ROLLER BEARING COMPANY  
Canton, Ohio





**Stormking**  
FOR USE ON ANY ROOF IN ANY WEATHER

## Make Your Roofs LEAK-PROOF!

You can make them absolutely watertight for ten years by coating them with Stormking. No chance of failure for we guarantee results.

This seamless, asbestic coating is not expensive. Cost of application negligible.

BUT—more important, it saves the expense of tearing off the old roofing.

Simply brush Stormking Liquid over any roofs or trowel Stormking plastic over badly worn surfaces and forget them until 1929. No repair or repainting expense after Stormking—one application is sufficient.

Send for full information and testimonials—it will pay you.

Special proposition for dealers. Write.

**Efficiency Products Company**

36 Fulton St. New York City

## THE BRUSHES OF THE WAR WHITING-ADAMS BRUSHES

DO THEIR PART TOWARD CONCEALING THE BIG GUNS

Their own bang-up goodness cannot be concealed. Quality sticks out all over them. Call for them at any dealer in brushes. Send for illustrated literature.

**JOHN L. WHITING-J. J. ADAMS CO., Boston, U. S. A.**  
Brush Manufacturers for Over 108 Years and the Largest in the World



## Cut Your Gas Costs

Better have that machine of yours equipped with a New Stromberg Carburetor if you are figuring on taking a vacation trip in it this summer. You'll get a lot more enjoyment out of your journey and you'll save a lot of money on fuel bills.

On any car—the New Stromberg gives greater power—greater speed—better acceleration. On any car it reduces mileage costs. Insures perfect gas mixture at all times. Eliminates all temper-ruining and time-wasting engine disturbances that come from faulty carburetion. Makes a better car of any car. Puts a finer edge of pleasure in motor trips—and cuts travel costs.

Write for descriptive matter. State name, year and model of your machine.

**Stromberg Motor Devices Co.**  
Dept. 616, 64 East 25th Street  
Chicago, Illinois

**New STROMBERG Does it!**  
CARBURETOR

### The Current Supplement

OUR new navy is naturally attracting wide attention today, both because of its superior fighting power and because it is to try out on a grand scale the efficiency of electrical propulsion for the great ships. The ill-fated "Jupiter" was the successful small-scale predecessor in our navy and the present well illustrated article on *Electric Propulsion for the U. S. S. New Mexico* will give us all a better idea of how the electrical engineer has met the problems set him in this new field. Another paper in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2266, for June 7th, 1919, with naval interest is the first of a series dealing with *Recent Developments in Marine Lighting* wherein are discussed the features of modern tended and untended lights and light-ships. A long article by Prof. Nageotti discusses *Organic Matter and Life*, a subject he has investigated by studying the peculiar history of the development of the connective tissues and their immigrant cells. Dr. A. Hrdlicka gives us the benefit of his long study of the peoples of eastern Europe in an illustrated article on *Races of Russia*. An illustrated article describes interesting experiences of a French biologist in raising and studying *A Giant Insect*, a tropical walking-stick measuring 15 inches in length. Shorter articles discuss *Electricity and the Nature of Matter*, *Zinc and Aluminum Alloys*, a simple type of converter unit for *The Oxidation of Ammonia*, and an account of the Government's experience in *Packing for Export* during the war.

### A United States Port in France

(Continued from page 599)

Bassans, however, remarkable project as it was in conception and speedy as it was both in construction and operation. There were many other engineer operations in France looking to unloading facilities, each presenting its own problem and each demanding the same resourcefulness in execution made necessary by the difficulties of obtaining French material, of getting supplies from America, of a never ending labor shortage and the ever increasing necessity for speed. Bassans stands as the greatest single piece of engineering construction in American port-making, but it is by no means the only example of what we could do when necessity made the law. At the signing of the armistice tonnage from the States was being unloaded along seven miles of docks and these were to be increased to a total of 12½ miles (160 berths), to care for an army of 4,000,000 men, had Germany not considered that discretion was much the better part of victory!

Brest had three entirely new berths completed. These, with Bassans, were all that the engineers made from the ground up, the rest of the 89 in use at the time of the armistice being more or less French in construction and more or less Americanized as time and necessity dictated. Had the 160 berths which were planned for completion by July, 1919, been necessary, 26 of them would have been new construction throughout and on all but one of the projected constructions work had already been started. Of course the armistice immediately brought a cessation of such labors, although a certain amount of work was in such shape that it seemed advisable to continue it to completion rather than to abandon it. Thus, the Montoir project, which would have, if not rivalled Bassans, at least divided attention with it as a remarkable engineering feat, was so far completed that it was thought necessary to finish at least part of it.

The eleventh of November found the Montoir project with piling driven for 650 feet, the full width of the dock, and most of the piling capped. Three of the eight berths contemplated were ordered finished.

The Talmont project was to be a 10-berth affair, of the standard length of 410 feet each. But Talmont was in no such state of completion as Montoir at the time of the armistice. Thousands of tons of equipment were ready for use, warehouses



## Cleveland Grindstones

It's in the Grit

Made from genuine Berea and Huron Stone. All hand picked. Will not glaze but preserves the temper of the steel. Used by majority of mechanics and Industrial Schools because of their uniformity of grit. Write for folder "Selection and Care of a Grindstone."

**The Cleveland Stone Co.**

1836 Euclid Avenue

Cleveland, Ohio

## WIRE

electrical, rope, air plane, piano, pipe-organ, flat hoops, bale-ties, tacks, nails, barbed wire, concrete re-inforcement, springs, netting, wire fences, steel posts, trolley-road wires and rail bonds, wire wheels, auto-towing cables, horse-shoes.

**Illustrated Books Describing Uses, FREE**  
**American Steel & Wire Co.** F. Baackes, V.P. & G.S.A. CHICAGO



## GEARS

All Kinds—Small

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalogue  
**CHICAGO STOCK GEAR WORKS**  
20 South Wells Street Chicago

## WELL DRILLING 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.**

## WONDER

PIPE, TUBING AND SOLID BAR BENDERS

Bend all sizes of standard or double thick steel, wrought iron, brass and copper pipe from 1-8 in. to 6 in.; tubing from 1-2 in. to 7 in.; round square and twisted solid stock from 1-4 in. to 3 in.

**American Pipe Bending Machine Co.**  
Manufacturers  
32 Pearl St., Boston, Mass. U. S. A.

## SOUTH BEND LATHES

Established in 1906 Over 19,000 South Bend Lathes in use

For the Machine and Repair Shop  
LOW IN PRICE  
13 in. to 24 in. swing  
Straight or Gap Bed  
Send for free catalog giving prices on entire line  
**South Bend Lathe Works**  
421 Madison St., South Bend, Ind.

## SOLVINE BOILER PRESERVER

Warranted, without reserve, to remove boiler scale prevent pitting and scale formation. Pamphlet on request. Money back guarantee.

**SOLVINE MFG. CO.**

Jersey City, N. J.

## THE BRIDGEPORT CHAIN CO.

Specialists in Small Wire Shapes & Flat Stampings

Bridgeport, Conn.

**THE SCHWERDTLE STAMP CO.**  
STEEL STAMPS LETTERS & FIGURES  
BRIDGEPORT CONN.

**INVENTORS** Give us only your ideas—we will develop them. We are experts in model and experimental work and developing inventions. Designing and building special labor saving machinery a specialty.

**Elk Mfg. Co., 1926 Broadway, New York**

## NOVELTIES & PATENTED ARTICLES

MANUFACTURED BY CONTRACT. PUNCHING DIES, LIGHT AUTOMOBILE STAMPINGS  
**KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.**

## 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.

**THE No. 51 UNIVERSAL WOOD WORKER** is the most wonderful wood working machine you have ever seen. 26" band saw, 8" jointer, reversible single spindle shaper, saw table and borer all in one. Ask for special catalog describing it. Also ask for catalog of band saws, saw tables, jointers, variety wood workers, planers, swing saws, disk grinders and borers.

**THE CRESCENT MACHINE CO.**  
230 Main St., Leetonia, Ohio, U. S. A.

## LEGAL NOTICES

## PATENTS

**IF YOU HAVE AN INVENTION** which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to **Patents, Trade Marks, Foreign Patents, etc.**

**SCIENTIFIC AMERICAN** contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions.

**MUNN & CO., SOLICITORS OF PATENTS**  
626 Woolworth Bldg., NEW YORK 625 F Street, WASHINGTON, D. C.  
801 Tower Bldg., CHICAGO, ILL.

## Annual Subscription Rates

## Scientific American Publications

Scientific American (established 1845) one year \$5.00  
Scientific American Supplement (established 1876) one year 5.00

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

## Foreign Postage

Scientific American \$1.50 per year additional.  
Scientific American Supplement \$1.00 per year additional.

## Canadian Postage

Scientific American 75c per year additional.  
Scientific American Supplement 50c per year additional.

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 \$1.00 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.

## WANTED

THE exclusive manufacturing rights of some machine, device, or article in the metal line—patented or otherwise, by one of the most completely equipped manufacturing plants in Indiana. Address: W. M. F.—P. O. Box No. 263, Bedford, Indiana.

## INVENTIONS

HAVE you a practical invention to sell outright or place on royalty? Send details to Adam Fisher Mfg. Co., 78, St. Louis, Mo.

**BE A CPA ACCOUNTANCY**  
The Highest Paid Profession taught thoroughly in a few months of home study by new system. FREE BOOK International Accountants Society Dept. 41P 2626 S. Michigan Ave., Chicago

**INSIDE TYRES Inner Armor**  
for Auto Tires. Double mileage, prevent blow-outs and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 8 Cincinnati

## If Horace Greeley Were Alive Today

Would he advise young men to go West, or would he advise them to take advantage of the opportunities that abound in their immediate vicinity—"Knocking at their door" as the saying goes. Undoubtedly he would tell them that everywhere in this big and prosperous country there is opportunity for the young man who will use his brains, acquire knowledge, and get busy.

Let me tell you of at least one opportunity right in your own town.

Business Manager

**SCIENTIFIC AMERICAN**

Room 676

Woolworth Building

New York City

and barracks had been erected, a steam shovel was at work, piling and timber had been assembled, a 1,500 horse-power lighting plant from the States had been received and was ready to erect, 2,000 men were at work—and then the armistice. Talmont would have provided space for the heaviest draft vessels and allowed 10,000 tons a day to be unloaded.

Just what is to become of the dock facilities erected, taken over, improved, Americanized, is something which no one seems able to say. It would seem far more logical to sell the whole to the French than to attempt to salvage the material for transportation back to America. There can be no salvaging the labor which went into these projects and no possible way, other than sale to the French, of recovering even a small proportion of the money spent upon their development. Doubtless some equitable arrangement will be made by which the French nation will benefit by the American work and the French ports in the future possess a degree of American efficiency in unloading which will be blest of mariners for generations to come!

But such speculations belong to the economist, not to the reporter. It is impossible to find an engineer who does not regret that his branch of the service could not continue to function and to show the world what we can do when we try. It is more impossible to find any who regret that what stopped the work was the defeat of the enemy.

The effect upon the commercial methods of France of this influx of American speed and efficiency in dock and unloading methods is not for consideration here. What may, perhaps be noted, as a matter of passing if curious interest, is that there is hardly a dock in America with the capacity or the speed of those America has erected in France, and that if we have the right to show the French engineer with some pride what America has done to his water front, he at least has a good American "come back" in asking us why we have for so long and in so many places put up with entirely inefficient methods of docking and unloading in our own ports.

But that, perhaps, is also something which belongs to the economist. Suffice it here that no American concerned in the making of the American ports in France, no American of our 2,000,000 who has been served by them, and none of the hundred millions who stayed at home, but has a real right to be very proud of what our engineers did on the coast of France, and a real right to feel that no matter how much Europe may call us a nation of boasters, we have in this particular, at least fully demonstrated our right to boast of our engineering ability, ingenuity and efficiency.

## Killing Weeds With Live Steam

(Continued from page 599)

prevent the steam from escaping and the boards from warping. Hoop iron is fastened around the edges, so that the pan hugs the soil closely and so that the steam will not seep out. There is an opening through one end of the pan through which the steam is admitted. The pan is provided with ring bolts near the corners, so that it may be easily moved.

The steaming may be done either in the spring or the fall. The disadvantage in fall steaming is that the beds may become reinfected during the winter. In the spring it is quite essential that the seed bed be dry and without frost in order that steam may penetrate the ground. Glass-covered beds may be used and in that case the glass may be left on for a few weeks before seeding time in order to dry the beds out. Sometimes when good weather is encountered in the spring, the steaming will be carried on for 24 hours at a stretch.

After a bed has been steamed for 30 minutes, the pan is moved along to the next point. The steamed area in the meantime is covered with a blanket to conserve the heat. Two pans may be used, one being left on the soil a half hour after the steam is turned off each time. It



Long wear can only be proved by long experience. The makers of the Hudson car, for instance, have used

*Genuine*  
**Pantasote**  
*Top Material*

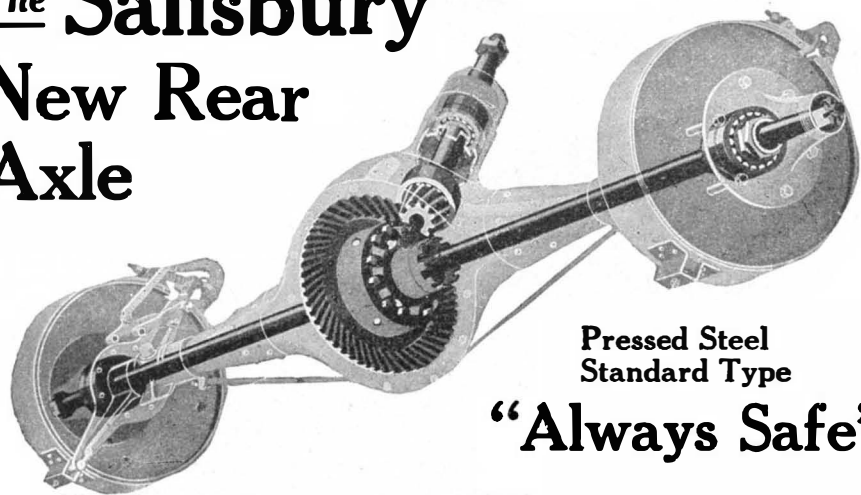
exclusively as standard equipment on Hudson cars continuously since 1914. No top material is too good for your car.

PIERCE ARROW	REO SIX
SCRIPPS BOOTH	KISSEL
PAIGE LINWOOD	WHITE
LOCOMOBILE	COLE
PREMIER	CHALMERS
HUDSON	COLUMBIA
MERCER	CADILLAC

Look for Pantasote Label inside the top—it protects you against substitution which is not uncommon.

The Pantasote Company  
Bowling Green Building  
New York City

# The Salisbury New Rear Axle



**A**N automobile is only as good as its rear axle. Remember—you may have the best engine in the world in your car but that does not and cannot make it a good motor car unless the rear axle is mechanically correct and physically perfect.

Few people realize that the rear axle of an automobile is, next to the engine, the most important mechanical factor in producing a good automobile. The engine's power is transmitted to the rear (driving) wheels through the pinion gear of the propeller shaft and differential mechanism—all part of the rear axle.

The rear axle of a carriage or wagon carries the weight of the vehicle on the spindle. The rear axle of an automobile carries the weight of the vehicle on its housing—the pressed steel case which encloses the differential gear, driving shaft and all bearings—and includes the wheel hubs, brakes and brake mechanism complete ready for use.

One may better understand the importance

*The manufacturer who specifies our axles adds a strong selling point to the prospective purchaser.*

**SALISBURY AXLE COMPANY**  
Established 1902



Jamestown, New York, U. S. A.

of the rear axle when it is said there are over 150 individual parts of the rear axle mechanism that must be carefully machined and fitted to micrometer measure. This mechanism must be compact, silent and of great strength to transmit the power of the engine to the driving wheels with the least possible friction or loss of power.

The Salisbury New Pressed Steel Rear Axle is produced in our two big plants after 15 years' successful building of front and rear automobile axles, complete with hubs and brakes for the trade. It combines the great strength and durability of our own special formulae steel with simplicity of construction. Made in three standard sizes for cars weighing 1700 to 4000 pounds.

**PERU AXLE COMPANY**  
Established 1909



Peru, Indiana, U. S. A.

## IMPORTANT ANNOUNCEMENT

**T**HE large increase in our practice before the Patent Office since the close of the war has led to our opening an office in the City of Chicago for the convenience of clients in the middle west. It is located in the Tower Building, corner of Michigan Avenue and Madison Street.

The SCIENTIFIC AMERICAN has for many years had an office in the Peoples Gas Building. This office has been transferred to the Tower Building and is consolidated with the new office of Munn & Co.

**CHICAGO OFFICE**  
801 Tower Building  
Michigan Avenue

**MUNN & CO.**  
Patent Attorneys  
Woolworth Building, 233 Broadway  
NEW YORK CITY

**WASHINGTON OFFICE**  
Scientific American Building  
625 F Street

has been found that 30 minutes' steaming will heat the upper two inches of soil to from 208 to 212 degrees Fahrenheit. At three to four inches deep the thermometer will register 170 to 180 degrees, and at six inches 120 degrees. Two hours later the temperature at six inches, it has been found, reaches 160 degrees.

The cost of steaming 1,000 square feet of soil is about \$6. It is figured that the saving in cost of weeding will about pay for this. It is also necessary to use less fertilizer on sterilized ground than on unsterilized. The seed may be sown safely 12 hours after steaming the beds. While the plants seem to be retarded at first, there is later a decided growth, so that they are ready for setting out two weeks earlier than those in unsterilized beds.

### Much Wheat—No Corn?

(Continued from page 600)

Hog raisers are evidently secure in the feeling that there is plenty of corn in sight. Now for the last comforting straw.

There are always two factors in the production of any crop; acreage and yield per acre. Yield per acre is a great variable. Climate, rainfall, temperature, drought, wind, frost—they all affect the yield.

But the variation in the corn crop in the years between 1910 and 1918 are the variations between 2,446,988,000 bushels in 1913 and 3,065,233,000 bushels in 1917; in 1910 the crop was two billion eight hundred million, in 1918 it was two billion five hundred million bushels. Corn has been a constant, not a variable, in spite of war, in spite of the increase in the price of wheat, in spite of everything. Not quite seven millions more acres were planted in winter wheat this year than last. There were 12 million acres difference between wheat acreage planted in 1919 and 1914. Yet the variation in corn planted between the nearest years to those for which figures can be had, 1914 to 1918 was the difference between 103 and 107 million acres and, in the amount reaped, the difference between two billion six hundred millions and two billion five hundred millions bushels. If twelve million acres planted in wheat made so little difference in corn harvested why should seven millions planted extra this year in winter wheat make so much difference in corn to be harvested?

The Department of Agriculture will venture no opinion. But all its reports, while as yet shy of figures, show encouragement as to the corn situation. Less wise than they and much bolder (as the fool must always be who rushes in where the angels won't walk), the present writer is quite willing to predict that the corn crop this year will not be a factor in raising the price of meat, either by its scarcity or its unusual size.

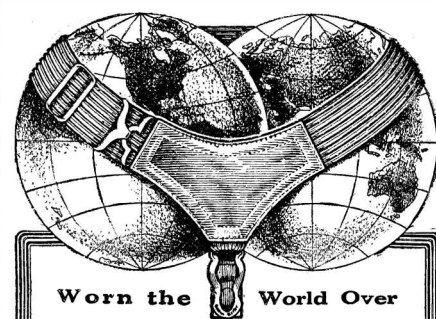
### American "Mystery" Ships

(Continued from page 600)

through an arched pipe over the propeller, so that the former would not become tangled in the whirling blades as they sped through the water.

Two projecting arms were attached to the device, one on each side and near the forward end of the tube. The arms were buoyed by air chambers along their lengths and they carried drags with grappling hooks for the purpose of picking up any anchored mines in the path of the ship. Each arm was about 25 feet long, so that the total width of the drags was ample to protect the vessel. The grappling drags were suspended to depths of 10 or 12 feet which insured catching the cables of mines.

The device preceded the vessel's course from 100 to 200 feet, or sufficiently far away, should mine explosions occur, not to damage the vessel itself. A mechanism, partly composed of electromagnets and installed in the body of the mine-catcher, provided the means of controlling or steering the device. The magnets were connected by wires running to the ship and contained in the cable holding the feed wire for the motor in the apparatus. These magnets also controlled a series of small rudders attached to the arms holding the



Worn the World Over

Quality First  
**Boston  
Garter**

*Velvet Grip*

GEORGE FROST CO., MAKERS, BOSTON

## LEARN WATCHWORK JEWELRY WORK AND ENGRAVING

A fine trade commanding a good salary and your services always in demand or you can start in business for yourself. At



**BRADLEY INSTITUTE**  
The greatest school for watchmakers in the world. Address: Horological Department H. Peoria, Ill., for catalogue of information. Also teach Optics and Instrument Repair.

### Does Your Hand Itch for a Pencil?

**YOU** don't have to be a genius. If you have that itching for drawing, you may have in you the making of a successful cartoonist or illustrator. Write today for your free copy of "A Road to Bigger Things" telling how America's 32 greatest cartoonists will help you develop your talent profitably. **FEDERAL SCHOOL OF APPLIED CARTOONING**, 9624 Warner Building, Minneapolis.



## The MIDGET SLIDE RULE



will solve any problem in addition, subtraction, multiplication, division and proportion. Handles decimals, whole numbers, fractions and mixed numbers. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease- and water-proof and will give years of service. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete slide rule made. Size, 4 inches. Made of white coated steel. Price, with instructions, \$1.00 postage paid.

Your money back if you are not satisfied.

Send for a Catalogue of Slide Rules

**GILSON SLIDE RULE CO.,**

**NILES, MICH.**

## ASBESTOS

We are miners and shippers of Crude Asbestos in any quantity. We produce all grades at our world famous **BELL ASBESTOS MINES** in Canada. We also card fibres, spin yarns, weave cloths, and make all sorts of Asbestos products.

For anything you want in Asbestos, turn to **KEASBEY & MATTISON COMPANY** DEPT. S-1

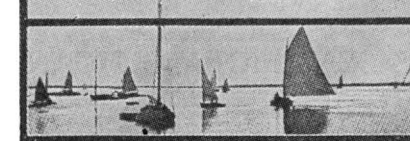
**AMBLER, PENNA., U. S. A.**

Owners of the world's largest Asbestos Mines



Beach Haven has the best combination of sea shore features on the Atlantic Coast. Matchless bay for sailing, always good fishing, perfect beach and bathing. The **ENGLESIDE** has all modern conveniences, private baths with salt and fresh water, and is a home as well as a hotel. Sarc relief from hay fever. Open June 20th to October 1st. Send for booklet.

**THE ENGLESIDE COMPANY, Inc., Owners**  
ROBT. F. ENGLE, Treas. and Mgr.  
BEACH HAVEN, N. J.



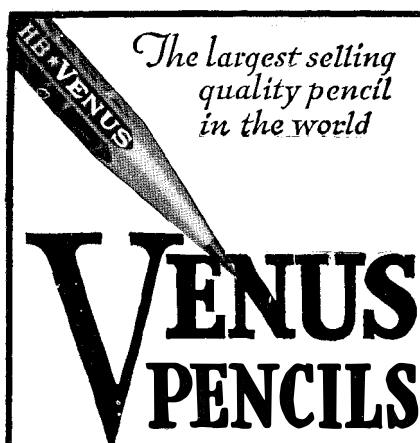
Stop Spread of Disease Germs  
Make Your Wood Floors Last Longer  
WITH

# REILLY'S SANITARY FLOOR DRESSING

It doubles life of wood floors by toughening and giving flexibility to surface fibres. Stops bulging, shrinking and slivering. Treated wood is not affected by machine oil, gasoline, dilute acids and alkalis, washing compounds, etc. This waterproof antiseptic oil enters wood, remains, disinfects floor dust and prevents it from flying. Kills disease germs.

Write for booklet and free sample can

**THE REILLY COMPANY, Indianapolis, Ind.**  
Factories: Indianapolis Minneapolis Mobile Seattle Norfolk



**V**ENUS Pencils insure accuracy, ease, quickness, economy, all-around pencil efficiency. Their superb unvarying quality has made their name synonymous with Pencil Perfection in every corner of the civilized world.

17 black degrees and 3 copying

For bold heavy lines, 6B-5B-4B-3B

For general writing and sketching, use 2B-B-HB-F-H

For clean fine lines, 2H-3H-4H-5H-6H

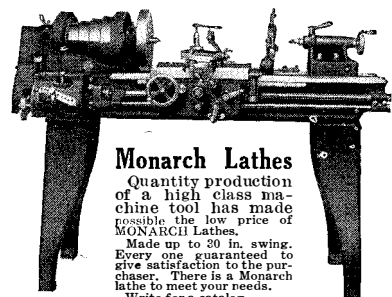
For delicate thin lines, maps, charts, 7H-8H-9H

#### SPECIAL 14c. OFFER

Send 14c. for three trial samples mentioning degrees. After you find how perfect VENUS Pencils are, buy them at any dealer.

**American Lead Pencil Co.**

217 Fifth Avenue, New York  
and Clapton, London, Eng.



#### Monarch Lathes

Quantity production of a high class machine tool has made possible the low price of MONARCH Lathes. Made up to 20 in. swing. Every one guaranteed to give satisfaction to the purchaser. There is a Monarch lathe to meet your needs. Write for a catalog.

**The Monarch Machine Tool Co.**

America's Largest Lathe Builders  
103 Oak Street Sidney, Ohio

## 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



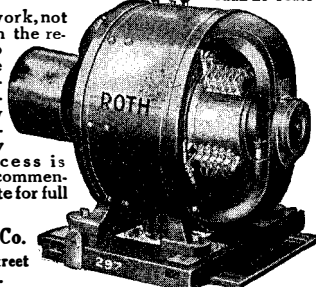
## Low Cost of Upkeep

#### ROTH MOTORS

Successful More Than 20 Years

are built for work, not for idleness in the repair shop. So they give steady, day-after-day service at a low cost of operation. Twenty years' success is their best recommendation. Write for full facts.

**Roth Bros. & Co.**  
198 Loomis Street  
Chicago, Ill.



drags. It is obvious that these arms encountered considerable resistance as they moved forward through the water, and the little rudders placed at the proper angles would keep the arms extended.

This mine drag system was applicable to all types of vessels operating in dangerous or hostile waters. It was simple and cheap in construction, easily operated, always under control.

Although the German U-boats reached American waters and were successful in sinking a number of vessels operating on this side of the Atlantic by some chance of ill-luck our decoy ships were not in the vicinity of the submarines when they made their attacks. Of course with only two decoys it was rather difficult to guard the entire coast line of the United States. The commanders and crews of the mystery ships were very much disappointed that, with their excellently equipped vessels, they were not able to sink a single sea pirate on this side of the ocean while the hunting season was open for Germans.

#### When Freight Cars Bump

(Continued from page 602)

its lowest position, until the shank of the draft gear is in contact with the face of the hammer. Then the hammer is pulled back until its center of gravity is raised a certain number of inches, and suddenly released. It swings downward and gives up a part of its energy as a hammer blow on the end of the draft gear shank. The draft gear absorbs a part of the energy delivered to it and passes the remainder on to the car, which takes it up in the form of motion. By means of the autographic record of the chronograph, the acceleration and velocity of the car may be determined, as in the tests previously described, from which the maximum pressure on the draft gear and transfer of energy from hammer to car may be determined. Blows of varying intensity are delivered by adjusting the drop of hammer from zero up to the maximum which is required to produce a full closure of the draft gear, or failure of its connections to the car sills.

Blows from a 16-inch drop of the 15,000-pound hammer have been delivered on certain types of draft gears, producing a pressure of 830,000 pounds, but on other types of gears, a drop of 22 inches produced a maximum pressure of only 186,000 pounds.

#### Stefansson in the Arctic

(Continued from page 603)

pologist by profession, and on his staff were specialists of note in oceanography, terrestrial magnetism, marine and terrestrial biology, geology and topography. There was stored on the "Karluk" a most complete and varied collection of scientific instruments, some of which could not be duplicated, such as the oceanographic instruments loaned the expedition by the Prince of Monaco, an oceanographer of reputation. Most of these invaluable instruments were lost on the "Karluk" when the ship went down off Wrangell Island on January 11th, 1914, after drifting in the ice for several months. Stefansson had left the "Karluk" with five companions on September 30th, 1913, on a hunting trip, expecting to be gone about a fortnight. His party reached the Alaskan mainland and never saw the "Karluk" again, the ice off shore breaking up and forming a lead which could not be crossed. Thus the explorer started off on his Arctic tour, which was to last about five years with almost no equipment. He picked up a few instruments, rifles and ammunition from a land party of his expedition, and proceeded.

Of instruments, Stefansson carried a sextant and a mercury artificial horizon, prismatic compasses, several watches, a sounding wire of 1,386 meters, deep-sea thermometers, a number of cameras, and two Mannlicher-Schoenhauer 6½ millimeter (.256-inch caliber), rifles with Gibbs modification, much used in African hunting, and having a muzzle velocity of 3,160 feet. The watches were ordinary standard American timepieces, which Stefansson

**DU PONT AMERICAN INDUSTRIES**

## The Greatest Chemical Industry In America

In 1802 the Du Pont Company made its entry into the chemical industry as manufacturers of explosives.

Since then, with our entry into related lines—Py-ra-lin, pyroxylin and coal tar chemicals, Fabrikoid, paints, pigments, acids and synthetic dyestuffs—our chemical interests have grown, until today, in the Du Pont American Industries, there has developed the greatest chemical organization in America.

At the present time, 1200 graduate chemists, or about ten per cent. of the total number in the United States, are employed by the various Du Pont companies.

Four great research laboratories, operated by the company's Chemical Department, employing in the neighborhood of four hundred technically trained men, are maintained by our company to carry on experimental operations for the improvement of existing processes, to find the means of utilizing our by-products and the most economical raw materials and to develop new products.

For work of this character, two million dollars will be spent this year by the Du Pont Company, exclusive of capital expenditures for buildings and equipment.

Thirty analytical laboratories are operated by our companies in the testing of raw materials and intermediates to control the quality of our finished products.

A large corps of chemical engineers supervise the manufacture of solvents, Py-ra-lin, acids, explosives, dyestuffs, etc., and promote the maximum chemical efficiency in the operation of our sixty plants.

In the world reconstruction era, this broad American chemical industry will play an important part.

The same logical reasons that led to its present diversified activities point to further expansions into other related fields of industrial chemistry.

**E. I. duPont de Nemours & Co.**  
 Wilmington      Established 1802      Delaware  
 Visit Du Pont Products Store when in Atlantic City

**DU PONT**

## The Price Is Your Safeguard

To make the WISCONSIN Engine lower priced, we would have to eliminate adjustments—running in, tuning up, and rigid inspections. The result would be a cheap engine that would cost you far more in the end. That's why WISCONSIN Engines are sent out *ready to run*. If we had not delivered this extra value, our business would not have doubled itself each year for the past five.

**Wisconsin**  
CONSISTENT

Powered Pleasure Cars Again

After two years of war work, the great WISCONSIN plant is again turning out the passenger car motors that were leaders in this field before the war.

See that your next car is WISCONSIN-powered. WISCONSIN's record and specifications sent on request.

**WISCONSIN MOTOR MFG. CO.**

Station A, Dept. 352, Milwaukee, Wis.

Distributors:

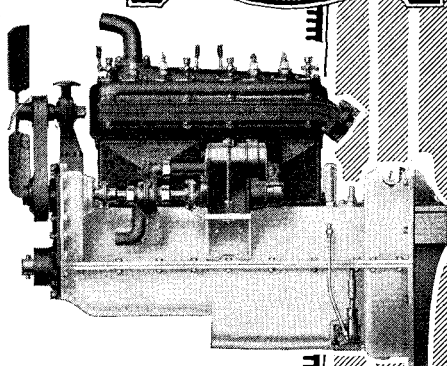
New York Branch: T. M. Fenner, 21 Park Row, Factory Representative.

Marine Equipment & Supply Co., 610 Arch Street, Philadelphia, Pa.

Pacific Coast Distributor: Earl P. Cooper Co., 1310 So. Los Angeles Street, Los Angeles, Cal.

#### WISCONSIN BEARINGS

are extra large. Made of Fahrig metal, backed with bronze. After being carefully reamed and scraped to a fit they are assembled, run-in and then taken down to make sure that they have a 100% bearing surface.



*"Makes its Mark Around the World"*

**The STANDARD** by which the world judges the quality and efficiency of a fountain pen

**Waterman's Ideal Fountain Pen**

3 TYPES  
Regular  
Safety  
Self-Filling  
\$2.50 and up  
At Best Dealers

Its readiness to write anywhere at any time without dependence upon desk or inkwell gives Waterman's Ideal Fountain Pen users a freedom of action, which enables them to do more and better work, suiting their own convenience as to time and place.

There is a nib to suit each and every individual character of hand writing—A size of barrel to fit any hand, and a type that meets perfectly any specific pen requirement.

**A VACATION NECESSITY**  
Unties you from a desk and inkwell and puts handwriting on the list of out door sports

**L. E. Waterman Company**  
191 Broadway  
New York

CHICAGO BOSTON SAN FRANCISCO

says he has always found preferable to expensive pocket chronometers. The latter, he declares, are likely to skip half-second beats whenever they are unduly jarred, and thus lose time. He rated his watches in winter by star observation, and in summer by the sun on both sides of a meridian. For establishing geographical positions, Stefansson used time sight methods for longitude, referring all positions to Parry's rock, Winter Harbor, Melville Island, perhaps the best "located" spot in the Arctic.

During most of the time, Stefansson and his men and dogs lived off the land and sea. He found that white men can subsist comfortably on meat and fish alone in the far North. There were few instances of illness. Three of his men became ill with scurvy from eating stored food. When Stefansson compelled them to eat nothing but fresh meat, they rapidly recovered.

The "Karluk" was of course intended to be the major vessel in connection with the expedition; and although there were four other vessels in the hands of the explorers, it was necessary to replace the lost ship. It was in this way that the "North Star," which we illustrate, came to be part of the outfit. Though materially smaller than the "Karluk," she turned out to be of greater value than any other vessel of the expedition.

### America Flies the Atlantic

(Continued from page 605)

#### Lessons of the Future

Great credit is to be given to the technical talent which was engaged in the design of these flying boats. The event has proved that the art has not yet progressed to the point where we can build boats of sufficient strength and radius of action to make a sure crossing, if a forced landing becomes necessary, not even with all the naval assistance in the way of destroyers and battleships to keep in touch with weather conditions and to check the observations of the flyers and hold them to a true course. Evidently, the flying boat of the future, if it is to become a commercial proposition, or even a satisfactory naval proposition for trans-oceanic flight, will have to be a much stronger and larger boat, with a wider margin of safety in the matter of its radius of action.

\*\*\*\*\*

As we go to press, we learn that NC-4 has completed her flight to Europe by a non-stop jump from the Azores to Lisbon. Thus to the navy goes the aerial blue ribbon of the Atlantic. The first to hold this emblem, may she long retain it in the fierce competition, which even now has begun, and promises to captivate the imagination and stir the pulse of mankind for many generations.

### Grain Binder Troubles

(Continued from page 607)

across the bill-hook. Thus a knot was tied in one end and the twine remains on the bill. (b) A band may be found lying with a discharged bundle, there being a loose knot in one end of the string and the other end being cut squarely off. In this case the twine disk held the twine until the knot was nearly completed, but one end of the twine slipped out of the disk just before being made a part of the knot, and the other end was tied in a loose knot around this freed end.

2. *Twine Disk Too Light.* (a) If a band with a knot in one end and with the other end presenting the appearance of having been chewed off is found with a discharged bundle, it is an indication that the disk is too light. When the bill-hook revolves, one end is pulled from the disk and does not enter into the completed knot, being similar in this respect to 1 (a). In this case, however, the ragged end shows that the disk was so tight as almost to hack the twine off. (b) If a band is found with both ends presenting the appearance of having been chewed off, it is an indication

that the disk was so tight that it would not allow the twine to slip at all as the bill-hook revolved. The result was that both ends were pulled out broken from the disk. The remedy is to loosen the twine-disk spring.

3. *Bill Spring Too Loose.* If there is found with a discharged bundle a band having both ends cut squarely off and each bent over as though a knot had been tied, it is an indication that the bill spring is too loose. The remedy is to tighten the bill spring slightly.

4. *Bill Spring Too Tight.* It is possible, though it does not frequently happen, that the bill spring may be so tight that the stripper will not slip the twine off the bill, and the discharge arms, in seeking to kick out the bundle, will break the twine, leaving the knot on the bill. A rough or rusted bill will cause the same trouble.

5. *Twine Tension Too Tight.* If the twine tension is too tight, the difficulties mentioned in 1 and 2 may be increased, so much force being required to draw the twine from the box that the sudden passage of the needle upward pulls the twine from the disk instead.

6. *Needle Trouble.* If a bundle is discharged with the twine extending back to the needle eye, it is an indication that the needle failed to deliver its twine to the twine disk. As a result the loop and knot were made in the usual way, but only one end was cut off. The disk of course was not threaded for the following bundle. This trouble may come from the fact that the needle pitman does not permit the needle to travel sufficiently far forward, though this is seldom the case. What happens more frequently is that straws or trash interfere with the proper placing of the twine in the disk. On the discharge of the following bundle the disk may catch the twine and the third bundle will be properly bound.

7. *Several Bands Clinging to Bill Hook.* This is usually the result of several successive misses and may be caused by any of the preceding troubles where the knot is left on the bill-hook.

More general troubles are the following:

1. *Loose Drive Chain.* If the main drive chain is too loose, it attempts to climb the teeth in the small sprocket on the secondary shaft and results in a jerky motion. The tension should be tightened or a link removed.

2. *Creeping Canvases.* If the canvases are too loose or if the elevators are not square, the canvases creep; that is, the slats do not remain parallel to the rollers. The remedy is obvious.

3. *Ragged Bundles.* Ragged bundles may be due to (a) improper manipulation of the reel, (b) improper setting of butt adjuster, (c) improper position of binder head, (d) creeping canvases.

4. *Choking on the Deck.* This frequently happens in light, fluffy, overripe grain. The only remedy is to lower the deck cover if possible.

5. *Tier-shaft Motion Irregular.* If the tier shaft, or the whole binder head, in fact, starts tardily when tripped, or, after starting, runs with a jerky motion or makes successive revolutions without stopping, the trouble is with the dog in the binder-head clutch. When the trip arm releases the dog stop, a spring behind the dog should force it to engage the clutch with the driving motion and start the binder head at once. It should remain in engagement throughout the complete revolution of the tier shaft. The dog stop may become so worn that it will not throw the dog out of engagement with the clutch, and the tier shaft continues to revolve. The face of the stop may be filled or its length adjusted to remedy the trouble.

6. *Discharging Very Small Bundles.* This is due to imperfect contact between the dog and dog stop. The remedy is the same as that in 5.

7. *Choking Machine in Wet Ground.* Only a part of a swath should be cut, and relief may be had by tying the bundles looser and making them smaller.

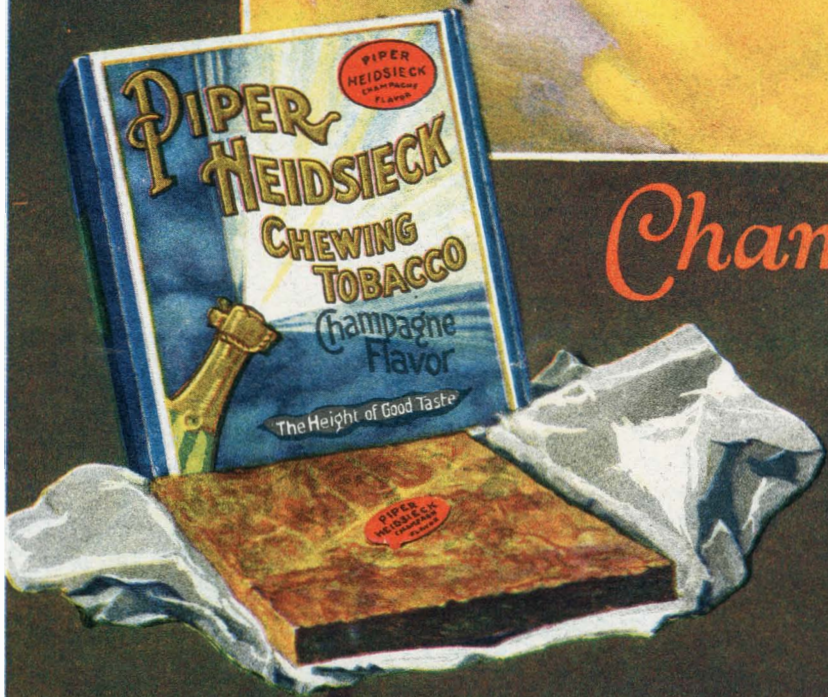
... and at the Waldorf-Astoria

**A fact:**

The Waldorf in New York is but one of the many hotels all over the country where Fatima is the largest-selling cigarette. The same thing is true, for example, at the Congress, Chicago; the Copley Plaza, Boston; the Willard, Washington, and dozens of other leading hotels, East and West.

*Liggett & Myers Tobacco Co.*

**FATIMA**  
A Sensible Cigarette



## Champagne Flavor

Luscious juices of firm full grapes and mellow Burley tobacco—skillful blending by our own process develops the lasting *Champagne Flavor*. Its distinctive quality places Piper Heidsieck above other chewing tobaccos while the price is only slightly higher.

# Piper Heidsieck

## CHEWING TOBACCO

Guaranteed by  
The American Tobacco Co.  
INCORPORATED

*If this Advertisement appeals to you stop at the first tobacco shop and buy a package of Piper Heidsieck*

# MARMON 34

## Pre-eminent Roadability

Running with steady smoothness even with only one or two occupants —this is a distinctive Marmon quality that never fails to impress the motorist who has previously driven other high class cars. Scientific construction makes it unnecessary to load the back seats to make this lightweight car cling to the road or ride on an even keel at any touring speed.

136-Inch Wheelbase — 1100 Pounds Lighter

NORDYKE & MARMON COMPANY

Established 1851 :: Indianapolis

Awarded to Nordyke & Marmon Company,  
Nov. 1, 1918, for October Competition.  
Permanent Award Nov. 26, 1918.

