SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIV.
NUMBER 16

NEW YORK, APRIL 15, 1916

10 CENTS A COPY
\$3.00 A YEAR

By carrying the torpedoes in a revolving cradle, back of the torpedo tube, it is possible to fire several torpedoes in rapid succession while the submarine is bearing on the enemy.

THE "REVOLVER" TORPEDO TUBE FOR SUBMARINES

The Rapid-fire, "Revolver" Principle Applied to the Submarine Torpedo Tube

By Edwin Cerio, Naval Architect

CONSIDERING the limitations of space which confront the submarine designer, it is only natural that the practice of increasing the number of torpedo tubes should have resulted in the adoption of an additional armament fitted to the outside hull of submersibles, thus obtaining a combined armament of inner and outer tubes of very doubtful efficiency.

The basic difficulty of increased offensive power of vessels in which limited dimensions and compactness are of paramount importance and essential for their handling, can only be adjusted by concentrating the torpedo armament within the water-tight hull in order that the armament may be easily controlled and speedily operated during the few instants upon which a submarine may reckon to deliver, successfully, a torpedo-attack.

Torpedo-tubes are the sole reason for the existence of the submarine, but their efficiency is entirely dependent upon a primary tactical condition: the possibility of firing torpedoes in a given position.

Owing to the limited field of vision and reduced under-water speed, the attacking position of a submerged submarine must be pre-established when the boat is running on the surface and maintained while diving. It is thus evident that only the torpedo-tubes bearing in the direction in which the attack has been prepared during surface navigation, have a chance of delivering a successful blow. It was only due to an error—which was emphasized by the British Admiralty's report on the sinking of the "Hogue," the "Cressy" and the "Aboukir"—that the German U-9 succeeded in accomplishing the remarkable feat of discharging within five minutes her forward and after tubes and

maneuvering under water so successfully as to hit three targets with four torpedoes. With the exception of this performance, all successful submarines' attacks performed during the present war confirm the tactical theory, based on the speed and vision limitation inherent to submarine warfare, and this will no doubt direct naval thought towards a more satisfactory solu-

tion of the torpedo-armament problem in the near future.

In attempting such a solution the features of torpedo armament which need be considered are the following:

1. The efficiency of torpedo armament depends upon the number of torpedoes which can be discharged in rapid succession by a submarine running under water on the course pre-established during surface navigation and followed when diving.

2. The primary offensive virtue of submarines depends upon the number of blows which can be delivered in the shortest period of time in a given direction and not upon the number of torpedo-tubes from which torpedoes might be fired if the vessel could be handled in order to alter its course and change rapidly from one advantageous tactical position to other successive favorable attacking positions. The latter is the case with modern destroyers and justifies the ample provision of torpedo tubes distributed forward, aft and amidships, but not with under-water craft.

3. As the high speed and the resulting tactical superiority of destroyers justify a wide distribution of torpedo armament throughout the ship's length, the low speed and tactical limitations of the submarine emphasize the advantage which results from concentrating all offensive power forward and within the water-tight hull of the boat.

If these conditions are considered, submarine designers will find the engineering problem of fighting efficiency outlined by the military features which torpedo armament must embody.

An attempt to solve this problem under the conditions stated above has been made by a revolving torpedo magazine and discharging device illustrated by figures 1, 2 and 3.

As the figures show, the forward end
(Concluded on page 409)

FIG. 1

Longitudinal section through revolving magazine

FIG. 2

FIG. 3

Cross-section showing details of revolving magazine

The Rapid-Fire, "Revolver" Principle Applied to the Submarine Torpedo Tube

(Concluded from page 395)

of a submarine water-tight hull is fitted with a magazine provided with cradles bearing torpedoes and in addition to these, compressed air vessels or chambers, arranged so that as each torpedo is brought up to the launching tube *L* it is accompanied by a chamber containing compressed air for discharging it.

Fig. 1 is a longitudinal section, Figs. 2 and 3 are cross sections of the forward part of the inner or water-tight hull.

In these figures *ss* are torpedo storing tubes carried by radial arms or disks *RR* fixed on a shaft *a* which revolves in bearings *CC*. *S* designates the torpedoes carried by the tubes *ss*, whose nozzles *M* can be made to fit into a mouthpiece *N* of the launching tube *L*, by moving forward the whole torpedo magazine or each torpedo-carrying tube in turn.

By disconnecting the storage tubes from the launching tube, when a torpedo has been discharged, the revolving magazine can be turned through the angle necessary to bring another torpedo to bear in the loading and discharging position.

The torpedo loading and firing device thus described and illustrated answers the main purposes desired in submarine warfare. Loading and discharging torpedoes from a revolving magazine further avoids all dangerous changes of trim as the centers of gravity of the weights displaced are all symmetrically disposed about the axis of the revolving device.

In addition to these advantages this system of storing, loading and discharging torpedoes in submarines enables the designer to concentrate the offensive power forward, in the most effective position for torpedo-attack and compact form. The speedy and simple way in which the device may be operated also contributes to the discharging of the torpedoes more rapidly and more easily than by the difficult and complicated handling which the system now in use requires.

War Game—V

(Concluded from page 405)

a rapid advance, which bears all the signs of a determination to press forward at all costs, will be the main factors in achieving success.

The coöperation, the team work, of the advancing troops and the fire of the artillery, together with the timely advance of the artillery to be on hand in case of need, and for possible pursuit of the retreating Blues, will be all important.

Questions

Question 1. Formulate the order which the commander of the Reds would send to the commander of the cavalry regiment, when he has made his decision to attack.

Assume that Lieutenant Colonel LC. is in command of the Reds.

Question 2. Using as a basis the general situation of the Reds as it was before the arrival of the reinforcing cavalry regiment, plan and place on the map the cavalry after the attack which was repulsed by the Blues.

Question 3. It is assumed that the Reds succeeded in crossing the creek, and are at a distance of 800 yards from the Blue line of skirmishers. Where will the Red artillery be? Will it remain on Chester Hill, or will it move to another position?

Taking your answer to this Third Question as the situation, place all the troops in position on the map.

Question 4. Which point of assault would be the most promising of results for the Reds to select?

Question 5. What would be the result of the capture by the Reds of the crest of Lookout Hill? Consider the situation of the Blues and the mission of the Blue detachment.

Question 6. In case of defeat by the arrival of Blue reinforcements, which way would the Reds retire?

Question 7. Night has fallen. What will happen?

Answers to Questions in War Game—IV

Question 1. The commander of the First Battalion, upon receiving Colonel K.'s order to take his battalion into action, will call his captains, and after explaining the situation to them, will give the order:

"We will attack the enemy along the lower portion of Timcum Creek, in the direction of the bridge.

"A' company will attack the enemy's line east of the bridge; 'B' company will attack west of the bridge.

"C' and 'D' companies as reserve will follow 'B' company.

"I will be with the reserve."

Compare Colonel K.'s order with this, to see how the battalion commander has worked out the details of that portion of the action allotted to him.

The reserves of the two companies going directly onto the firing line are called "supports." Whether the company will have its own supports or not, and when and how they are to be used, is for the company commander to decide. When we speak of "reserve," we mean the reserve of the battalion.

Question 2. Captain C., as left flank guard, has to cover almost a mile before he can get in touch with the cavalry skirmishers holding the lower edge of Pine Forest. He will proceed almost directly east, marching his company through the woods in "security formation," which is very similar to the formation adopted by the detachment in gaining Lookout Hill. However, the passage of woods, or thickly covered country, needs special security measures in order to guard against a possible surprise. Patrols may be sent ahead to reconnoiter. At times, the leading element may be deployed as skirmishers, and, by pushing ahead, cover the front of the advancing column.

The chief aim of the flank guard will be to reach the eastern edge of Pine Forest with a patrol and ascertain that no enemy is to be seen in that neighborhood.

Question 3. See diagram.

Question 4. Lieutenant Colonel LC., of the Reds, will put one battalion on the firing line. By retaining control of two thirds of his infantry as reserve, he will be able to assume the offensive, if the proper occasion should arrive. As soon as the reserves have been sent into the action, the control of the action has slipped from the hand of the leader. Therefore, the defensive line will not be a single line of closely-packed men, but exactly like the line of skirmishers of the attacking party, rather thin, and strengthened at need by pushing in portions of the reserve.

Question 5. The answer to this question may be decided by a comparison. Suppose you were in a house with a few friends, and this house should be attacked by a band of outlaws, what would be your first thought for defense? Naturally, to guard the doors and windows. By every available means you would attempt to strengthen these weak points. This same course must be followed in combat. With the help of the reserve which you have held out, you close the doors against the enemy.

In the present case, the doors through which the enemy may come, are the bridge, the partially destroyed railroad bridge and the forest on the right. The last two approaches are rather distant, therefore the bulk of the reserve should be retained directly north of the bridge.

Question 6. The artillery should be placed on the slope of Chester Hill, behind the house, near the railway. This would partially cover the battery from direct view, and would also permit an effective fire on the sloping hillside which the enemy has to use for approach.

At the same time, in case the enemy succeeded in reaching the bridge, which is the key to the situation, the battery would be in the most effective position to assist the infantry.

War Game VI will deal with the attack enveloping the enemy's flank. The details of the enveloping attack will be worked out on the map.

SAFE-GUARD YOUR FILES AND VALUABLES AS YOUR GOVERNMENT DOES

From the National Enemies—Fire and Theft!

Fire destroys each year about a quarter as much as America builds. And the law of averages says: *Your Turn May Come Next.* Consider the peril that surrounds your *business* and your *home* every hour. A fireproof building may protect itself—but not its *contents*. Consider that.

And remember that Science now leaves you no excuse if some day soon only ashes remain of your files, records, documents, instruments or priceless keepsakes. For here is a great invention *that ends fire peril*. It's the *genuine* and *only* SAFE-CABINET in the world.

Unlike Anything You Know

This is not a mere "insulated" cabinet, for THE SAFE-CABINET, S-Clientest Model, protects from fire where others fail. Yet it has all system's conveniences, and will house any standard filing devices in use.

It is not a ponderous iron safe. Size for size, it has twice the capacity of that, weighs only a third as much and costs far less.

Tested by Underwriters' Experts

THE SAFE-CABINET is inspected and certified "Light-weight safe" by the Underwriters' Laboratories.

Government, Railway and Insurance experts, State and City officials, and hundreds of business men in America and foreign countries have seen it scientifically tested—

First heated white-hot. Then hurled for a sheer fall of 30 feet under an avalanche of bricks. Returned unopened to the laboratory furnace and heated again near the melting point of steel.

All this—yet without a paper inside of it scorched!

No other container known to withstand such terrific attacks.

For Universal Use

Now in the War, Navy, State, Treasury and other Departments at Washington, in the U. S. consular offices throughout the world. The SAFE-CABINET protects the nation's secrets, files and records.

It is used in thousands of large and small offices, stores, factories, camps, public and private buildings and homes. It is fast replacing old-style built-in vaults, bulky iron safes, and wood and steel filing cabinets.

In Conflagrations

It has fallen red-hot amid thundering walls and debris. Laid buried for days in burned and water-soaked ruins. Ever with the same result when opened by the owner—all *contents intact—unharmful—safe!*

No man can estimate THE SAFE-CABINET'S value to the world. For probably 90 per cent of all uninsurable wealth is exposed to hazard. And this great achievement ends that.

Burglars have often tried in vain to force and blow open THE SAFE-CABINET.

Easy Payment Plan

You need this priceless discovery at once. Send today for catalog, low prices and monthly payment terms. Don't delay to your sorrow. Get the documentary evidence from men who've saved millions by using THE SAFE-CABINET. Full details free. For Safety's sake—mail the coupon **NOW**.

SAFE-CABINET USERS

Here are a few of thousands; some have purchased as many as 250 SAFE-CABINETS.

Equitable Life Assurance Society, New York
Live Stock Exchange Building, Kansas City
Continental & Commercial Nat. Bank, Chicago
First National Bank Building, Pittsburgh
Southern Express Building, Chattanooga
Hearst Building, San Francisco
Carter Building, Houston
Penn Mutual Building, Philadelphia
Bank of Nova Scotia, Winnipeg
Lebolt & Company (Jewelers), New York
Stone-Ordean-Wells Co. (Wholesale Grocers), Duluth
Hollywood Farm, Seattle

THE SAFE-CABINET S-CLIENTEST MODEL

48 Styles and Sizes Adapted to Every Known Business, Profession and Home. Highest Award at Both California Expositions. Protected by Numerous Patents. Trade Name Protected.

THE SAFE-CABINET COMPANY

Dept. 119 Marietta, Ohio

Originators and Sole Manufacturers of The SAFE-CABINET. Fifteen Branches and 800 Dealers in United States and Canada.

FOREIGN SALES DEPARTMENT, 15 East 26th St., New York

MANY RECORDS LIKE THIS

The Aetna Life Insurance Co., Hartford, Conn., writes: "Building practically destroyed by fire. A gas main exploded and SAFE-CABINET blown down to the basement. But contents all intact, although the SAFE-CABINET subjected to extreme heat."

Mail for Safety's Sake

THE SAFE-CABINET COMPANY
Dept. 119 Marietta, O.

Send your catalog postpaid and names of SAFE-CABINET users engaged in business similar to that indicated below.

Name.....

Business.....
(Please signify if for home use only)

Address.....

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway,
New York, Saturday, April 15, 1916

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

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Matter at the Post Office Department, Canada
Trade Mark Registered in the United States Patent Office
Copyright 1916 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

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

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

Militarism and the Militia

IN our issue of April first we discussed the army bills before Congress and the probable effect, good and bad, of their several provisions. Particular effort was made to invite attention to the clauses affecting the militia, and to the danger of creating a political organization in each state, under the immediate command of the governor, which organization, unified by military discipline and constantly increasing in numbers by reason of federal pay, would soon be in position to exert compelling influence upon members of Congress.

That our fears in this respect are shared by those who have opposed this legislation is proved by the minority report of the House Military Committee on this same proposition in 1912. In that report it was stated that "this course will surely lead to the creation of a great military force so powerful politically that Congress will be no more able to resist its demands than it has been to resist the demands of the far less compactly organized army of pension applicants." (Report 1117, Part II, 62d Congress, 3d Session.) Some of those who submitted that report are still members of the committee. On April third Senator Chamberlain, on the floor of the Senate, publicly complained of the influence the militia lobby was exerting to obtain greater concessions than his committee had deemed wise, "and we are already stepping upon the heels of the Constitution," he added.

The passage of the bill in the House, with the defeat of every amendment looking toward a better regular army, and toward the creation of a truly federal citizen force, showed that constructive military legislation could not be expected from that body. It was hoped, however, that the Senate would save the situation. But in the debates it soon became evident that Senator Chamberlain's statement as to the militia lobby was justified. One of the first amendments proposed was to authorize the appointment of five officers of the National Guard (militia) as members of the General Staff of the Army.

The General Staff was born in the Senate, and around the appointment of its members was thrown the safeguard of "such special rules of selection as the President may prescribe." These rules require that officers shall be detailed as members of that corps only on recommendation of a board of five general officers of the Army, all sworn to make such recommendation solely on the basis of proven professional efficiency and probable aptitude for the important duties delegated to the General Staff. These general officers have not only a personal knowledge of the character and ability of their subordinates, but have access to the records of all officers' service, day by day, for periods of from fifteen to twenty-five years, including the confidential opinion of each immediate commanding officer.

It may be seen that, though a mistake in selection may be made, nevertheless the chance thereof has been reduced to a minimum. And now the very legislative body which, in its wisdom, insured the General Staff of the Army being so carefully selected, has passed an amendment authorizing five militiamen to be appointed thereto. Not one of the safeguards can be made to apply. There is no exhaustive record of these militia officers' lives, nor can we ever hope to have such a record. And it is not possible for militia officers to have the experience and training heretofore considered an essential for a general staff officer of any army.

The effect of five votes in a small body can be appreciated by any who have been members of a board of directors of any large business. Certainly any member of Congress who has served on a committee cannot fail to appreciate it.

It was stated in our issue of April first that the pro-

posed legislation threatened to turn over the nation's defense to state-controlled troops. It was thought then that the General Staff would be the last corps of the Army to be invaded. That it has been the first indicates the gravity of the danger.

Simultaneously with this action in the Senate there has come to our attention a circular letter of the National Guard Association of New York which proves beyond peradventure of doubt the existence of an all-powerful lobby of militiamen in Washington. In that letter militiamen are informed that, while the Hay Bill is not all that could be desired, it was "felt by the *National Guardsmen in Washington* that it would be better not to raise any issue as to that bill, but to concentrate against the *Senate Bill* which cuts out pay for militia officers above the grade of captain." Throughout this letter there is no evidence of any interest in national defense. Special consideration for the militia is its guiding impulse, concerted effort to bring pressure upon Congress to that end being urged.

The present progress of the militia propaganda, if it be indicative of the future, points plainly to increasing demands with increasing power. No thinking man can doubt that the political force so dreaded by the Democratic minority in 1912 has already become formidable. Secretary Garrison opposed it and was forced to resign from the cabinet. Another year may see the militia representation on the General Staff doubled or trebled and the pay of the state troops still further increased. And when the full six hundred members in each congressional district have been enrolled and organized, we may see the election or re-election of any Congressman entirely dependent upon his attitude toward militia preferment and pay.

The Constitutional safeguards around the Regular Army can have no application to this new army. The Regular can rarely vote—he can never hold office. The members of this new force can and will do both. Unless some strong action is taken to check this movement in its incipency the strongest assurance for the continuance of a truly representative government in these United States will be lost, and militarism, which may be defined as the existence of a military force which exerts a political influence insuring for its members special consideration under the laws, will be ours before we know it. And so the menace of a great standing army, so dreaded by our fathers, will be an accomplished fact.

Sea-Going Submarines and their Torpedo Armament

UNAPPROPRIATE or imperfect definitions of certain classes of war vessels, notably of torpedo craft, have often caused confusion as to their real purpose and actual calling in naval warfare. Such, for instance, has been the case with the destroyer, which, through the many stages of its evolutions, has retained a descriptive denomination implying the destruction of torpedo boats, whereas the essential purpose of the latest specimens of such craft has become the destruction of line-of-battle ships. Similar confusion has arisen in defining the present day submarine and that which shall be the submarine of to-morrow: the type of boat of large displacement and high surface speed combined with a strong armament and highly developed sea-going qualities. The "fleet" or "squadron" submarine, as this type is generally referred to, as opposed to the coast-defense and the mosquito craft, is a conception, or, rather, a misconception, derived from an obsolete utopian idea: the French *submersible d'escadre*. With the advent of the internal-combustion engine French naval constructors and other authorities who followed the French lead had hoped to increase the surface speed and other tactical qualities of submarines to a degree that would have permitted their employment in the line of battle.

The hope of developing the submarine into a weapon capable of being employed as a fleet unit—to perform, in daylight, the work which falls to the lot of the destroyer at night—might well have been entertained in the ante-dreadnought era, at a time, that is, when valve gear and superheated steam seemed to have marked the last stage of progress of steam-propelled vessels and the great increases of speed which armored ships have attained through the adoption of the steam turbine were yet undreamed of. In naval warfare, tactical qualities and, above all, speed, have a purely relative value, and if the relative speeds of to-day's battleships and submersibles are considered, all hopes of realizing the fleet submarine must be given up or postponed to the remote future, in which the speed-problem of submarines may be solved by the advent of the single motor for surface and submerged navigation.

The outstanding feature of submarine warfare, *i. e.*, an inferior speed to that of its objective—the battleship—the absence of protection on the surface and the proportion of offensive power to displacement, all combine to indicate that, tactically, submarines either of-

fensive or defensive are better employed when independent of armored fleets or squadrons.

The purely defensive submarine has been successfully realized and it represents an effective weapon of coast and harbor defense. Between this type, which is yesterday's reality, and the "fleet submarine," which is to-morrow's dream, there is room for a conception embodying all requirements of present day submarine warfare: the sea-going, sea-worthy diving boat of 1,000 or 1,200 tons, powerfully armed, of high surface speed—20 to 22 knots—and great fuel radius—3,000 to 3,500 miles—capable of attacking battleships and destroying commerce on the high seas.

This class of vessel, better referred to as the sea or ocean-going submarine than the fleet submarine, with scarcely any increase in tonnage over that which has already been attained (1,200 tons), if more efficiently armed than the present day diving boats, would find a wide field for action in naval war.

Maneuvers carried out in time of peace by the principal navies to ascertain the tactical value of submarines since 1909, and the actual war practice in which such craft have been engaged these last two years, have directed naval thought to the shortcomings of submarines, but, at the same time, have pointed out the path on which further improvements of this redoubtable weapon might be realized.

Such remarkable and exceptional feats as the performance of U-9 on September 28, 1914, which succeeded in sinking three armored units, or that of the British E-9 at Heligoland, do not lend themselves to generalization, though they indicate the degree of efficiency which might be attained by all submerged vessels operating under favorable tactical conditions. These instances and other numerous feats performed by submarines operating independently of armored squadrons have reopened the much-debated question of torpedo-armament and its proper proportion to the other elements which combine to make fighting efficiency.

Up to the present the only attempt made to increase torpedo-armament has consisted in increasing the number of torpedo tubes. This number, which was 2 or 4 in the coastal submarines of a few years ago, has gradually reached 6 and 8 in recent designs, and even 10 in the case of the French "Diane" class. Obviously, the ideal arrangement of the torpedo tubes would be one that permitted all of the torpedoes to be fired in rapid succession while the submarine was bearing on the enemy, and as a solution by an Italian naval architect of this problem, we direct attention to the article by Edwin Cerio on another page.

A Seeming Paradox

THE more you put into a patent claim, the less it covers.

Many applicants for patents and many patentees complain that their claims do not fully describe their inventions, in that certain features of construction appearing in the drawings and described in the specifications have been omitted from the claims, and it takes a lot of explaining to make them understand that these things were intentionally left out of their claims in order that their invention shall be fully protected.

Courts must take the claims of a patent as they stand. They will add nothing thereto, nor omit anything therefrom. Therefore, if a claim is loaded up with unessential details, such a claim is a limited claim, and nothing that does not embody every detail specified in the claim, or the full mechanical equivalent therefor, will infringe such a claim.

Thus, if an invention consists in bringing together for the first time a wire basket, a handle, and a cover for the basket, forming a corn popper, and the model submitted should show the cover for the basket as being hinged at one end and closed automatically by a spring, a properly drawn broad claim for such an invention would omit to describe the cover as made of wire, or that it was hinged at one end to the basket, or that it was closed by a spring. If such features were added to the claim, it would make it a relatively narrow claim and one that would not be infringed by another corn popper which did not embody all the features specified. And, assuming that the patentee was the first to produce a corn popper comprising a wire basket, a handle and a cover, his patent, if it contained only such detail claim, would not afford him that protection to which he was entitled.

All of which shows how important it is to have patent claims properly drawn, for as laid down by the Courts, the claim is the measure of protection afforded by the patent, and the patentee is absolutely bound thereby.

Properly prepared patents and carefully worded claims not only afford full protection to inventors, but if litigation ensues in the effort to stop infringers, much of the time of attorneys and the Courts is saved, resulting in a saving in the costs of such litigation.

Naval and Military Notes

Tramp Steamer Record in the Mediterranean.—The French squadron operating in the Mediterranean has to coal and ship stores at sea from improvised mother-ships coming from Toulon. J. B. Gautreau, writing in the *Naval and Military Record*, says that one of these slow tramp steamers recently had a record of 19 voyages, during which it had supplied to the fleet 90,000 tons of coal, 20,000 tons of water, and 6,500 head of cattle, and this in spite of the fact that it was operating in submarine-infested waters.

Naval Personnel on a War Footing.—When war broke out, there were 146,000 officers and men in service in the British Navy. In addition to these were 67,000 reserves. At the end of January, there were in active service 320,000 officers and men. Parliament had authorized the Navy to work up to a maximum of 350,000 officers, men and boys by March 31st, 1916. Back of these, engaged on ship construction, repairs, etc., are about 700,000 men, making a total force working for the Navy, ashore and afloat, of over 1,000,000 men.

The Age Question in the French Navy.—Evidently the United States Navy is not the only one which is troubled by the problem of promotion in relation to age; for we are informed that the French officers are older than in any other navy, Vice-Admirals being, on an average, appointed at the age of 61, as against 52 in England; Rear-Admirals at 56 as against 47 in England, and the French Captains and Commanders being as a rule older than British Flag officers. Under the new scheme, the age limits are to be brought down approximately to what they are in England. We should do the same in the United States.

The 17-Inch Naval Gun.—The largest naval gun in commission on a warship is the 15-inch piece mounted on the "Queen Elizabeth" and her class. Next in size is the 14-inch gun mounted in our own and the Japanese navy. The largest gun reliably known to be mounted in the German navy is the 12-inch piece. However, among the many rumors regarding the German naval developments is one to the effect that a 17-inch naval gun is being mounted on the latest German battleships. The story that earlier ships are being armed with a 17-inch gun may be set down as a canard—the thing simply cannot be done. The big-gun movement is active and will persist for some time. Possibly the 16-inch gun will be adopted for our future dreadnoughts.

Warship-Building Capacity of Germany.—According to that excellent naval critic Hector C. Bywater, so far as building ways and construction plants are concerned, there is no reason why Germany could not have 25 battleships or battle-cruisers under construction at one and the same time. Though he admits that this figure may be astonishing, he shows that an examination of the various yards, Governmental and private, in Germany, justifies the estimate. In fact, he goes further, and states that, simultaneously, a program including light cruisers, destroyers and submarines, could be put through, since there are many German yards which, although they cannot build capital ships, are well equipped to produce the lighter craft. He estimates the total working force in all these yards at 100,000 men.

Gun Construction Capacity of Germany.—It is well understood among naval men that the limiting element in the question of rapid construction of a navy is the speed with which the guns and armor can be produced. Speaking upon this question, Mr. Bywater draws attention to the fact that during the naval agitation of 1909 in England, the then First Lord, Mr. McKenna, stated that it was not beyond the power of the Krupp establishment to produce all the guns and armor necessary for eight dreadnoughts per year. This output would be additional to the enormous home and foreign orders for war material taken care of at Essen. Hence, having in view the increased size of the Krupp works, this authority believes that the Essen and affiliated factories could supply the guns and armor for all the dreadnoughts and other ships which Germany is capable of building.

Ships Lost By Allies and Neutrals.—The most reliable statement of the total losses in merchant vessels, both steam and sail, is that recently made by Admiral Sir Cyprian Bridge. His report gives the total losses from the beginning of the war to March 23rd. The Allies have lost a total of 538 ships of an aggregate tonnage of 1,668,000. Great Britain heads the list with 410 ships, of 1,339,000 tons, France being second with 53 ships, of 158,000 tons, followed by Italy with 27 ships of 73,000 tons, Russia with 35 ships of a total of 49,000 tons, Belgium with 10 ships, of 30,000 tons, and Japan with 3 ships of 19,000 tons. Very surprising in their magnitude are the losses of neutrals, which total 218 ships, with a total tonnage of 393,151 tons. The British loss in steam shipping is less than 4 per cent of the total number of vessels, and a little over 6 per cent of her total tonnage. The French have lost 7 per cent, the Russians 5 per cent, and the Italians 4.5 per cent.

Astronomy

A Great Meteorite Found in Brazil.—A meteorite weighing about 20 tons is reported to have fallen recently at Bezerros, in the state of Pernambuco, Brazil.

The Solar Eclipse of 1918.—Astronomers are already beginning to make plans for observing the total eclipse of the sun which will occur June 8th, 1918. The path of totality extends diagonally across the whole United States, as the shadow, after crossing the North Pacific Ocean, will enter the country in the neighborhood of Chehalis, Washington; pass over Baker City, Oregon; Hailey and Montpelier, Idaho; Rock Springs, Wyoming; Steamboat Springs, Central City, Golden and Denver, Colorado; Lakin and Ashland, Kansas; Enid, Oklahoma; Jackson, Mississippi; and Orlando, Florida. Along the easterly part of the route the sun will be too near setting for the best observations.

Studies of a Star Cluster.—The Mount Wilson Solar Observatory has completed a catalogue of the magnitudes and colors of more than a thousand stars in the globular cluster Messier 13. Nearly 11 per cent of these stars have negative color indices, suggesting that in this direction there is no marked absorption of light in space. Of the 400 brightest stars, 70 per cent are redder than a normal solar-type star; of the 400 faintest, 85 per cent are bluer than the normal solar-type star. By statistical methods the parallax of the cluster has been found to be less than 0.0001 second of arc. Five new variables have been discovered in this cluster, making a total of seven.

French and German Astronomical Journals in War-time.—Considerable turmoil has been stirred up in the ranks of the Astronomical Society of France by the action of a former member, a Swiss named Weibel, who recently resigned from the society, giving as his reason the fact that he "had enough of this abominable war, or rather butchery, in the daily press, and when he sought recreation in the study of astronomy he did not wish to read more articles on the same subject." This criticism had reference to the monthly journal of the society, *L'Astronomie*, which has delivered one onslaught after another upon the Germans, including the German astronomers, ever since the war began. Herr (or Monsieur?) Weibel proceeded to say that he much preferred reading the German astronomical journal *Sirius*, in which he had never seen a single word about the war. Needless to say, his resignation was promptly accepted.

Stellar Radiation and Star Colors.—The remarkable measurements of the radiation of stars made by Dr. Coblentz, of the Bureau of Standards, with his new thermo-electric apparatus in connection with the Crossley reflector at the Lick Observatory have brought out an interesting relationship between total radiation and optical brightness. It appears that the eye is a poor judge of stellar radiation. For example, in the "Dipper" the yellow star Alpha, one of the "pointers," is somewhat fainter to the eye than the blue star Epsilon, in the handle; yet the total radiation emitted by the former is nearly twice as great as that of the latter. It is found that in general red stars emit two or three times as much total radiation as blue stars of the same photometric magnitude. Measurements of stellar radiation transmitted through an absorption cell of water reveal the fact that in the spectral region to which the eye is sensitive blue stars have about twice as much radiation as yellow stars and three times as much as red stars.

Dark Nebulae.—A recent paper by Prof. E. E. Barnard, in the *Astrophysical Journal*, gives strong support to the belief that, just as there are probably many dark stars—more, perhaps, than bright stars—so there are many dark nebulae. Dark stars are necessarily invisible, and reveal their presence only by their perturbing effect on the motions of bright stars and by eclipsing their light. Dark nebulae may, however, be visible as silhouettes against a luminous background, supplied by dense star fields, as in the Milky Way, or by luminous nebulosity, or, possibly, some faint general luminosity of space (a condition that Prof. Barnard thinks may exist). There are in the heavens many dark spots, of striking appearance, which have generally been assumed to be merely starless regions. The author presents photographs of some of these, and expresses the suspicion that "most of them are really dark or feebly luminous bodies shown in relief against a brighter background," though some are doubtless real vacancies. That a nebula may lose its light is proved by the case of Hind's variable nebula in Taurus, which, after having been a conspicuous object in small telescopes, ceased to be visible in the most powerful instruments. At present it is feebly visible in very powerful telescopes. Dark nebulae may have lost their light, or may never have been luminous. Since they are opaque they must be relatively dense, and hence their great mass needs to be considered in studies of celestial mechanics.

Automobile Notes

Shortage of Material Imminent.—It is beginning to be acknowledged by the automobile trade that serious difficulties on account of shortage of materials is imminent, and that as a result either prices must be raised, or substitutions must be made. Of course no first-class company would consider the latter alternative, as their reputations are too valuable; but some of the weaker houses will undoubtedly be compelled to this course or suspend operations. Even the larger manufacturers, who have long term contracts with the producers of materials, are having difficulty in maintaining their supplies, and this through no fault of the material men, as they too are having their difficulties in getting their raw supplies, and the future looks serious for many smaller manufacturers and assemblers.

A New System of Repairing Tires.—The procedure of the average repair man when mending an injured tire has heretofore been decidedly crude, for he did not remove the damaged parts, but simply laid on one, or a series of patches that destroyed the resiliency of the tire in their neighborhood, and which, on account of their unsuitable or unyielding character, were sure to work their own destruction in time. One of the prominent tire companies has given out instructions for making correct repairs, which include the complete removal of all defective portions, and the insertion of proper materials to effect a perfect renewal of the injured portion of the tire. The instructions are very simple and clear, and no new tools are required to carry out the improved methods; moreover, the cost and time are not increased. The improved methods will be appreciated by all automobilists in view of the increasing cost of tires.

Simplified Lubrication.—It is by no means unusual to find automobiles that require lubrication in eighty or more different places, and everyone of these requires careful attention, some every day, others once a week, while a few points will go six months without renewals; but it is very probable that some owners never discover all the little cups and holes provided for the lubrication of more or less essential parts. In such cases there is bound to be excessive wear on the undiscovered points. One of the most interesting cars seen at the recent show in New York was a foreign car where simplicity had been carried to most surprising degree; and in it there were but eleven oiling points in the entire motor and chassis, and even these required attention but once in six months. This result was attained by ingenious oil circulating systems, and the providing of capacious reservoirs by the drilling out of various shafts and fittings. Best of all, there appears to be no doubt as to the efficiency of the arrangement.

Pumping Oil in Cylinders.—Complaints are often heard that the action of the piston in an automobile cylinder tends to pump the lubricating oil up into the combustion space. A simple remedy for this condition, which is said to be satisfactory, is to round off very slightly the upper outside corner of the upper piston ring, and the lower corner of the lower ring. This does not affect the compression in the least, and the action is to permit the upper ring to pass the oil on the cylinder walls on the up stroke, instead of scraping it up to the top of the cylinder; while on the down stroke the surplus oil is scraped back. On the other hand, the up stroke of the lower ring tends to carry the necessary oil for lubrication up the cylinder wall, while on the down stroke the rounded lower corner of the ring would pass over the oil thus distributed and leave it behind. The intermediate rings should have both upper and lower corners eased so as to disturb the oil as little as possible, allowing it to remain and perform its function as a lubricant.

A Cemented Tire Causes Loss of Battle.—That a poorly cemented "solid" rubber tire could have a deciding influence on a battle would be incredible were it not for the letter a driver in the Supply and Munition Column, of British Army Service Corps in France, to a friend in England, describing how a fight near Ypres was lost by the British some months ago. The tire was on the front wheel of a big motor truck, leading an ammunition column at high speed towards the scene of the heavy fighting. Suddenly the entire outside of the tire came off, leaving a layer of rubber around the wheel about half the thickness of the original tire. The truck swerved violently, finally going half into the ditch, and blocking the road for nearly half an hour. In the meantime a section of the British front had to fall back because of lack of ammunition. Examination of this tire showed that it had evidently been made up of two layers with smooth edges, the two halves being cemented together. Under the heat and friction of the drive the two halves came apart and the expensive accident resulted. Truck tires of this type usually are molded from one single piece, and an investigation is said to have been started, with the idea of discovering whether other tires from the same factory were made in a similar manner.

Houdini's Strait-Jacket Mid-Air Escape

ON March 29th the employees of the Custom House in New York City were treated to a unique spectacle when Harry Houdini, the "Handcuff King," was suspended by the heels at a dizzy height of 60 feet over the subway excavation at the Battery. His arms were confined by a specially constructed strait-jacket—the ordinary article of commerce, intended for the restraint of the insane, being about as much good to Houdini as would be a strait-jacket made of sheer lawn. His heels were securely tied and his arms were pinned by the enormously reinforced strait-jacket. He was then swung out by the derrick by his heels, head downward, and in the course of five minutes he wriggled himself free.

The well-known vaudeville entertainer does not make any trick of this act; it is a feat of strength and skill. When his challengers have fastened him in the strait-jacket he elongates his arms, by partial dislocation, giving him at least 3 to 4 inches of free space, and this space is practically the key to his strait-jacket releases. He manages to writhe, struggle and by sheer muscular strength gradually work the arm straps, which are buckled behind into the small of his back, slowly but surely toward his head, and eventually manages to get the binding straps over his head where with his teeth he opens the first buckle. His hands are trained to loosen things through the canvas sleeves and in this wise he opens the remainder of the straps. He has often performed this trick on a floor, using it as a lever, but it is a great deal more difficult to free himself in mid-air. On the first occasion that he tried this act, it took him one hour and 50 minutes and he could not work for several weeks.

Houdini states that he first conceived the idea of this act when going through a lunatic asylum where one of the unfortunate inmates was confined in one of these distressing contrivances. He asked the superintendent for a strait-jacket and proceeded to try the experiment. The life of the ordinary strait-jacket, however, was not very long, as Houdini, with his immense strength burst it asunder almost immediately. It gave him the idea, however, of a very sensational act.

A New Type of Military Rifle Fitted With a Bayonet Shield

THE present war in Europe has not shaken the standing of the infantry rifle as a weapon of offense and defense, despite the introduction of marvelous artillery, machine guns, hand grenades and many other accoutrements of modern warfare. If anything, the rifle has proved more indispensable than ever, especially in conjunction with the bayonet.

Bearing these facts in mind, much interest cannot fail to be attracted to a new type of military rifle and bayonet shield that have been invented by a former Greek army officer, Demetrius Stergianopoulos, now residing in the United States. His rifle is unique in that it is provided with a magazine holding eight cartridges, which are discharged with great rapidity by the movement of a handle situated under the rifle stock, well forward of the butt. In the conventional type of military rifle, the bringing of the cartridges into position is effected by operating the bolt mechanism, which necessitates removing the rifle from the firing position each time a shot has been fired. In contradistinction to this method, the Stergianopoulos military rifle ejects the shell of an exploded cartridge and moves a fresh one into place by the simple movement of the handle previously mentioned, which also serves as a convenient grip for the left hand in holding the firearm; in fact, it is claimed that this method of holding the rifle is less trying than conventional practice in which the wrist is awkwardly bent so as to allow the stock to rest on the palm of the hand. Because the rifle need not be removed from the firing position in bringing a new cartridge into place, the inventor claims that it can fire 50 rounds per minute, or three times faster than any other military rifle. Again, the chamber-actuating lever affords an ideal method of holding the rifle during a bayonet charge, for it permits of throwing greater weight into the thrusts; besides, since the breech mechanism can be actuated while holding the weapon in position for a bayonet charge, the rifle can be discharged during such an attack, the advantage of which is immediately obvious.

Despite its superior features, the new military rifle is of the same weight as the German infantry rifle, the Mauser, which

Houdini releasing himself from a strait-jacket while suspended in mid-air, with head downwards

tips the scale at nine pounds. However, the Stergianopoulos has the advantage of taking eight cartridges at a loading as against the six of the Mauser. The chamber-actuating handle under the stock is, of course, an exclusive feature which gives to the rifle manifold ad-

Military rifle which is operated by a lever placed under the stock, and provided with a bayonet shield

vantages. It is provided with a safety device which locks the handle in place so that a soldier has something firm to grasp when so desired.

In connection with his military rifle, the Greek inventor has devised a steel guard which is claimed to be most efficacious in protecting the modern infantryman,

while charging, against any thrusts or blows from the enemy's bayonets and swords. As will be noted in the accompanying illustration, it is placed at the end of the rifle, at the base of the bayonet's blade. Small as the shield is, its use affords considerable protection to the user, while its construction is such that it may readily be adapted to any military rifle now in use.

So well have the French military authorities thought of Stergianopoulos' rifle and bayonet shield that the French Military Commission in New York City, having seen his rifle last year, invited him to go to France. Accompanied by French officers, the inventor went abroad and demonstrated his weapons in the presence of an especially appointed commission. The French government delivered to him a Lebel rifle and cartridges, with the order to adapt, if possible, his rifle to the French 7-mm. cartridges. This he has done, and the rifle is now in the hands of that government.

An Automobile Speedometer That Operates by Air Friction

DEPENDING upon the principle of air friction and consisting essentially of two metal cups fitting one into the other, but not touching at any point, a speedometer has been developed to a commercial stage after three years' experimenting on the part of a leading watch company.

The new speedometer is unique in that it does not employ the centrifugal nor the magnetic principle as do the other types of speedometer in general use; instead, it relies on the friction of air as developed by metal surfaces. The two main components of the speedometer in question are a driving cup, which is rotated by power from one of the automobile wheels through the flexible shafting, and, suspended over and around it, a driven cup. The driven cup, which is also the indicating one since the numerals representing the miles per hour attained are marked on its periphery, is inverted over and around the driving cup, as will be noticed in one of the accompanying illustrations. This cup, as is also true of the driving cup, in reality consists of a double cup.

The driving cup of the speedometer comprises two concentric brass cups with a spacing of .108 centimeters between the two vertical walls, called "ribs" for convenience, both of which are rigidly mounted on a vertical shaft so as to revolve in perfect unison. Likewise the driven or indicating cup is made up of two aluminum cups attached together so as to form a single cup insofar as its mechanical operation is concerned. These cups are extremely light, being made of aluminum .008 centimeter thick. This means that 313 of these cup thicknesses would be required to total a thickness of 1 inch.

The driven cup when in position in the instrument has its inner rib floating in the annular space between the ribs of the brass cup, while the outer rib of the aluminum floats outside of the brass cup. There is an air space of .5 millimeter between the ribs of the brass and aluminum cups. In one of the accompanying views may be seen how the two cups are telescoped.

The operation of the new speedometer is of the utmost simplicity: the revolving of the brass cup generates the air friction which, were it not for a regulating hair-spring serving normally to maintain the aluminum cup at the zero marking, would cause the latter to revolve; in other words, the air friction developed serves as a means of transferring the driving power from the brass cup to the aluminum cup. The hairspring is so adjusted as to permit the aluminum cup to be affected by the air friction in direct proportion to the speed of the brass cup, so that the reading of the instrument will be correct.

The air friction developed in the instrument has been proved to be directly proportional to the speed of the revolving cup. It is this fact that has made possible a uniform calibration without introducing compensating devices to gain this end. Comprehensive laboratory tests are reported to have proved that air friction is not influenced by heat, cold or altitude up to 10,000 feet. The revolving cups, contrary to expectations, do not have to be carried in an airtight compartment, and no sealing is necessary. The regulation between the tension of the hairspring and the tendency of the aluminum cup to rotate under the influence of the air friction is so delicate that the instrument indicates immediately all speed changes, and indicates as low as one half mile per hour. Yet the instrument is so sturdy that its accuracy is not affected by vibration in regular service.

Brass and aluminum cups used in the new air-friction type speedometer, and parts and section of the flexible shaft which is assembled without a rivet

Air-friction type speedometer completely assembled, showing the arrangement of the parts

Method of mounting the driving and driven cups in the new speedometer

Counting the tails of captured rats to determine the rat-catcher's remuneration at a penny apiece

An official rat-catcher and his dog, with their "bag" of rats from French trenches

How the French Soldiers Wage War on Trench Rats

AMONG the grisly phenomena attendant upon war, one of the most offensive and dangerous is the plague of rats to which it always gives rise. Thus the black rat is said to have been brought into Europe at the time of the Crusades, while the "rat of the Goths" and the "rat of the Huns" were terms given to the predatory rodents who were camp-followers of those predatory barbarians. The reason for this unpleasant fact, to which the present European war offers no exception, is not far to seek. Where men gather in hordes to slay each other there is abundance of provision, both of the grain which some varieties live on, and of the carrion that tempts others. Moreover, sanitation is imperfect; and finally, the rats are permitted to breed unchecked. Since the female is fertile at the age of three months, and casts several litters per year of from 9 to 18, the rats rapidly grow into an appalling army. This is exactly what has happened in the trenches of France, until the matter has become so serious that the authorities have been obliged to take vigorous measures to abate the nuisance, not merely because of the complaints of the soldiers that both food and clothes are destroyed, but because of the many cases in which the men have been bitten. Owing to the filthy habits of the rat and its deadly fare of putrifying cadavers, such bites may cause grave infections, which may also be spread by its droppings upon food.

The French press is giving much attention to the matter, and a recent supplement of the French encyclopedia, *Larousse Mensuel*, contains an exhaustive article, to which we are indebted for the facts contained in the present article.

Rats have many enemies, including the dog, the cat, the ferret, the weasel and the owl, and all these aid man in their destruction. Besides this, they may be taken in traps; again, they may be suffocated or poisoned. Lastly, they may be exterminated according to the very subtle and modern method of infecting a few with a pathogenic culture. The disease rapidly spreads because of their cannibalistic habits.

The method chosen must be adapted to circumstances. Traps are probably best

where only a few individuals are concerned. But as the rat is extremely wary, care must be exercised to see that the trap is not contaminated by the odor of human hands or of previous victims. If necessary, the wires may be touched with a few drops of the essence of anise, to which rats are very partial. The trap must be put in a dry place and disguised as well as possible, and the bait should be attractive and varied. It is advisable, too, to make it of a kind not easy to get. Thus meat or cheese in a granary become unusual delicacies, to be sought by the epicurean rodent.

Where large numbers are to be destroyed, chemical poisons are commonly used. Arsenic or arsenious acid has long been thus employed, but its slight taste and odor and its resemblance to flour have led to its disuse at present, since it so easily lends itself either to accident or to crime. Carbonate of barium mixed with flour to form biscuits has been proposed, and phosphorus is peculiarly toxic to rodents. Several vegetable poisons have also been suggested, among them *nux vomica* and the toxic extract of squills.

Mechanical poisons, such as crumbled sponges or a mixture of plaster of paris and flour, are sometimes used. In this case buckets of water are placed at hand, and the thirsty animal succumbs to internal pressure after drinking. Asphyxiating gases are effective in some instances, especially fumes from disulphite. A few centimeters of this, introduced into a burrow, will slay all the residents. It is much used to exterminate field mice, about 8 or 10 kilograms to the hectare being required. In isolated burrows a successful method is to throw in a few fragments of calcium carbide, stop up the exits, and then pour in water. The mice are

(Concluded on page 410)

Is the Chinese Dragon Based on Fact, Not Mythology?

By J. O'Malley Irwin

DURING the latter part of a holiday trip in the Yangtze Gorges undertaken by my wife and self in November, 1915, we met Mr. M. Hewlett, British Consul at Ichang, and his wife, and in their company spent a day in the Ichang Gorge, landing at various points to climb the cliffs and explore some of the numerous caves.

While exploring a large cave on the right bank of the river, about one mile above the Customs Station at Ping Shan Pá, we discovered the fossils about to be described. The cave is reputed by the Chinese to extend some 20 miles to a point near Ichang. It is reported that a party of bluejackets from H. M. S. "Snipe" spent three days in the cave some years ago and that they failed to reach the end. Evidence that this party penetrated beyond the point where the discovery was made exists in the name of their ship painted on the cave walls at a point considerably farther in. The Chinese name of the cave is Shen K'an Tzu, which means "The Holy Shrine," and one of the characters forming the word K'an is the Chinese character for "dragon." A large rock is seen at the entrance, and some eight or ten yards behind this there is a peculiar piece of curved rock bearing some slight resemblance to a portion of a dragon's body; the resemblance is possibly suggestive enough to impress the Chinese mind, but

(Concluded on page 410)

Portions of the bodies of various reptiles as they lie in the Chinese cave

Coil of an extinct reptile in the foreground, two feet in height

A near view of the body of an extinct reptile, showing scale formation

(Concluded from page 408)

former, 907 New York Ave., Brooklyn, N. Y., N. Y. The invention resides more particularly in a structure by which, instead of compressing the carbureted air or gas in the crank case, the air is first drawn into the crank case and compressed so as to force it out under pressure in a highly heated condition through the carbureter to obtain the proper mixture which is fed to the combustion chamber of the cylinder and ignited or exploded to cause the operation of the engine.

VALVE OPERATING MEANS FOR INTERNAL COMBUSTION ENGINES.—P. H. MARCIL, General Delivery, Summerville, S. C. This invention provides means for operating the valves which will dispense with the ordinary extra shaft known as the cam shaft and of cross sprockets and chains for rotating the same. It provides valve operating means in which the valves are actuated by cams on the main crank shaft in such manner that the valves are only operated at every other revolution of the crank shaft.

AIR STARTER FOR INTERNAL COMBUSTION ENGINES.—F. E. CLINE, San Diego, Cal. This invention relates to an air starter for internal combustion engines, the starter being arranged to compress air within a reservoir while the engine is running, and by means of suitable valves to subsequently utilize the stored pressure for the starting of the internal combustion engine.

MIXING DEVICE FOR USE WITH EXPLOSIVE ENGINES.—H. W. ALLEN, P. O. Box R., Coalinga, Cal. This invention provides a device adapted to be arranged between the engine and the carbureter, and having mechanism for thoroughly mixing the several elements of the explosive charge to make a homogenous mixture, and wherein controlling mechanism is provided controlled by the action of the engine for regulating the amount of the charge of fuel admitted.

CARBURETER.—E. H. ARQUEMBOURG, 71 Rue du Moulin Vert, Paris, France. This invention has for its object an improvement in carbureters for explosion motors and particularly to carbureters with automatic intake, for the purpose of allowing said carbureters to give a constant carburation at any speeds of the motor whether running light or under a load.

Railways and Their Accessories

COMBINED DRIFTING AND RELIEF VALVE FOR LOCOMOTIVES.—J. F. MILLER, 743 14th St., Douglas, Ariz. This invention provides a drift valve associated with a relief valve of any preferred construction and automatically operated upon the actuation of said relief valve to admit a constant supply of saturated steam from the boiler to the main super-

COMBINED DRIFTING AND RELIEF LOCOMOTIVE VALVE

heated valve chambers, steam pipes, or cylinders of the locomotive so that when the latter is drifting the combustible gases in said chambers will be destroyed and the temperature in the different parts will remain constant. While the locomotive is drifting means provide for the practical elimination of the drawing in of cinders and heat at the exhaust.

CONDUIT COUPLING.—W. W. CARPENTER, 251 Dixwell Ave., New Haven, Conn. This invention has relation to improved conduit couplings, and is especially adapted for use in

CONDUIT COUPLING

connection with railway rolling stock or other coupled vehicles of transportation for the purpose of carrying fluids, gases, electric currents, and the like, these constituting the source of power or energy for the drawing of the train and for stopping the same by applying the brakes, for lighting purposes, or what not.

SLEEPING-CAR.—E. FLAGG, 109 Broad St., New York, N. Y. The invention relates to sleeping-cars of compartment and dormitory type. An object thereof is to provide a sleeping-car structure having a larger number of

berths in a standard car length than hitherto has been possible, thus securing greater efficiency and economy in floor space.

Pertaining to Recreation

PLAYING CARDS.—J. S. WAREAM, care of R. E. Butrick, 30 Church St., New York, N. Y. The invention consists of two packs of cards, there being printed on each card an animal, musical instrument or device with words indicating the call of the animal or device. The cards in each pack are numbered so that when the cards are dealt the players having cards with corresponding numbers may make the sounds indicated on the cards, each player endeavoring to guess the other player who is making the sound indicated by the words on his card.

HANGER FOR SWINGS AND HAMMOCKS.—W. J. BLACK, 41 Ellis St., Atlanta, Ga. The hanger consists of two portions connected in such manner that one of the said portions may be firmly and rigidly secured to a ceiling

HANGER FOR SWINGS AND HAMMOCKS

or the like fixed support, and the other being adapted for connection with the article to be supported, the two portions being connected so that the last-named portion may swing with respect to the first-named portion in opposite directions, and in the same plane, within limits, and wherein the connection is so arranged that the action will be noiseless during the swinging movement.

TOY PISTOL.—L. S. BIXLER, care of Kenton Hardware Co., Kenton, Ohio. The purpose in this instance is to provide a toy pistol constructed to represent a hammerless magazine pistol, the hammer being disposed within the casing and having a stud extending through a slot in the side of the casing by which the hammer may be cocked.

RESILIENT PLATFORM FOR STRIKING BAGS.—R. N. DIEHL, 2309 South Grand Ave., Los Angeles, Cal. This invention relates to a structure on which a striking bag or a punching bag is mounted, the structure being generally termed a striking platform, and receiving the impact of the bag when struck. It relates particularly to a striking platform in which the element presenting a surface or surfaces is resiliently supported to yieldingly receive the impact, and by reaction to exert a return force on the bag.

ADJUSTABLE GOLF-TEE BOARD.—M. FUCHS, Baker, Ore. An object of this improvement is to provide a golf-tee board having tee elements movable to provide separate individual tees either of which may be positioned for use, and thus provide a tee at different elevations above the board to meet the ideas of individual players.

GAME APPARATUS.—P. J. McCULLOUGH, 5201 Delmar St., St. Louis, Mo. The player directs the device by a limited number of movements over the surface of the board from an optionally designed starting point over a designated route to a particular selected destination, there being appurtenant to the board impediment pins adapted to be variously positioned adjacent to the starting point and between the same and the point of destination to limit the directions and movement that may be imparted to the mobile device in routing its course to the point of destination.

GAME.—J. KERR, Adrian, Mich. In this case the invention has for its general objects the provision of a toy which is suitable for playing as a game, the toy including novel means for holding a piece which is adapted to be thrown into the air and drop into a pot suitably placed.

Pertaining to Vehicles

RESILIENT WHEEL.—G. W. WATTS, 32½ Central Ave., Hot Springs, Ark. This invention provides a construction of springs for absorbing shocks incident to the travel of a vehicle. It provides a wheel having an inner hub member and outer rim member, between which are positioned a plurality of flat spring members each engaging, at both ends, the outer rim and, intermediate its ends, the inner hub member.

SPRING HUB CONSTRUCTION FOR VEHICLE WHEELS.—S. D. SIMMONS and H. AMLING. Address the latter, 4228 Park Ave., Bronx, N. Y., N. Y. This invention has to deal more particularly with a resilient hub construction whereby pneumatic or other resilient tires and their attendant disadvantages are dispensed with. It provides a wheel having spring means embodied in the hub and acting between the wheel and the axle to provide a cushioning action against the wheel and vehicle body.

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

The Gasoline Situation

IT seems unnecessary to go to any unreliable source for information concerning the gasoline situation when we have an organized bureau of the Government which has devoted so much attention to the subject as the Bureau of Mines. As a matter of fact, if Director Manning had not about one year ago dug Dr. Rittman out of the laboratory in New York and put him at work on investigations of the importance of gasoline, we probably would be just a year behind the point where we stand with regard to the development of the gasoline production.

The General Supply Schedule Committee organized by the Government has received bids for the supply of gasoline to the Government for the four months beginning July 1st, 1916. The lowest bid for the four months is 27½ cents per gallon, while the lowest bid for the supply of gasoline for the Government for the year beginning July 1st, 1916, is 31½ cents per gallon, and this it should be understood is in lots of hundreds of thousands of gallons, so that it is easy to see where the ordinary consumer will be when this wholesale rate to the Government is so high. Now, is this the result of manipulation, or is it the result of a normal use of what a few years ago would be regarded as an abnormal consumption of gasoline?

Senate Document 310 is rich in information as to the source of gasoline and its use, and the reason for the enormous use which has led to present conditions. Dr. Rittman in public utterances tells us at this time there are in the United States 2,250,000 automobiles, while the country is manufacturing between 3,000 and 4,000 additional automobiles each day, one company making at the rate of 2,000 a day, while another is making 500 a day, so that the automobile companies at the present time are producing considerably more than 1,000,000 per annum. In addition to this, there are 300,000 motor boats in the United States and 700,000 internal combustion engines in use on farms and elsewhere. At 500 gallons of gasoline per year per automobile, this reaches the sum total of 1,200,000,000 gallons of gasoline, more than 29,000,000 barrels. The new automobiles being put into commission each day, together with other engines on motor boats and farms mean an accumulated daily increase of considerably more than 7,500 gallons of gasoline per day.

Now as to exporting. While little more than a year ago we were exporting about 100,000,000 gallons of gasoline per year, we are at the present time exporting between 300,000,000 and 400,000,000 gallons per year, the exports thus equalling 30 to 40 per cent of the entire American production. As to the output, the Cushing, Oklahoma, field a year ago was producing daily more than 300,000 barrels of crude oil, while at the present time the yield is at the rate of less than 100,000 barrels a day, showing a loss at the rate of 73,000,000 barrels a year. As a matter of fact, the United States production of crude oil, whose content of gasoline is high, has fallen off, and there is less likelihood of discovering new fields such as the Cushing field. It must not also be overlooked that much of the new oil discovered in America does not naturally contain gasoline.

In the foregoing some reasons are set out why the price of gasoline has advanced as a natural commercial result of both increased demand and decreased production. It remains to be seen in what way the Government can control a situation which appears to be affected by purely natural conditions of supply and demand.

In the Senate Document 310 the situation is summed up generally by pointing out that the consumption of gasoline is rapidly increasing, and that the production of crude oil has been generally regarded as nearest its maximum. It also indicates that some immediate relief may be secured by the use in internal combustion engines of heavier distillates approaching kerosene; that an acceptable kerosene car-

bureter would at once go a long way toward relieving the present shortage of gasoline, and such relief as might result from a general use of cracking processes whereby gasoline is made from kerosene and other less valuable petroleum oils, which cracking processes are being rapidly developed and do promise some relief in the near future.

With a view to relieving the situation as far as possible at the present time 11 refining companies have just been licensed under the Rittman process, and it remains to be seen just how far this will affect conditions.

When the great demand and the shortage in supply is considered, the necessity of conserving the present resources is emphasized, and in a future article we shall deal with conservation of such resources, especially from the point of view of the Government experts who are giving the matter consideration.

Is the Chinese Dragon Based on Fact, Not Mythology?

(Concluded from page 399)

altogether fails to impress the foreigner. After proceeding some hundred yards inside the cave we found ourselves walking on a peculiar ridge in order to avoid the surrounding pools of water. This ridge curved backward and forward across the width of the cave like the curves of a large serpent, the suggestion being so strong that we lowered our lamps in order to examine the ridge more closely. To our astonishment and delight, we found that we were in very truth walking along a perfect fossil of some huge reptile. Further inspection revealed the presence of six or eight of these enormous monsters. Having taken a few small specimens of loose portions of scale for examination in a better light, we left, planning to return the following morning for the purpose of measurement.

On our return the following morning we selected one of the largest fossils lying for a great part of its length isolated from the others—the coils of the remainder being rather entangled. The isolated portion measured 70 feet, so that it is absolutely certain that the length is at least 70 feet, and as far as we could ascertain, this same specimen extended for another 60 or 70 feet. However, I admit that error is possible here, owing to the interlacing coils of the reptiles. The depth of the body seen in the foreground of the first illustration is two feet. The head is partially buried in the cave wall and appears to be a large, flat head similar to that of the *Morosaurus Comperi*. About 12 or 14 feet from the head two legs are seen partially uncovered, and again two more about 50 feet from the head. The fact that several persons have penetrated this cave in former years beyond the point where the discovery was made seems to indicate the fossils have been but recently uncovered, probably by a heavy discharge of water through the cave. It seems probable that these reptiles were trapped by some volcanic disturbance and starved to death; the size of the bodies compared to their length would indicate this. A point of peculiar interest is the resemblance to the Chinese dragon of these fossils. I believe that it has heretofore been supposed that the Chinese borrowed their idea of the dragon from Western mythology. The discovery has created a great stir among the local Chinese and foreigners, who are daily flocking to view the fossils. I am attempting to interest the Chinese authorities in Peking and also the Chinese Monuments Society in order that the specimens may be preserved from damage.

How the French Soldiers Wage War on Trench Rats

(Concluded from page 399)

suffocated by the acetylene gas disengaged. Since 1906 the "deratisation" of ships has been compulsory at all the ports of France. This is usually accomplished by sulfurous anhydride, which also kills all other vermin. The simplest way of producing this gas is by the combustion of

sulfur. Sometimes the liquified anhydride is sprayed by suitable apparatus.

The microbic destruction of rodents, previously referred to, has been developed by the Pasteur Institute. Dr. Danysz, "Chief of Service" at that famous institution, has prepared a culture of a bacillus somewhat similar to the *bacillus paratyphic B* and the bacillus of enteritis, known as the *typhic bacillus of rats, type D*. It is pathogenic to all species of rodents. Mice and field mice succumb to it in two to eight days; the gray rat, which is more resistant, in five to fifteen days. Sometimes a few individuals seem to have escaped the malady, but perish of feebleness at the end of two or three months. An inoculated individual has never been known to be cured. This virus, so fatal to rodents, is harmless when injected in men or other animals. It has been observed, however, that food polluted by dejecta from sick rodents may cause accidents to men. For this reason it is not regarded as safe to employ this method in the trenches, where life is peculiarly favorable to such pollution and where numbers of the men are in a debilitated condition which invites fevers of the typhoid type.

The Danysz virus is prepared in cultures of meat broth. It conserves its virulence a couple of weeks. It is used to impregnate grain or other food. In exterminating field mice 8 kilograms of grain thus treated is required per acre. The malady is transmitted by the absorption of the grain and also by contagion, since the animals devour the dead and moribund members of the species. Experiments have proved that from 95 to 98 per cent of the mice are thus destroyed.

For ridding the trenches of the fierce gray rats which add so much to their discomforts and dangers, the Pasteur Institute advises the use of extract of squills. But it is necessary to have a plan of campaign, since the rat is crafty and wary and quickly takes alarm. This plan consists in attracting the rats to special feeding places by an abundance of wholesome provision. They come in increasing numbers, until at the end of several days practically all are accustomed to come to certain spots at certain hours. Thereupon the poisoned food is set forth, and all are killed. The work is considered of such vital importance that it has been undertaken by the military *Service de Santé*. Squads of four men are formed and equipped. Each squad is capable of treating 5,000 meters of trenches, or 5,000 square meters of barracks, per day, using 10 bottles of extract to prepare 60 kilograms of bait made with milk or bread. Strict orders are enforced, likewise, as to the collection and incineration of organic debris. Finally, some of the officers have stimulated the interest of the men in the work of destruction by offering a premium of a sou per head for dead rats, which has induced the men to enliven the trenches by a new sport.

Industrial Preparedness for Peace

(Concluded from page 400)

grow and prosper. A few weeks before these men had been opposed to the "time-study" method of observing an operation. A short time before these men had questioned him and agreed with him regarding the necessity of scientific research in industrial operations. He went home that night satisfied because every last one of them had, without his suggestion, analyzed the operation, drawn his watch from his pocket, and measured the operation by timing its units. The change in attitude was felt throughout the plant. Men began to study their jobs. They were getting a new viewpoint. They cultivated new habits, and the new habits gave them still newer viewpoints. He found one man "timing" himself with an alarm clock and he kept an accurate record of his work for an entire day. At a meeting of our "Club," as we began to call it, he proved to us that 36 per cent of his time was wasted through avoidable delay. He made a bitter attack upon the repair department, and condemned the purchasing department for

the poor belting on his machine. The seeds of efficiency were sprouting.

The Conversion of John Holt

John Holt had attended each and every one of these meetings. He had sat apart and watched the proceedings with a languid interest. From day to day a change was noticed. He began to accept changes, and each change led to other changes. John Holt was open to change when that change was brought about through his own mind and heart. We were able to introduce the principles of efficiency, and achieve the anticipated results, without discharging a single man, without having a single serious discussion. "We" were able to do these things. He meant by the "We": John Holt, the workers and the "efficiency engineer."

Industrial Education

He had made a discovery. He had found that scientific management required an educative method. That education as a method of developing coöperation was more effective than executive authority and the theory of force. In our campaign for Industrial Preparedness for Peace we are seeking a high productive efficiency. We can achieve this goal if we still take adequate recognition of this educative factor in industry. The owners and managers of large industrial plants can learn much from this story of John Holt. Scientific management must start with education. Not a class-room exercise, but a laboratory school, wherein management and men will have an opportunity to study the problems of efficiency together. If the efficient way is the better way, then the worker should be taught the ways of efficiency. Fast horses are developed through breeding, training and careful attention against over-strain. The forced horse is not efficient—he is soon a wreck. Unlike horses, men may be educated, led, and guided by intelligent coöperation. All men have potential capacity for efficiency.

The Efficiency Viewpoint

Industrial Preparedness for Peace will depend upon our viewpoint of the meaning of efficiency. If it means merely a system of cards and files, a forcing, driving method of doing things, we shall make little headway. If we shall look upon efficiency as the conservation of our resources, the saving of our energies, the direction of our efforts, the establishment of coöperation—we shall then become adequately prepared for the economic and industrial struggles to follow the war. He read an advertisement the other day which had as a heading:

"The dumbest oyster can make a better pearl than the wisest man."

This truth applies to the problem of efficiency. The pearl of real human efficiency is a growth of nature. We efficiency men may create an imitation, but that efficiency which is the outgrowth of an educative and coöperative system will stand the tests of purity.

From the Editor's Mail Bag

The Cleveland Chamber of Commerce, Cleveland, O.

"I have noticed with interest the series of articles which you have recently contributed to the SCIENTIFIC AMERICAN on 'Industrial Preparedness for Peace.' I do not know whether you have completed your series or not, but I take the liberty of calling your attention to the work that this Chamber is carrying on along these lines. The plan of the Cleveland Industrial Development Company somewhat follows that of the recently incorporated American International Corporation of New York, having, of course, a naturally more limited field.

"As one of the methods of meeting the situation, however, I thought it might interest you.

"Following closely upon the announcement of the incorporation of the American International Corporation of New York, and the Allied Machine Company of America, in assisting American interests in securing business relations from foreign companies, the Cleveland Chamber of Commerce has just announced a

Why S-V Sales Have Climbed

During the period in which we offered Goodyear S-V Truck Tires in competitive tests, their sales increased 1,446 per cent.

A year ago we said to the truck owners of America:

"Put a Goodyear S-V and any other truck tire, on opposite wheels of the same truck. And if the Goodyear S-V doesn't show a lower cost per mile, we will refund its price."

We not only *believed* that the Goodyear S-V would outlast any other truck tire made. We *knew* that it would.

So we set out to *prove* the superiority of the Goodyear S-V.

Side by side with other truck tires, subjected to the same roads and jars and strains, the Goodyear S-V has proved itself a better tire.

Not once, but *thousands* of times, it has established the fact so conclusively that you cannot afford to disregard the evidence.

The Goodyear S-V Truck Tire has given uniformly better service; it has given uniformly longer mileage—and at a uniformly lower cost.

Get in touch with any Goodyear Branch, and have them send a man to tell you the S-V story.

The Goodyear Tire & Rubber Company
Akron, Ohio

GOODYEAR
ASBON
TRUCK TIRES

Goodyear S-V Truck Tires are steel base tires of the "pressed-on" type. The method of attachment is the easiest, quickest and most effective yet devised for motor truck tires. There are no holes to bore, no bands to shrink on, no stop-plates or keys to attach, no staples to insert, no wedges, no tinkering whatever. The tire is pressed directly on the wheel to stay until legitimately worn out.