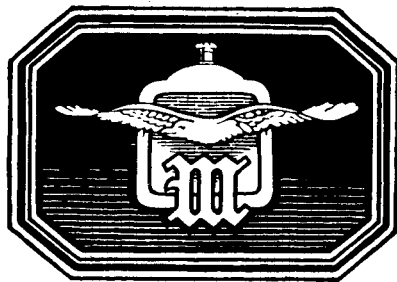


SCIENTIFIC AMERICAN



RUSSIAN INFANTRY MAKING USE OF MOVABLE STEEL SHIELDS DURING AN ATTACK.—[See page 407]



A STATEMENT

Concerning Final Drive in White Motor Trucks

IN VIEW of the conflicting claims for this form and that form of final drive which now confront the purchaser of heavy duty trucks, this Company, as the largest manufacturer of motor trucks in America, deems it fitting to make a public statement of its own purpose and practice in the matter.

White Trucks of over two tons capacity have always been chain-driven, and *will continue to be chain-driven* until some other form of final drive is developed in the future which is more efficient or equally efficient. In its present stage of development, worm drive will not be adopted by this Company, and White engineers now see no prospect of its basic handicaps ever being sufficiently overcome to warrant its adoption.

CHAIN DRIVE EFFICIENCY

1. White chain-driven trucks are more efficient because more power is delivered to the rear wheels.
2. They require a smaller motor for equal load capacity.
3. They consume less gasoline, getting as high as 50% more mileage per gallon.
4. They endure a higher road speed; perform more easily on rough roads, steep grades, and in heavy going.
5. They pull loads out of chuck holes and over obstructions which would stall a worm-driven truck.
6. Tire mileage is materially greater because the unsprung weight on the wheels is so much less.

WHITE TRUCK PERFORMANCE

Motor trucks have been in use long enough to accumulate a volume of motor truck experience, long enough for owners to know *actual operating value*. They can compare one truck with another. They have the records of performance; and large users who keep the most effective cost records indicate the showing of those records by an overwhelming preference for White Trucks.

That preference is well known. It is eloquently reflected in the fact that in total annual sales White Trucks predominate two to one of any other make, and among many large users they predominate ten to one.

WHITE TRUCK PREDOMINANCE

When a truck both outsells any competitor two to one and commands a higher price—its competition is severely felt by trucks of similar design, so severely in fact, as to necessitate a change in that design to escape the brunt of parallel competition. This gives rise to new theories of construction, which are adopted to arouse fresh interest rather than to improve the truck, in the endeavor to divert attention from White *performance*.

At this late stage of motor truck experience there is no need of truck buyers being bewildered by fads and theories. Over and above the conflict of all theory looms the solid fact of White Truck performance—longer life, more days in service, lower eventual cost, as attested by comparative cost records of numerous large users and by the fact that such users purchase more White Trucks every year than trucks of any other make.

THE WHITE COMPANY

CLEVELAND

ONLY GRAND PRIZE for Motor Trucks, Panama-Pacific International Exposition, San Francisco

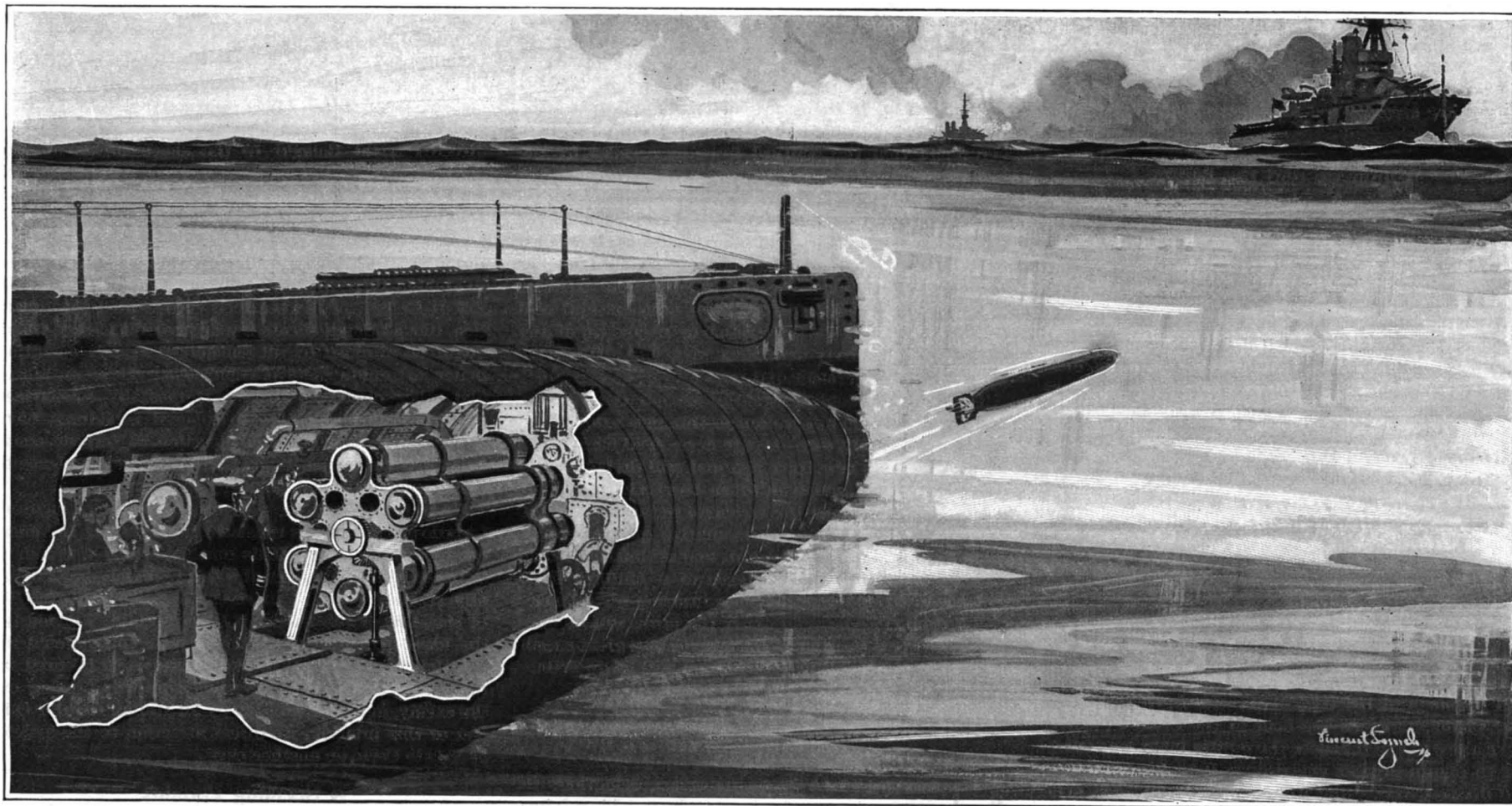
SCIENTIFIC AMERICAN

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)

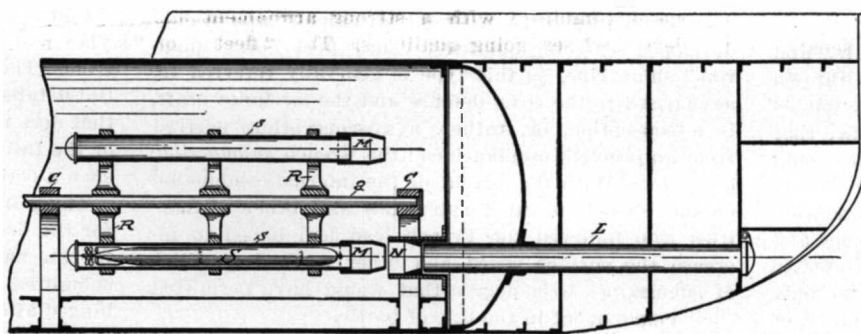


FIG. 1

Longitudinal section through revolving magazine

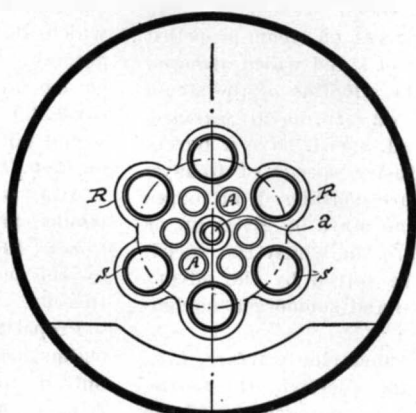


FIG. 2

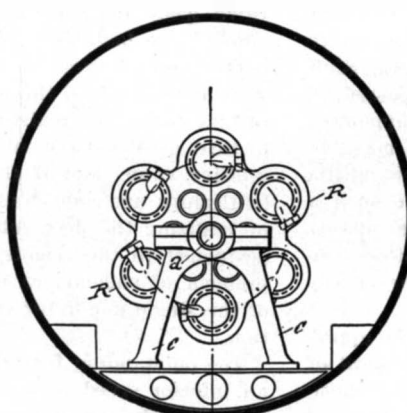


FIG. 3

Cross-section showing details of revolving magazine

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

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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 nebulae, 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.

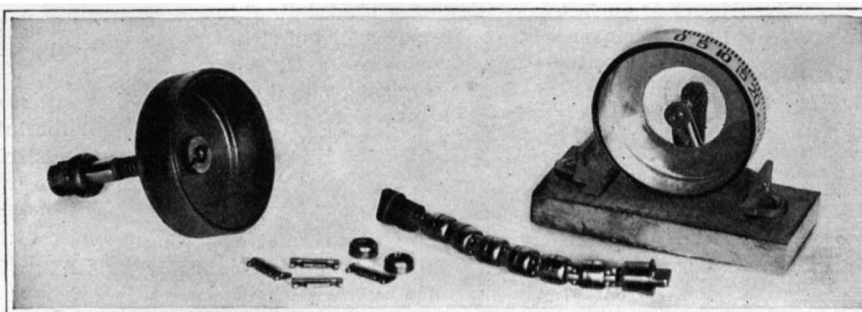
The new speedometer is unique in that it does not employ the centrifugal nor the magnetic principle as do the other types of speedometer in general use; instead, it relies on the friction of air as developed by metal surfaces. The two main components of the speedometer in question are a driving cup, 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.

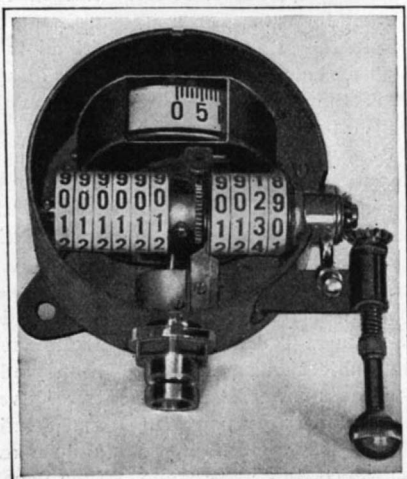
The driven cup when in position in the instrument has its inner rib floating in the annular space between the ribs of the brass cup, while the outer rib of the aluminum floats outside of the brass cup. There is an air space of .5 millimeter between the ribs of the brass and aluminum cups. In one of the 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 hairspring 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.

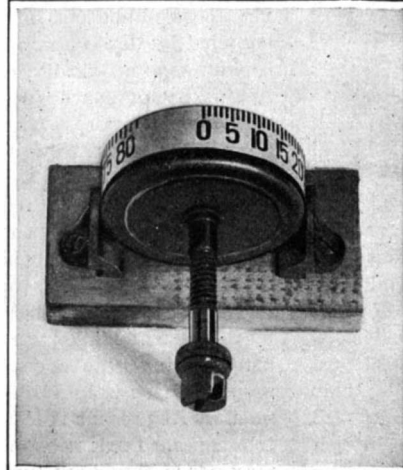
The air friction developed in the instrument has been proved to be directly proportional to the speed of the revolving cup. It is this fact that has made possible a uniform calibration without introducing compensating devices to gain this end. Comprehensive laboratory tests are reported to have proved 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

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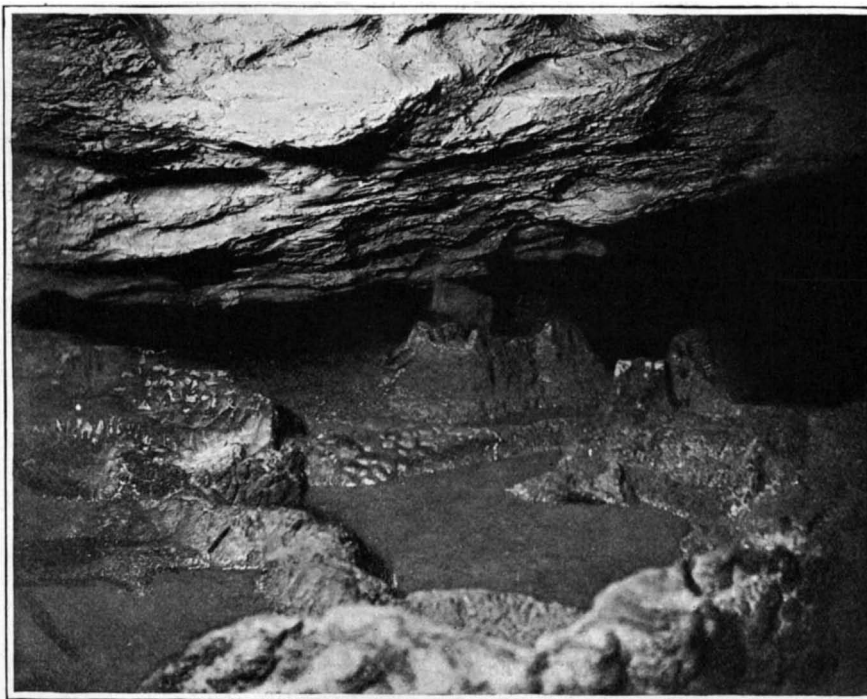
Is the Chinese Dragon Based on Fact, Not Mythology?

By J. O'Malley Irwin

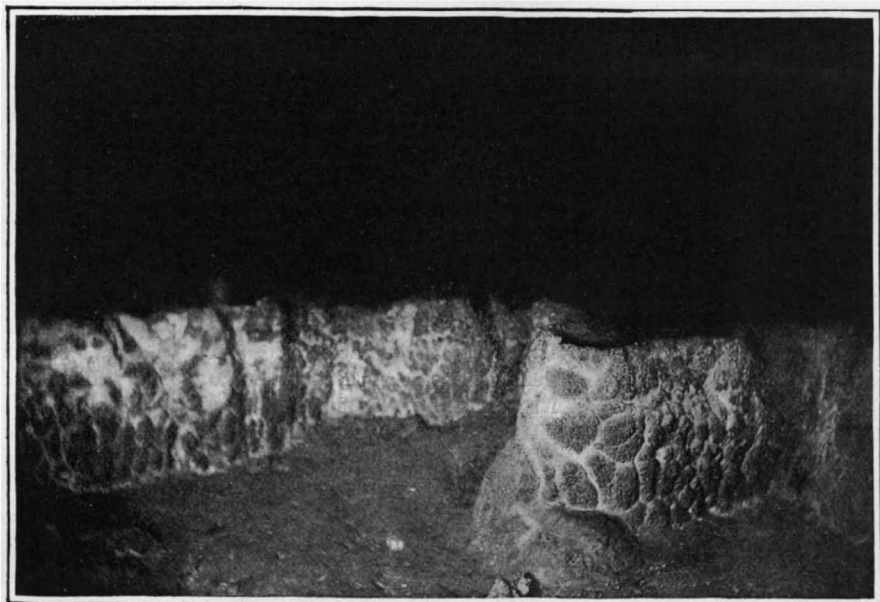
DURING the latter part of a holiday trip in the Yangtze Gorges undertaken by my wife and self in November, 1915, we met Mr. M. Hewlett, British Consul at Ichang, and his wife, and in their company spent a day in the Ichang Gorge, landing at various points to climb the cliffs and explore some of the numerous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

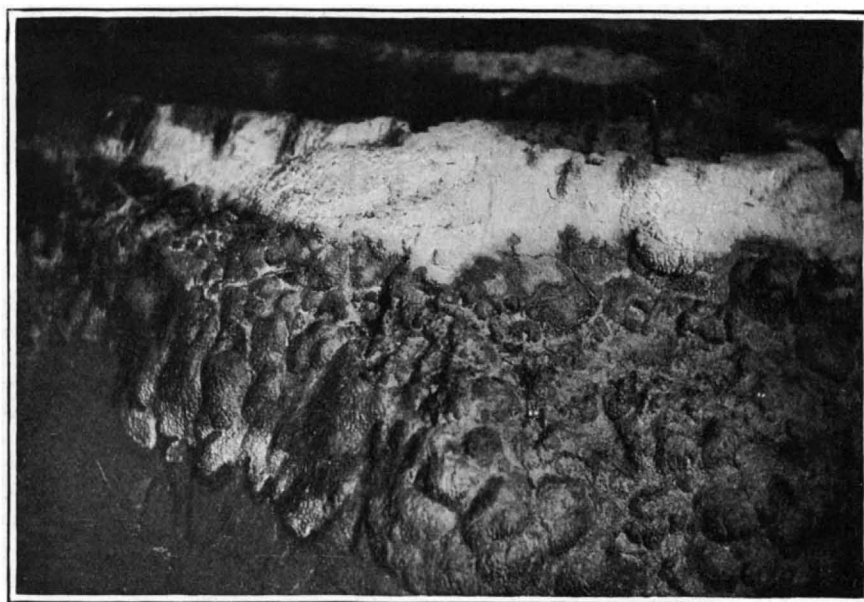
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Portions of the bodies of various reptiles as they lie in the Chinese cave



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

Industrial Preparedness for Peace

VI. Planning and Dispatching

By Miner Chipman

JOHN HOLT had been manager of the plant for 22 years. The factory consisted of a small wooden building with four machines, and 36 workers, when he first took up the reins of management. He had seen the business grow from a volume of a few thousand dollars per annum, to nearly two million. He was proud of the achievement. He handled the multitude of details in much the same manner as he had handled the simple operations of management 20 years before. The time-clock, the telephone, and a species of cost-keeping had in their time entered in the routine transactions of the plant. Looking backward, John Holt could see vast improvements in the management of the factory, improvements he had devised and introduced. That anyone could question his success as a manager was not to be imagined. His attention was devoted to manufacturing. He knew little or nothing of the problems of distribution. The sales department was a very insignificant and unimportant function of the business insofar as John Holt was concerned. It must be easy to sell "his product," there was no real job about that. He never associated the net earnings of his company with his manufacturing problems. He knew, or thought he knew, that there were no wastes in his factory. If the company did not make money it must be because of selling at too low a price. The sales department must be to blame. On several occasions he had visited the factories of competing companies. He had been shown the new systems of planning out the work of the factory. These new devices had impressed him as so much red-tape, which he vowed should never be imposed upon his organization. He had read with more or less interest certain books on efficiency and scientific management, the president of the company had given him. He realized that certain very remarkable things had been accomplished by these experts, but could discover no analogy between the factory operations described and the operations involved in his own factory. He could see just how these scientific principles could be applied in the "machine shop," but was satisfied that no such scheme could be worked out in his factory.

Forced by Competition

John Holt had always prided himself upon the fact that all betterments to plant, method and system had been suggested by himself. His long experience had led him to believe that no suggestion of real worth could come from without. It was a matter of great surprise, and grave concern to John Holt, when he was suddenly called into conference with the president, and introduced to a stranger to whom the president gave the title of Efficiency Engineer. The chief executive went on to say that the company was not making profit. Competition had grown to such an extent that something radical must be done. He was quite satisfied with John's management, but felt that the new efficiency methods might be applied to the factory. John struggled to maintain his poise. It was difficult. He had a strong inclination to resign. He felt that the introduction of the "efficiency man" was a personal affront, a reflection upon his experience, ability, and prestige. He controlled himself, and kept silent. The efficiency man was employed.

An Experiment in Efficiency

The "efficiency engineer" introduced by the president to John Holt had been placed in the same position many times before. He had been given authority by the board of directors and the president of the corporation. It had been his habit to "force" efficiency systems into a plant, and it had mattered little to him whether or not the manager or the superintendent liked it or not. A number of experiences in forcing efficiency had awakened within him a realization that the method was not strictly scientific. Very gradually the thought evolved in his mind that there must be a better way. His first visit with John Holt convinced him that the time had arrived when he should make a new departure in the method of introducing "efficiency" systems. He started out, therefore, with a different attitude toward the management, and a different viewpoint toward the wastes of inefficiency. He laid down as the first principle of his new experiment the following:

"The first duty is to know, to understand, and to appreciate the attitude of the management."

Instead of placing John Holt upon the defensive, he placed himself upon the defensive. Holt was not the kind of a man to be forced. There was a possibility of his being convinced. If we have the power, it is

much easier to force a man than it is to convince him. It takes power and creates much friction, and altogether it is an expensive undertaking. As he sat talking with John Holt he made up his mind to get his viewpoint, and appreciate just what that business meant to him, and what John Holt meant to the business. The experience was really refreshing. He purposely refrained from relating his previous exploits. He did not mention the word "efficiency." He was careful not to allow the word "waste" to enter the conversation. Given half a show, he found John Holt very much a man.

Habits and Viewpoints

In the first place, he found that John Holt *was not* opposed to efficiency methods. John Holt thought he was efficient, and the methods he used were likewise efficient. John Holt was not satisfied with things as they were. Not at all. He had many plans for improvement, and had suggested many things which had been rejected. With all his pride for his achievements of the past, he had many disappointments. Things had not always worked out in a way just to suit him. As soon as he found that the "efficiency man" was willing and ready to listen, and was not attempting to force upon him a new world of technical words and phrases, he began to pour himself out—his real self, and the real John Holt began to be known. Without any strain upon the imagination he could see him as he would have been if he had used the theory of "force." He began to realize that he was on the right track. John Holt was very human, and being human was made up of habits and viewpoints. Given an opportunity to tell something of his experience, something of his inner life, the engineer began to appreciate the meaning of these habits, and to discover the reason for his viewpoints.

Planning and Dispatching

He soon discovered that he too was made up of habits and viewpoints. The principles of scientific planning and dispatching had grown to be a part of him. He attributed any objection to his orthodox plans and systems to ignorance and cantankerousness. When he sat down with John Holt to discuss the planning and dispatching of work through the factory, he was immediately confronted by grave difficulties. He found that John Holt was convinced that orders were well planned and efficiently dispatched through the plant. He felt that he was in close touch with every transaction in the factory. He could call any foreman on the telephone in a moment and get the facts about any order. What more could be asked? From an examination of the orders the engineer had discovered that deliveries were not being made according to promise. He had difficulty in tracing certain orders. He found where certain parts of the order had been waylaid and lost in the process. He knew all of these things, and yet he could see that John Holt conscientiously believed that his management was 100 per cent efficient. To demonstrate to him that such was not the case would be exceedingly difficult. He had not only John Holt to convince, but a corps of foremen, and a large number of workers. John Holt typified the organization. If the efficiency engineer's experiment was to be tried out he could not assume that the whole plant was ignorant and cantankerous. He set himself to work, therefore, in a study of the planning and dispatching problems of the plant. He made up a check sheet of all orders coming, and followed them day by day through the plant. He made up what he called a Daily Report of Work in Progress, which showed at a glance the following:

- (1) Orders on file and untouched.
- (2) Delivery promises.
- (3) Orders started.
- (4) Orders in progress by department.
- (5) Work done upon orders by department.
- (6) Department balances.
- (7) Delayed orders, and cause of delay.
- (8) Failure to deliver on promise.

He kept this sheet running for about 30 days. He had proved his case insofar as his own satisfaction was concerned. He realized that it would not do at all to turn this evidence over to the president, or present it to John Holt. The result would have been an explosion in either case. During all this time he had been having daily conferences with John Holt, and had made an intimate acquaintance with many of the foremen and workmen. The time had arrived for action.

The Open Forum

The efficiency man procured the use of one of the rooms in the Board of Trade and issued written invita-

tions to 100 or more of the men. He followed up this invitation by a personal request for their attendance. He stated that he would talk about efficiency and efficiency systems, and that he wanted every man to come loaded with questions. On the appointed evening he was confronted by about 25 men. He talked for one hour, and told them the story of his work in other and similar manufacturing plants. He said nothing about their own work, nothing about his discoveries in planning and dispatching. When he had finished he passed through one of the most strenuous ordeals of his life. That group of workers and foremen flooded him with a stream of questions. These questions were not theoretical, they were exceedingly practical. He found himself facing facts not arguments. Looking backward he was convinced that his audience got the better of it. We adjourned the meeting at midnight, and he promised to meet them again the following week.

Demonstration of Principles by Analogy

In the meeting which followed he worked out with these men the underlying principles of shop management. Given a proper opportunity to express themselves, he found that each meeting cleared up many of the more perplexing problems. In his talks he refrained from discussing "principles." He took particular problems in management, and by analogy and illustration forced these men to evolve a solution. The end of every meeting found us closer together. He discovered that the company had many "efficiency engineers" in their employ. The men had developed into efficiency men through practical experience, while he had gained his reputation through an exposition of principles. The combination of the two was bound to succeed. The method he used for demonstration of a principle was usually through the medium of "play." He "put over" the idea of scientific planning and dispatching by playing a very interesting game with a number of decks of cards. It was successful because it was simple.

A Model Factory

He purchased at the 10-cent store a dozen decks of playing cards. Four decks of the standard size, four decks of a medium size, and four decks of the "baby" size. He selected cards having a differently designed back for each deck. Each deck consisted of 52 cards with a Joker and an advertising card. He had, therefore, 648 cards, and 12 boxes. He opened the boxes, and threw the cards into a suit case with the wrappers. He then shook the suit case until the cards were thoroughly shuffled, faced and mixed up generally. He then said:

"Gentlemen: We are going to open a factory. I have here in this suit case all of my raw materials. Out of these raw materials I want you to make for me twelve decks of playing cards. I wish to have each deck arranged as follows: Ace low, King high, arranged in order, and piled in the following order: hearts, diamonds, spades and clubs, Joker, advertising card, and placed in the proper box. I can only accept perfect work." He then selected three men out of the group to perform the functions of the organization. He handed one of the men the suitcase, took out his watch, and said, "Go!"

It was an example of pure socialism. Each of the three wanted to be boss. There was no head. They wasted several minutes in discussion before they opened the suit case. The cards were in a condition of chaos, so were the men. It took them just 48 minutes to "deliver the goods." In the meantime the group had been watching the operations of the three with merriment and occasional suggestion. The obvious inefficiency of the operation had impressed itself upon the mind of every man in the room. The engineer called for volunteers, and selected three more men. They made an immediate improvement. They cut the time down to 30 minutes. Before the evening was over the entire group had entered into the spirit of the game, and a picked group of three men finally made a record by performing the operation in 14 minutes and 45 seconds. Even at this stage, there were many suggestions wherein seconds could be saved. There was not a man in the room that had not "held his watch" on his fellow workers. Everyone of them had been counting time on the second hand. They had never realized the importance and significance of a "second."

The Seeds of Efficiency

He went home that night thoroughly satisfied. He had planted the real seeds of efficiency. He knew they would

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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.]

Open Sights vs. Peep Sights

To the Editor of the SCIENTIFIC AMERICAN:

I am honored by having Mr. Walter Winans, one of the best known big game shots in the world, and the running deer champion, disagree with me as to the optical performance attaching to the use of open sights on the rifle (SCIENTIFIC AMERICAN, January 22nd, 1916, page 99). While agreeing with me in my review of the military rifle sights of the world in "How a Rifle is Sighted," Mr. Winans does not agree as to the details of the stages in aiming over open rifle sights.

Mr. Winans' letter is an amusing example of the difference between what one does, and what one thinks one does. He states that he does not see the rear sight ever as blurry or fuzzy, nor yet sharply for an instant and then change his focus to the front sight, some 20 inches or so farther up the barrel and ergo in a different focal plane from that of the rear. He states that he entirely "ignores the rear sight." He states that without looking at the rear sight the front goes instinctively into the right position in the notch, and then to the right spot on the game.

Inasmuch as the description of his sighting applies properly and entirely to the peep sight alone, and never to the open sight so far as actual optics are concerned, we are impelled somewhat to examine into his statements. If we could do with the open sight what he says he does then we would not condemn, as we do, the open sight.

The open sight system of a rifle consists of a small bead or other form at the muzzle of the rifle, this usually about one sixteenth inch in diameter, and on the barrel of the rifle near the breech, and usually 20 inches to the rear, a bar of steel, with a notch cut in it, so proportioned as to show the front sight with a little light around it.

The rear may have its notch in wide "V" shape, or in narrow "U" notch according to the preference of the shooter or the peculiarities of the maker of the rifle, but always the principle involved is the same. This is that the rifle is correctly sighted when the front sight touches the mark in the right spot, and then is drawn into the notch in the rear sight in the position selected by the rifleman as his standard sighting.

If Mr. Winans will consult his oculist he will learn that when one object lies in a plane say 12 inches from the eye, and another object in a plane 32 inches from the eye, the two cannot be seen sharply with the same focal adjustment of the eye any more than the two can be photographed sharply with a camera set for either one, and the lens wide open. Neither is far enough away from the eye to be in what is practically the hyperfocal or the universal distance of focus from the eye-lens.

Ergo the optical portion of seeing either sight clearly consists of focusing distinctly for an instant on either one to the exclusion of the other. Or if one is seen sharply all the time, the other is seen, if at all, blurred and fuzzy as stated.

That this is precisely what the eye has to do is proven by the fact that men on whom age is creeping, must abandon the open sight principle and use the peep, which does not entail this leaping of eye and change of focus from one sight to the other. Stiffened muscles of accommodation prevent this. The writer, as instructor in the militia, and as secretary of the strongest rifle club in this country and as "consulting arms expert" for *Outing* and other magazines for some years, has so repeatedly and so successfully prescribed the peep sight in place of the open for men with eye troubles, that he knows beyond peradventure of the success of such change.

While target shooting entails finer sighting than does most big game shooting, still target shooting is at a contrasting mark and so not so much more difficult in sighting process than is big game aiming. This being so let us consider the record of riflemen using open sights.

The British have for years used the open sight on their service rifle, the Lee-Enfield. The United States has used the peep for years on its service rifles.

The poor British rifleman, using this open sight, is compelled to use an "orthoptic" spectacle to enable him to define front and rear sight sharply. This orthoptic consists of a steel plate set in an ordinary spectacle frame, and pierced in front of the eye with a very fine hole. In the finer grades this hole is adjustable in size with an iris diaphragm just as is the lens opening in front of the camera lens.

In effect this sharpens up the vision and makes the focus of the eye nearer to the desired universal focus, just as stopping down a lens increases the depth of the

focus of the camera lens. This is a standard article of equipment in British rifle shooting.

Despite even this freak aid to aiming, the American rifle team in 1908 visited Bisley and wiped up the ground with the British and other rifle teams in typical and prayed-for British weather. The American team used peep sights, the British team the open sights to their disgust.

In 1912 the American team went to the Olympic games at Stockholm and there once more wiped up the Swedish earth with the British and every other rifle team using open sights. The British were not out-gunned, their match ammunition was as good as ours, they were out-sighted, despite being possibly better individual shots than our men.

So much for the accuracy of the open sight in tests that are open and above-board tests or sights.

Now let us consider Mr. Winans' reported performance of ignoring the rear sight and seeing but the front one.

In a rifle stocked exactly to fit the rifleman, fired with no great desire for high accuracy, and a rifle to which the rifleman is as accustomed as he is to his gloves, this is partially possible.

Before accepting this dictum of what Mr. Winans says he does for what he really does—which are horses of different colors—let us consider the ballistics of the matter.

In the case of sights 20 inches apart, a fair average for sporting open sights, we have a radius of 20 inches, a diameter of a circle of 40 inches, using the rear sight as the center from which we strike our circle, and hence a circumference of 123 inches. Inasmuch as a circle contains 21,600 minutes of angle, a minute of angle with our radius stated is just .0058-inch long on either sight.

A minute of angle includes one inch for each hundred yards of distance, accurately 1.047 inches. In other words the error of a minute of angle on the sights means the error of an inch for each hundred yards of range the mark stands from the muzzle. Ergo the error of .0058-inch in aligning the sights means an inch error at 100 yards, 2 inches at 200, etc.

The width of the common front sight hunting bead, or 1-16 inch, includes with our stated sight radius practically 11 minutes of angle, because in decimals the width of the front sight is .0625, and the width of a minute of angle is .0058. Ergo if Mr. Winans makes the small error in aligning his sights of just the width of the small front bead, he puts his shot 11 inches wide at 100, 22 inches wide at 200, and 33 inches wide at 300, all of which is unhappily sufficient to miss the vital spot on a brute if not the entire body. Such errors in elevation are very easy to make, particularly as open sights are sensitive to changes in light, which make the notch more distinct and alter the apparent relation of front and rear.

Half this error or half the width of the front bead or 16 inches error at 300 is not good shooting, and yet half this means but 1-32 inch in the position of the front sight in the rear notch.

These being the figures and the performance pertaining to the use of the open sight, the reader of the SCIENTIFIC AMERICAN will agree that if Mr. Winans can pitch his trusty sporting rifle to his shoulder and without looking at or ever seeing the rear sight, place the front sight in the rear notch with less than a 32nd inch error each time, he must have a rifle fitting him to perfection or be very lucky or both.

What Mr. Winans does do is to perform the operation of glancing at the sights so rapidly as to be practically instantaneous, but our armies are not made of a few million duplicates of Walter Winans, big game shot extraordinary, nor are military rifles made to fit like a suit of clothes as are the rifles of Mr. Winans. Such men have to aim slowly, have to fish for front, then rear, and cannot depend on long practice and well fitting rifle to enable them to practically ignore the rear sight. Hence the undesirability of the open military rifle sight.

Using the typewriter has as much to do with sighting a rifle as using a typewriter has to do with trundling a wheelbarrow. In one case we become so accustomed to the keyboard that we write by "touch," training of the fingers to stay in certain position over a familiar keyboard.

In the other we have a lot of men very unfamiliar with the rifle, compared with the experience of Mr. Winans, and they cannot use "touch" and they must perform the operations of sighting as I have described them. And the greater their deficiencies of eyesight, the greater will be their error in sighting with open sights.

The dictum of Mr. Winans as to the superiority of the open sight over the peep may seem very conclusive to Mr. Winans. The cold fact of a few hundred thousand American riflemen paying from \$2 to \$6 additional for peep sights on their sporting rifles each year, would seem to throw some little doubt on the conclusiveness of Mr. Winans' findings.

The matter boils down to the fact that Mr. Walter Winans, a Baltimore American but thoroughly imbued with the conservatism of his adopted "right little, tight little isle," prefers the open sights because most British rifle makers prefer them and install them and most British hunters conservatively follow.

The other fact still remains—that target riflemen, who desire only to hit what they fire at, American big game hunters in the proportion of two to one, the American ordnance department of the army and optical science all declare in favor of the peep sight.

The open sight is efficient in spite of optical difficulties so long as the eyes hold out.

The peep sight is efficient because it complies with optical facts and it is efficient regardless of the eyesight.

EDWARD C. CROSSMAN.

Los Angeles, Cal.

The Auroras of Iceland

To the Editor of the SCIENTIFIC AMERICAN:

During the last two months, there have been some magnificent auroras visible here at Akureyri, notably during the former half of October and the latter half of November.

On the 6th and 7th of October last, I observed some splendid auroral arcs crossing the sky from east to west, as usual a short distance north of this place and rising from 30 to 70 deg. above the horizon.

From the 13th to the 22nd of November the auroras were extremely brilliant. Those of the 13th were particularly beautiful. Words alone cannot describe their beauty. Between 6 and 7 o'clock in the evening of that day, there appeared suddenly a stream, or wand, of light above the horizon and to the northwest of this town. In a twinkling of an eye this stream of light extended itself across the heaven forming an arc of continuous light even to the western horizon. The latter is formed by a range of mountains 1,500 meters high and 15 kilometers distant, while along the eastern horizon runs a heath about 1,000 feet in height and 6 kilometers distant. The arc of auroras crossed the sky just beneath the Great Bear (Ursa Major) constellation, and remained there growing in brightness for a few moments, resembling an immense band or fringe of light, made up of dazzling lances or spears of ethereal flame moving from east to west and west to east like a vast line of infantry. Then, this arc was paralleled by another which crossed the Ursa Major constellation; a third crossed by the Pole star; a fourth crossed the zenith (Akureyri is situated on 65° 40' north latitude); a fifth a little to the south; and a sixth and a seventh arc crossed by the Pleiades. The seven arcs formed a bridge of continually moving light completely across the heavens.

This continued for some 10 to 15 minutes, during which time the auroras assumed at times various colors reflected by the moonlight. Then the most northerly arc faded away as did also the most southerly arcs, but the second, the third and the fourth arcs remained a few moments longer, when they broke up and rolled themselves into a vast spiral of dazzling light which outshone the stars and hid from view the cirrus clouds immediately above it.

A similar though less brilliant display greeted the eye on the 14th, the 15th and up to the 20th of November between 6 and 8 o'clock in the evening.

On the 21st, three young men of this town saw, about 6:15 to 6:30 in the evening, a brilliant stream of light dart up above the eastern horizon, and then form an arc of light across the sky just above the Great Bear, but below the Pole star. After remaining a few minutes the arc rolled itself up into a spiral of light of great brilliancy which displayed all the colors of the rainbow.

From 6:30 until 8:30 that evening I, myself, observed some very brilliant auroras, but the rainbow tints were not generally visible, these being probably due to reflected moonlight. At times the auroras were bright enough to hide some cirrus clouds immediately above them and were therefore at a lower elevation than these, but they were decidedly above the cumulus clouds which covered part of the sky.

The height of these auroras has therefore been between 3,000 and 9,000 meters, and the most northerly arc which rose to 30 deg. above the horizon has only been some 12 kilometers or good seven English miles north of this place.

The auroral displays are most frequent and most brilliant in cold and clear weather and seem periodical. Many reasons lead me to suppose them to be emanations of terrestrial energy rather than of solar energy.

As yet there is no meteorological station of any value in Iceland although industrial, commercial and scientific interests demand one, as also an astronomical observatory, both here and in the southern section of the island.

FRIMANN B. ARNGRIMSSON.

Akureyri, Iceland.



An Irish flax worker spreading water-retted flax to dry and "nature"



A field covered with flax which is exposed for a number of days to the elements

Increasing the Profits In Flax Mills

How Simple Efficiency Methods Have Resulted In Higher Prices for This Commodity

By J. A. McCracken

THE flax industry is seriously affected by the war. The present prices of flax fiber are about double those that obtained before the war. Irish flaxes bring as high as 43 cents a pound, Belgian flax as high as 60 cents. Canadian dew-retted flax has been sold in New England at as high as 25 cents, and a small lot of Canadian water-retted flax at slightly over 45 cents a pound.

The high prices and especially their wide range have been something of a revelation to Canadian flax operators. If one man's fiber sells for only 16 cents and another's at 25 cents and 45 cents, according to quality, the low man naturally begins to take notice. Formerly, when all shipments of Canadian fiber brought less than 14 cents (varying between 8 and 14 cents), the range of prices between lowest and highest was only a few cents per pound.

The causes of these differences are wrapped up in the curing and manufacturing, as well as, to some extent, in the crops as grown. In concrete terms, varying skill and attention create a difference of between \$200 and \$500 a ton in final returns. For the average crop of 300 acres, yielding 400 pounds of fiber per acre, this difference would be:

Three hundred acres at 400 pounds gives 60 tons at from \$200 to \$500 per ton equals \$12,000 to \$30,000.

In a word, a crop of 300 acres handled at one mill would yield between \$12,000 and \$30,000 more revenue than the same crop handled at another mill, the two factories being at extremes in efficiency.

To accomplish this result there are, aside from the character of the labor involved, only minor factors and a small outlay to consider.

Let us examine the processes that influence the final returns.

Harvesting

The progressive mill man sees to timely harvesting. Realizing the danger of labor shortage—so common at flax plants nowadays—he sets his pullers in motion

before the customary time, thereby losing somewhat in the yield of seed, but gaining enormously in the quality and yield of the fiber in the fields last to be pulled. Operator Number Two, on the other hand, does not start pulling until the flax has yellowed half-way up the stem. Therefore he ordinarily finds his last fields in process of deseeding and in second green before their turn comes to be harvested.

As the price for a given quantity of mixed flaxes depends on the poorest fibers in the lot, Operator Number

reach himself, as some flax men have previously done.

The two tanks already used at Forest are of concrete, each 25 feet long, 15 feet wide, and 4 feet deep. They are placed end to end. The water is supplied by a gasoline pump, from a well 108 feet deep, whose water tests 5.25 degrees Clark for softness and is quite muddy.* It is only four miles in a direct line from Lake Huron, from which fact some have supposed that there is a subterranean connection with the lake. This opinion is plausible in view of the shale formation of the lake bed opposite this point. Discharge from the tanks is through removable stoppers at the bottom to a public ditch.

The best fiber yet produced at this plant—the 45-cent lot—was secured from flax put direct into the tanks after it was pulled; that is to say, the flax was placed in the tanks without threshing or curing in the shock. This is the method long famous in Ireland, but it is gradually being abandoned for the method by which the seed is saved. In Belgium and Holland still more valuable fiber is obtained without sacrificing the seed. The crop is carefully cured and frequently held over from one year to another in order that there may be material for steady retting from early spring until late fall. Fraleigh intends hereafter to hold a portion of his straw over until the following year, and to start retting as soon as fine weather begins. By this means not only will the straw be improved, but he can keep his men steadily engaged and can reduce his equipment for a given crop to the minimum.

Each of the tanks mentioned above holds about two tons of threshed straw. The sheaves are placed tightly in a leaning position in the tanks until all the space is occupied. The mass is weighted with planks and stone so as to overcome not only the natural buoyancy of the straw, but also the added tendency to rise

* Note: Rain water, which is the ideal liquid in which to ret flax, tests 3 deg. Clark; upland surface water 154 deg., and ordinary spring water 185 deg.

(Concluded on page 413)



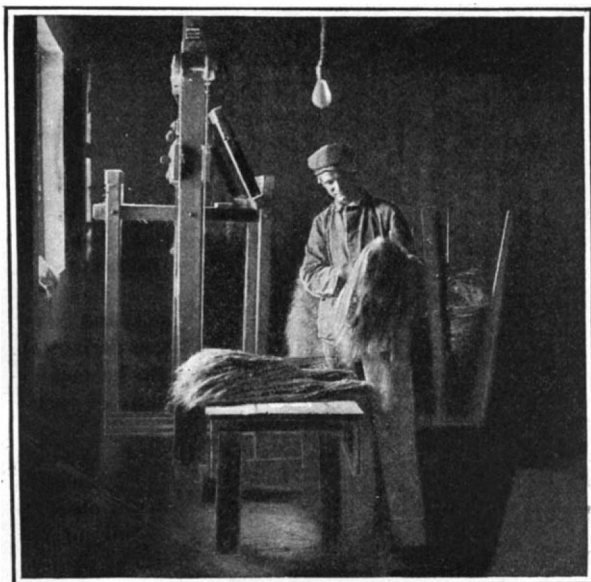
Spreading flax according to the old method of dew-retting

One loses no opportunity of separating good flax from poor flax, and starts grading at harvesting time. He pays extra to the pullers for making two or more separate lots, according to quality. Fifty cents an acre spent for this purpose is a profitable investment. Where short flax and long flax, coarse flax and fine flax are mixed indiscriminately at harvesting, no amount of pains or skill at later stages can separate them economically.

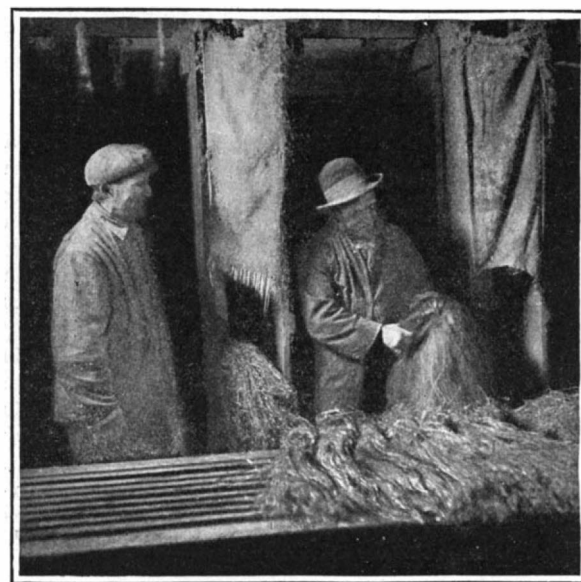
Retting

The importance of the system of retting is fairly indicated by the average price of Irish flax compared to the average price of Canadian flax. This season the former brings between 36 and 43 cents per lb., while the latter—except for one small lot, water-retted—brings between 16 and 25 cents per lb. The Irish and Canadian crops, as grown, differ little in quality. But Irish flax is water-retted, while Canadian flax, except for one departure to date, is dew-retted.

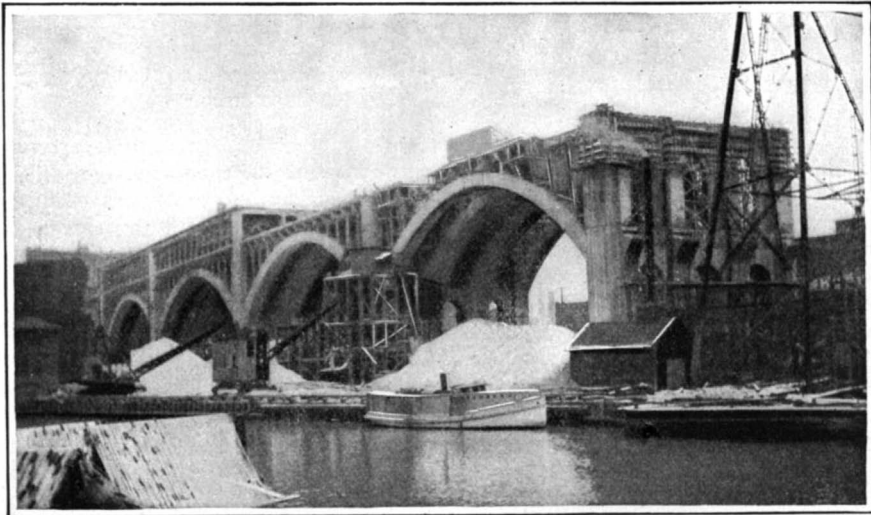
The chief advantage of water-retted over dew-retted fiber is one of uniformity, which is obviously important in fine spinning. The most satisfactory experiments in water-retting yet undertaken in America are those connected with the exception cited above, in the form of experiments conducted at Forest, Ont. The fiber which has been produced in this manner has brought 45 cents per lb. on the New England market. This flax, by the way, did not receive the complete advantages of water-retting, but only those of mixed retting, which means treating the flax half way in tanks and the balance of the process on the grass, as in dew-retting. The operator, Howard Fraleigh of Forest, Ont., was satisfied to take one step at a time so as not to over-



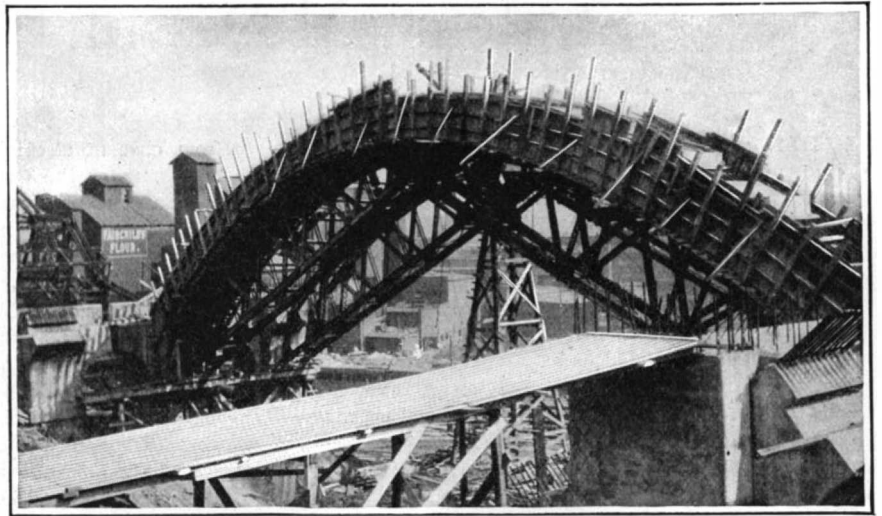
Examining and sorting flax before baling it



Two scutchers at work in the Forest flax mills



General view of one of the land sections of the Cleveland double-deck viaduct, in a partly finished stage



Wooden molds in place, supported by steel framework, ready for the pouring of the concrete

A Half-Mile Double-Deck Concrete Bridge

THE double-deck concrete viaduct now nearing completion in Cleveland, Ohio, is the largest of its kind in the country. The structure is 2,880 feet long and connects Superior Ave. at West 9th St. and Detroit Ave. at West 25th St., spanning the Cuyahoga river at a height that is sufficient to clear the largest lake steamers. With the exception of the arch that spans the river proper, the entire structure is built of reinforced concrete. The lower deck has six street car tracks, while the upper deck is confined to vehicle and pedestrian traffic. The latter has a 40-foot roadway and two spacious sidewalks.

In the building of the Cleveland viaduct over 106,900 yards of concrete and 6,000,000 pounds of one-inch steel bars, for reinforcement purposes, have been used. Twenty-five miles of concrete piling were driven for the secondary piers. The river piers contain 20,000 cubic yards of concrete.

Not the least interesting feature of the new viaduct are the 12 quadruple arches of concrete with an average length of 140 feet. These arches were constructed by erecting temporary arches of structural steel upon which the wooden molds for the concrete were built. The steel arches were of the adjustable type, and after the concrete had been poured and become hardened, they were removed and erected to support other molds.

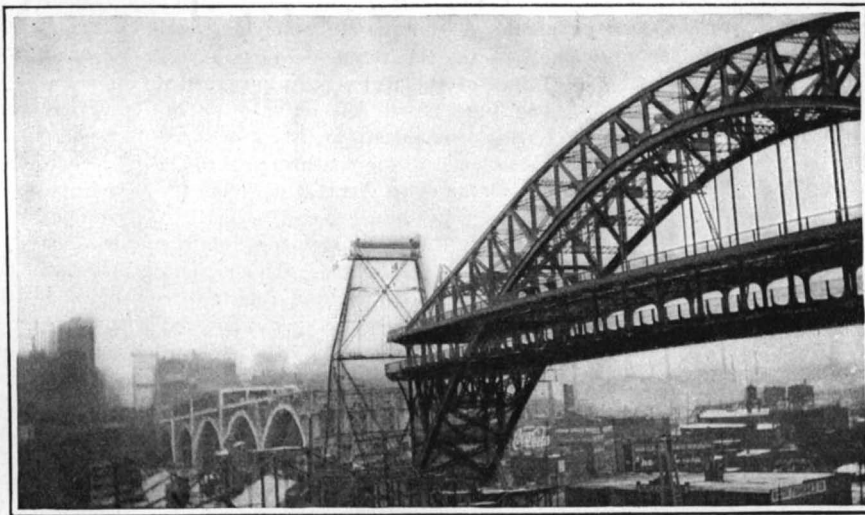
The steel arch which spans the Cuyahoga river proper is the largest span of the double-deck type in the country. It is 591 feet from base to base. Only two steel cantilever arches in the country exceed it in length—the one at Niagara Falls, and the Hell Gate bridge of the Pennsylvania railroad now nearing completion in New York City. The crown of the arch of the Cleveland viaduct is 200 feet above water level, and the two decks are suspended by hanger bars, the lower deck clearing the river by 96 feet.

The viaduct has a grade of 3 to 3.7 per cent, being 20 feet higher at the center than at its approaches. The cost of the structure will be \$4,500,000, it is estimated.

The Air Breakwater Put to Severe Test

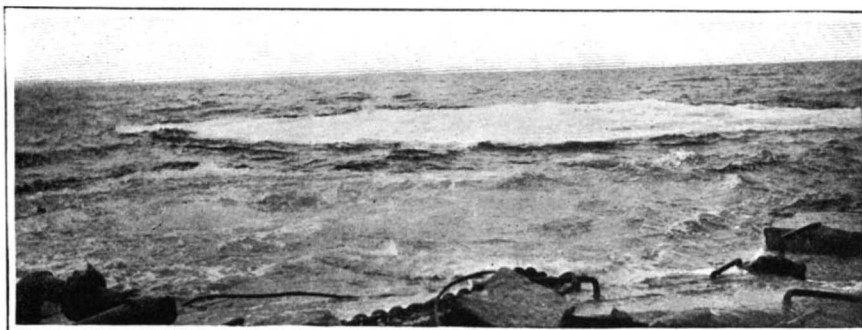
A "BREAKWATER" of air bubbles can rob heavy waves of most of their destructive force. This has recently been conclusively demonstrated upon the Pacific coast. Much is reasonably promised because of that success, and the subject is of both spectacular and technical interest. A little over a year ago it was questioned in these columns whether or not Mr. Philip Brasher's invention would turn out to be of practical value when battling with the very exacting circumstances of an exposed seacoast. Prior to that time he had given his "breakwater" trials in more sheltered positions, and while the results were decidedly promising they were not of a nature to answer our query.

As can be recalled, during January just past, the Pacific coast was swept by a severe gale that destroyed much property along the shore and ravaged the sandy beaches to a wide extent. Among the structures exposed to the fury of the



Steel span section of the double-deck viaduct at Cleveland

winds was a pier 2,100 feet long reaching seaward from El Segundo, California. A year before this wharf had been 4,100 feet long, but substantially half of it was then carried away by the waves during a violent storm. The structure was then so racked that it was not in a condition to withstand an attack of even lessened severity, and yet its maintenance was quite vital to the continuance of certain important shipping operations. It was to protect this pier from further harm that a so-called air breakwater was installed, and happily it was ready for service when the hour of trial came.



White area produced immediately after turning on air. This zone blocks the advance of the waves



Great 4100-foot pier at El Segundo, Cal.

Half of this wharf was swept away by the storm blowing when the photograph was taken. It is now protected by an air breakwater.

Fundamentally, the equipment was decidedly simple and consisted broadly of the following essentials. The seaboard end of the wharf has a width of 70 feet. Parallel with this and 145 feet farther out, 4-inch piping, perforated, was laid on the waterbed for a length of 120 feet. Each end of this was coupled up to smaller pipe leading back to the pier and was fed by two compressors, each having a capacity of 1,000 cubic feet of air per minute. On each flank of the dock head was laid under water more perforated piping running parallel with the face of the pier for a distance of 100 feet, thus giving a total length of 320 feet of air breakwater. These flanking sections also drew their air from the two compressors, and they were designed to catch any seas that might get in around either end of the outlying 120-foot section.

When the storm came that was to put the installation to an exacting test the waves had a height varying between 12 and 15 feet, and were, undoubtedly, of ample size either to have wrecked a part of the dock outright or to have racked it harmfully. The pier was a costly structure and the owners might profitably have spent a good round sum to insure its security. During the worst of the storm and as long as the waves were big enough to threaten harm, the two compressors were kept going. This was for a period of 23 hours, and as the air bubbles rose surfaceward from the perforated piping they served to blast the billows, or, to be more exact, to destroy the wave motion of their masses. As a result, the rollers seemed to drop as if their foundations had been knocked out from under them, and the remaining motion lacked sufficient surging force to disturb the supporting piles among which they eddied as they spent themselves in their shoreward travel.

The compressors were located something like 2 miles away from the breakwater, and, allowing for leakage en route, it is probable that not more than 1,500 cubic feet of air was available for service at the perforated pipe. Under normal conditions, the air pressure need not be but a trifle in excess of the hydrostatic head, in this case the pipes were laid in 30 feet of water, but it so happened that the compressors at El Segundo were for much higher pressures and, therefore, more expensive to run. This added needlessly to the outlay, and yet for the 23 hours of continuous service the cost amounted to only about \$60. Surely this was a very modest price, indeed, to pay for the saving of that pier.

German Twine and Yarn Made from Paper

AS Germany has been unable since the war to import in sufficient quantities the raw materials used for making twine and string, German manufacturers have turned to the production of these articles from paper and have succeeded so well that they now appear upon the market. Paper twine and paper yarn can not be said to be novelties nor products of the war, as Japan manufactured yarn and textiles from paper pulp over a hundred years ago, America some 60 years ago, and Germany since 1890. The products resemble those made from jute or hemp.

Strategic Moves of the War, April 7th, 1916

By Our Military Expert

WHEN mention is made of "The Ring of Steel" about the Central Empires, with but one mode of egress, Asia Minor, no intimation is intended that these empires have any desire to effect an escape from anything. The ring of steel is an arbitrary term which designates the position of the battle lines and the limits of neutrality which, for all purposes of activity from within or without, supplement the former in the formation of the *enceinte* of blockade.

Lest there arise an erroneous opinion of favoritism, it may be well to add that there are two distinct ways of looking at the situation; and as matters now stand, both views are correct. To simplify discussion, however, the situation as mentioned in these lines will be referred to generally as "The Blockade." And the two points of view are as follows:

The Entente.—"Teutonia is completely enclosed now, throughout the extent of its allied territories, by powerful battle lines wherever there is free field for operation; with the exception of the Asia Minor peninsula. And there the armies of the Caucasus are steadily driving onward to set the last link in the chain."

Teutonia.—"The Entente has tried at every point to break a way into our possessions; and not only has every attempt failed, but we have wrested territory eventually from each attempt and are now holding the whip hand. As for the army of the Caucasus—it will not be difficult to hold the Asia Minor peninsula."

It boils down to "Germany cannot get out"—"The Allies cannot get in."

Examination of the map will disclose how, in effect, the territory of the Kaiser is isolated from the rest of the world so far as the acquisition of supplies from the exterior is concerned.

Take Nieuport, on the Channel, as an initial point. The English-French battle line establishes a so-far unbroken barrier to the Swiss frontier. The neutral barrier extends to the beginning of the Italian battle line—and neither belligerent seems disposed to poke the Swiss hornet's nest. From the head of the Adriatic control of the sea rather than a neutrality line forms the barrier. And even if the Italian fleet is not predominant in the Adriatic, the Strait of Otranto is blockaded by the Allied fleets. A tiny corner of Albania forms a link in the battle line; then the pseudo-neutral frontier of Greece interposes until the lines of Saloniki are encountered. And the coast, eastward of the Saloniki position, past the mouth of the Dardanelles and down the Palestine coast is under the guns of the Mediterranean fleet of warships.

Start again from Nieuport. The Belgian coast is under blockade. The line of neutrality loops about Holland, which country, reports now state, is seething with latent activity, directed no one knows where as yet. From the northernmost point of the Netherlands the British fleet, by means of innumerable patrols, blockades the bight of Heligoland to Denmark. A neutral coast and the blockade is again effective across the Skagerrack, enclosing the Cattegat and the Straits. The line of neutrality then follows the Swedish shore of the Baltic and the Gulf of Bothnia to Finnish Russia. Germany controls the Baltic with its communication through the Kiel Canal to the North Sea. But at Riga the Russian battle line begins, to extend with slight variation almost directly southward until the Roumanian frontier is reached. Again doubtful neutrality requires that the enclosing line loop itself along the Austria-Hungary borderland, along the eastern edge of conquered Serbia, along the Bulgaria-Roumania frontier, where troops are massed on either side in anticipation of trouble. Russia controls the Black Sea, so the blockading line justly faces the shore of Bulgaria and Turkey, past the entrance to the Bosphorus and along the Black Sea coast of Asia Minor to a point some miles west of Trebizond. As the Baltic is virtually a German lake, so the Black Sea is Russian.

From east of Trebizond the Russian Army of the Caucasus under the Grand Duke flings itself forward in a loop toward Sivas, then back to south of Lake Van, thence southeast in broken array until it crosses the Persian border, its tip feeling for the not distant Persian Gulf.

At the present time this Russian Army in Asia Minor establishes absolutely the only moving element in the line of battle, the only force, excepting the troops which oppose its progress, engaged in strategic maneuvers throughout the theaters of war, and the object of its advance is the sweeping of Asiatic Turkey and the closing of the blockading ring.

Comparatively speaking, there is little in the way of supply that can enter Teutonia from Asia Minor. Mineral wealth is there undoubtedly, and a certain amount of food supply, but scarcely enough, under the disturbed conditions existing in Turkey, to more than supply the immediate needs of the Ottoman Empire.

Teutonia's strategic advantage of interior lines is clearly evident from the map. At will the forces of the Kaiser can be shuttled back and forth on defense or offense, from east to west or vice versa, even to the southward through the Balkans to Asia Minor; on the other hand, the two great elements of the Entente, England-France and Russia, are absolutely separated from each other for all purposes of combined movement. One side cannot reinforce the other in time of reverse or threat; Teutonia seems—and is—a cohesive unit, not only through arbitrary political affiliation, but territorially as well, and the military advantage is a tremendous one.

Morally, the loss to Teutonia of Turkey in Asia, by no means an impossibility or improb-

the Vistula—Carpathian front. And from the expressed determination of the Entente the time may come when it must be assumed through the steady loss of men, which has averaged about six per cent per month of the entire force afield, and the consequent safety-factor necessity for contracting existing lines. When such a condition occurs the real fighting must begin unless some agreement for peace has been reached.

Arithmetic is inexorable. No one, pro-Ally or pro-Teuton, can deny that if the war lasts long enough and pawn, bishop, rook and castle are exchanged, man for man, the two-to-one advantage of superior numbers must tell. And no one, either, will deny that the military organization and cohesiveness of the Central Empires is superior to that of the Entente, for from the standpoint of the Teuton, the military spirit has been the guardian of German institutions and has been scientifically developed as such.

It brings the situation to this:

The Entente, while as unwilling as Teutonia to sacrifice a life or squander a dollar of national fund for mere war, is playing the game of attrition—for arithmetic is inexorable, and the gaining of its end seems assured if the war can be prolonged sufficiently.

Teutonia, conscious of superiority of organization and the possession of strategic interior lines, must win quickly, before the policy of attrition can begin to tell too heavily. The masterly strokes that began on the west, shifted to the east, back to the west again, and again to the east, have been delivered with this necessity for speedy decision uppermost in mind; but what a problem it is! The giant Russia, Antaeus of nations, seems to rise with increased strength from each heavy fall; as Germany's national spirit, in fear for the fate of the Fatherland, is stirred to its roots, so too is that of France, which, with England's tremendous aid, stands firm athwart the western way. Italy lends its principal service in holding inactive a great Austrian force which might have swayed the balance elsewhere.

So it may be said that scarcely more than the initial stage of the war, theoretically, has begun; the coming summer will surely bring developments of moment, for the strain to both belligerents is too great for them to remain passive.

Vodka or Potato Flour?

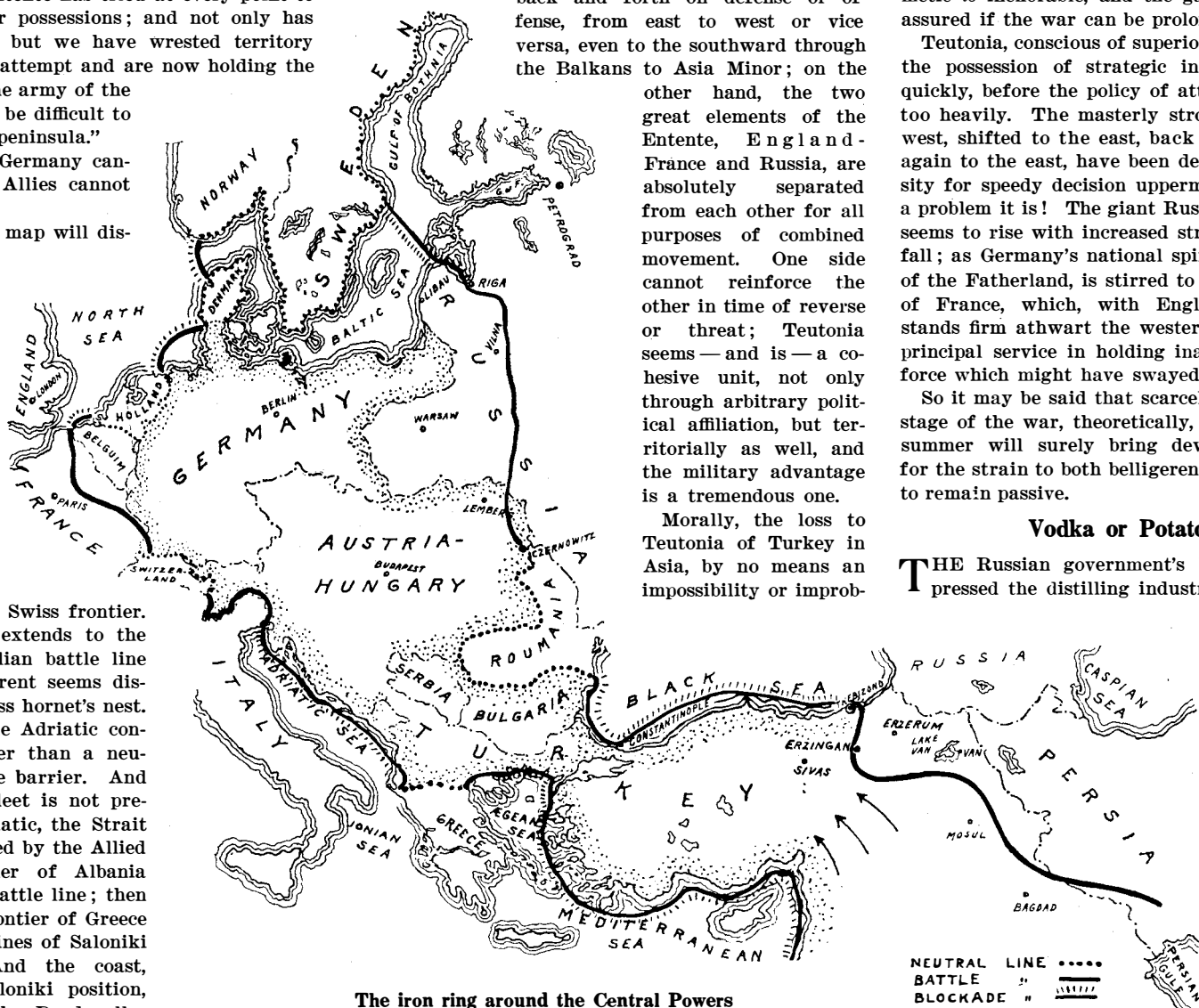
THE Russian government's ban on vodka has depressed the distilling industry and consequently reduced the demand for potatoes. The farmers plan to restrict the potato acreage and will, of course, have to arrange a new rotation of crops.

The Russian Department of Agriculture is anxious to maintain the potato industry and point to the example of Germany in developing new uses for potatoes. The Germans began ten

years ago to build potato-drying mills and had built 500 of them before the war began. What the number is now, considering their great shortage of grain, is difficult to estimate, but it must be great.

Potato flour mixed with wheat or other grain flours makes a nourishing bread, the present military loaf of Germany, in fact. Furthermore, the coarser flour or potato bran makes excellent stock food. The Russian farmer, deprived of his distillery market for potatoes, might be induced to dry the crop and grind it into flour—especially in war time—if he can be convinced that the machinery is not too costly. The big German dryers have a capacity of 20 tons per day and cost as much as \$12,000 to build. This is too great an initial expense for Russian needs. Recently the Department of Agriculture has shown that ordinary starch dryers costing only \$500 or \$1,000 are quite satisfactory as potato dryers. The actual drying costs only one eighth of a cent per hundred pounds of raw potatoes. About 30 per cent of the raw weight is obtained in the dried form so the cost of the product is less than half a cent per hundred pounds. The cost of grinding this into flour is about double the above and premiums are now offered for devices that will cheapen the process.

Possibly the prohibition of vodka will stimulate resourcefulness in the Russian farmers.



The iron ring around the Central Powers

ability, would be severe; tactically, its severance from the Central Empires would seem to be a net gain, for, in view of the inherent responsibility for defense of the present long line, in faith to the Turkish ally, its defense requires men, many men, not only for the actual line of battle, but for the operation and defense of the long and tenuous line of communication. To the Kaiser, could the neutrality of Roumania be assured, the most ideal line of frontier in the present war, for defensive purposes purely, would extend from the western tip of Roumania, across Serbia to the Adriatic. The now far-flung line would then be contracted until a minimum of men could defend it; the railway service of rapid communication would be at its zenith of effectiveness and the twin empires, Germany and Austria-Hungary, while practically besieged, would still maintain the severance of their enemies, possess the most feasible interior lines and really begin to fight.

It must be evident to all that the real, bloody, cheek-by-jowl war has not yet begun; nor will it as long as present conditions exist—that is, without an unlooked-for break in the lines or the interposition of a new neutral force athwart a dangerous sector. The Kaiser's present position is one of territorial gain, with which he is properly anxious to bargain for peace; the German (Austrian, etc.) line of defense proper lies well back of the existing lines, along the storied Rhine and



War Game—V

Frontal Attack

By Guido von Horvath

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THE development of a combat should enable the commander to decide when and where to deliver the decisive attack.

When we speak of a frontal attack, we mean a direct advance against the enemy line. Superiority in numbers, heavier fire, and the culminating shock of the final assault, give the decision. At the start, the advantage is with the defenders, and such an attack is difficult to push home.

In actual warfare, a direct frontal attack is rare, both because it is difficult and because of the great losses which it imposes upon the attacking forces. Therefore, it will occur only under circumstances where no other means to force a decision are at our disposal. The frontal attack may occur when a quick decision is demanded, or where the terrain favors it, or when armies have settled down to trench warfare, and the whole front is covered in such a way that the frontal attack may provide the opportunity for other decisive tactical movements.

The reason the frontal attack is chosen as the subject of the present problem, is that this attack is one of the simplest tactical movements, and that its development will give us practice in tactics which will enable us to handle other problems.

In the previous War Games, we have taught the general principles by the solution of the problems; from this point we shall have the direct action. To do this, we shall need the map as representing the terrain of the field of operations, the conventional signs representing the troops drawn to the scale of the map, and the perspective to help us visualize the terrain. By these means, each particular phase of the combat can be carried out in a manner to bring closer home to us the meaning of war and the necessity of preparedness.

The map enables us to measure our distances accurately. When we have the distances, we can determine the time necessary to place the various troops in their proper positions. To avoid mistakes and to guard against unintentional slips, stick pins should be used to locate the forces on the map. The error of a small distance on the map represents a considerable distance on the ground, and may mean the difference between success and failure in the development of the combat.

We can now return to the Blues, Colonel K.'s detachment, at the moment when the last game closed. The situation is given in the accompanying map. This map will also be useful for the location of the troops, which will work out the future problems.

This situation represents the phase of a frontal attack at a distance of 1,000 yards from the enemy. Undoubtedly, the appearance of the Red cavalry at this moment, and their surprise attack on the left flank of the Blues, is a development of great importance, and must cause several changes in the action. It will be remembered that Colonel K. has given orders *not to attempt* an assault against the enemy's left flank, but to hold the edge of the forest. It is evident that the commander, directing the attack from Argus Farm, expected the possible coming of the enemy on the left, but that he lacked the time to forestall the disaster to the troops guarding the left flank.

To represent the situation, place signs on the map showing the location of all the Blue troops when at a distance of 1,000 yards from the enemy. Then locate the defensive line of the Reds. Last, the two attacking squadrons of Red cavalry just overwhelming the left flank of the Blues.

With his staff at Argus Farm, Colonel K. has started the action, and is now watching its development. He must have his eye not only upon the ensuing combat, but also upon everything else which may happen. Either

he or one of his staff will carefully search the edge of Lebanon Forest through his field glass. The flank guard commander has undoubtedly sent patrols ahead, but the Red cavalry, with its rapid advance, has made the patrol service useless. At the moment when the enemy squadrons break from the edge of the forest, Colonel K. has to take counter measures against the attack of the Red cavalry on the left flank, or it will prove disastrous.

dedicated by changing the troop signs on the map.

So far, we have not gone further than to consider the enemy cavalry alone. We must know that the Red commander will be aware of the change in the situation as soon as the Red cavalry appears on the scene. He, too, will have to act, and his duty will be to make the best of the favorable change and to utilize the moment to the best of his ability.

Naturally, his first movement will be to direct his infantry fire, and especially his artillery fire, in such a way that his own cavalry will benefit by it. This can be done in two different ways, either by increasing the fire along the whole line, or by directing a fire against that portion of the enemy forces which are threatening the cavalry.

It is very easy to realize that if the Red artillery will shell the left flank of the Blues, the troops there will have to suffer severely while warding off the blow directed by the Red cavalry.

It is assumed that the Red cavalry will have to withdraw, but it is evident that the left flank of the Blues was seriously shaken.

Colonel K. will have to send out a new left flank guard. This is immediately engaged with the now dismounted Red cavalry. The fire combat rapidly develops, and its volume assures Colonel K. that considerable forces are involved. Whereupon, having in mind his original mission to hold the bridges for the advance of the division, he now decides to draw back the left of his firing line and to remain on the defensive on the crest of Lookout Hill, with a left flank guard on the highest point.

It is now 4 P.M., and early summer.

As soon as he learns of the partial withdrawal of the Blues, the commander of the Reds, now reinforced by one regiment of cavalry, finds the time right to assume the offensive. A study of the map will make it evident that, as things now stand, the Red offensive must also be a frontal attack. This movement will be a very difficult one, for Timcum Creek is just deep enough, at this season of the year, to prove a very serious obstacle. Therefore, the Red advance must be made by way of the bridge, or by boats, if any are available, or by the remnants of the destroyed railroad bridge.

There is the chance to use the cavalry on the right flank to commence the attack, and under cover of the cavalry action to throw the infantry gradually across the bridge. As a matter of course, it may be expected that the Blue artillery will shell the bridge and endeavor totally to destroy it by its fire. This artillery fire will cause great loss to the Red column, forcing the passage of the bridge.

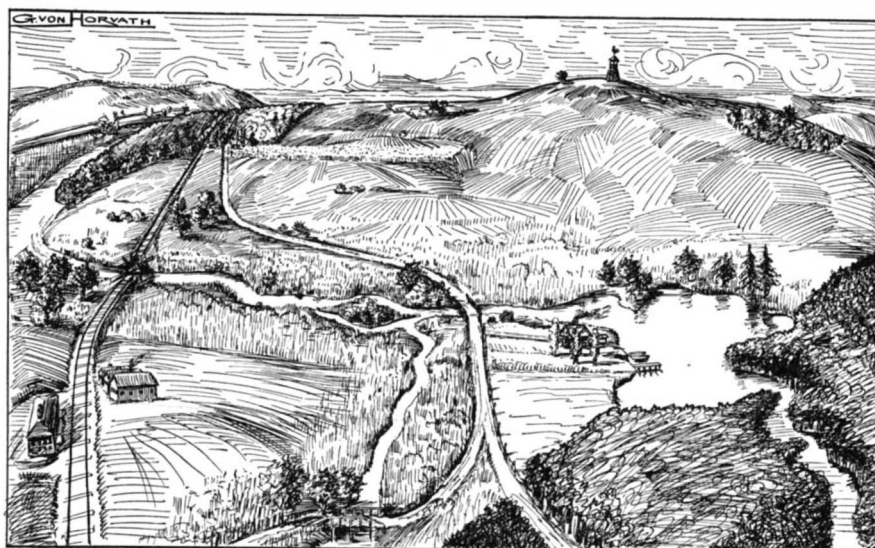
The reason which decides the Red commander to order an attack which will necessarily cause many casualties, is his desire to force a speedy and probably favorable decision. With the arrival of the reinforcing cavalry regiment, his forces

are numerically superior. In addition, the moral effect of the cavalry attack, although unsuccessful, and the partial retirement of the Blues, on their left flank, is greatly in his favor. His chances, therefore, are fairly good for a decision in his favor.

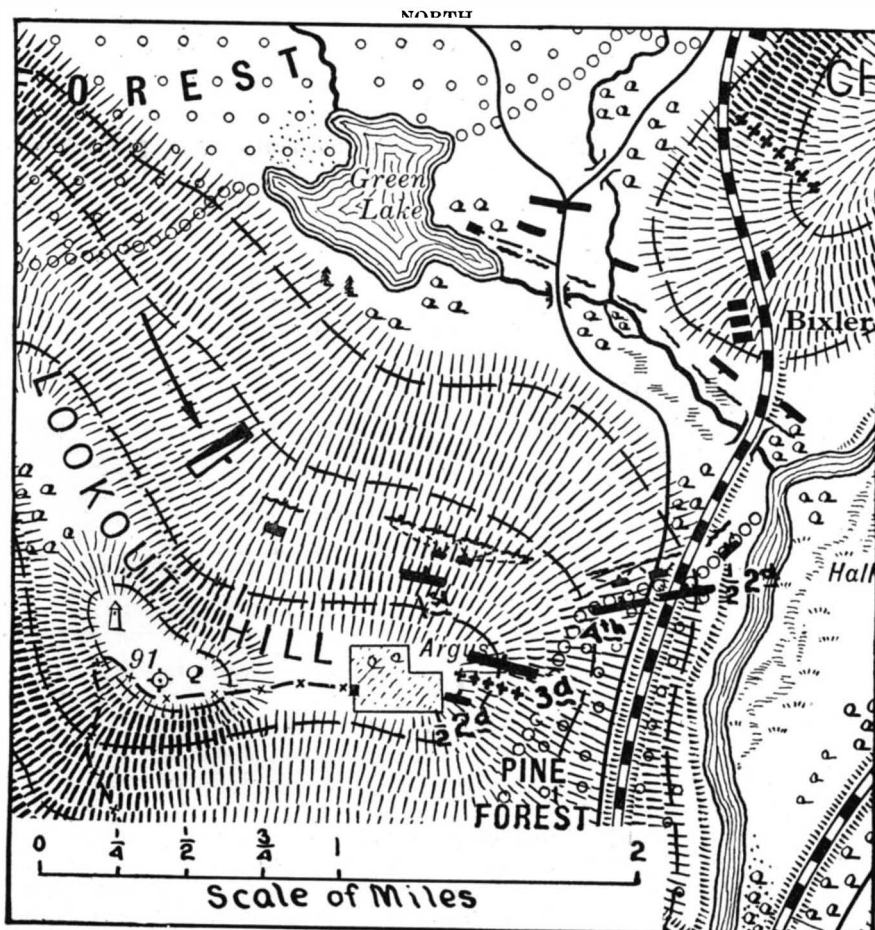
The difficulties in the way of the infantry advance must be overcome by the skillful and judicious use of artillery. For instance, the crossing of the creek will be very difficult. To overcome this, the Red artillery must direct its full fire on those Blue forces which are trying to prevent this crossing. If the artillery does its work cleverly, the crossing can be accomplished without too great a loss.

Before the infantry can attempt the decisive assault, it must approach close to the enemy, and it must gain fire superiority. Then, the use of superior forces and

(Concluded on page 409)



Bird's-eye view of region mapped below, looking toward the south



Enlarged map of the vicinity of Lookout Hill

The forces which Colonel K. can immediately utilize are his artillery and the reserves behind the left flank. Well-trained troops, in circumstances like this, can act very quickly. All that is necessary is the proper order and counter action will follow. The order should be to fire on the cavalry on the left flank. The reserve battalion would have to form a firing line to the left, and, as soon as the enemy arrives within effective range, he should be met with a withering rifle fire.

The action of the artillery is even quicker. The range and target are known. The battery, or a part of it, would have to change front to the left. Even before the infantry could fire, shrapnel would be bursting over the Red cavalry. The Reds would have to turn, and probably pay heavy toll for the destruction of the left flank guard.

These changes in the situation should be in-

The Motor-driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles

Cushioning the Truck Tire

WHILE no form of tire has ever been devised that can displace the air-filled form almost universally used on automobiles of the light and medium weight classes, inventors are giving the problem of a puncture proof, yet resilient, tire considerable attention. One of the latest devised is illustrated in the sectional view herewith, though this is said to be more suited for trucks than it is for pleasure cars, on account of its weight. The shoe has an extremely thick tread and is said to give considerably more mileage than the ordinary form on account of this extra material. The usual form of inflated inner tube is replaced by a series of steel cylinders in which a fixed air pressure is maintained by movement of the wheel over the road. Each cylinder is provided with a guided piston or plunger which compresses the air in the cylinder as the piston moves in from distortion of the shoe when an obstruction is passed over. The cylinders are imbedded in a ring of rubber as indicated, so that they cannot be displaced. The rim is a special form and the tire must be installed by special machinery. It is made in popular sizes.

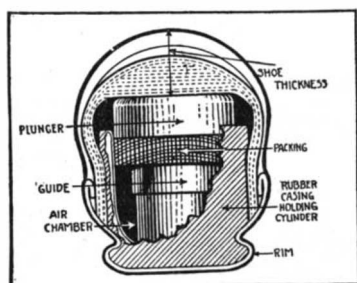
The solid rubber tire is the most enduring and practical for commercial vehicle use, but it has the disadvantage of lacking resiliency which causes vibration of all mechanical parts and tends to loosen the various fastenings throughout the chassis. This factor of vibration becomes more severe as the vehicle speed increases, so on relatively high speed trucks, as used in fire department service, special forms of wheels incorporating a cushioning element distinct from the solid rubber tire are fitted.

Two forms of cushion wheels are shown herewith. That at "A" has a peculiar double hub formation in which cylindrical blocks of rubber are placed in semi-circular bed spaces between inside and outside hubs, these acting as driving members as well as cushioning elements. As the rubber is not subject to depreciation due to contact with the road, as the outer solid tire is, it can be of very resilient composition. The wheel at B operates on a similar principle except that the cushioning element is carried out near the rim. The solid tire is carried by the outer rim, which rests upon the special soft rubber cushion interposed between it and the wheel felloe. This cushion is inserted between the wheel parts under pressure and there can be no sliding around of one rim relative to the other. The inner and outer rims are joined by rings of tough rubber compound, one on each side, which act as walls to keep grit, water and other foreign matter out of the chamber or annulus in which the rubber cushion is carried.

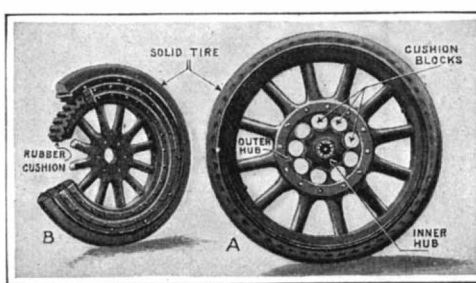
Motor-Driven Street Cleaning Outfit

THE combined street flusher and sprinkler illustrated is mounted on a 5-ton chain-driven chassis and while the chassis incorporates novel features, we will confine ourselves to a consideration of the flushing apparatus because most municipalities are interested in

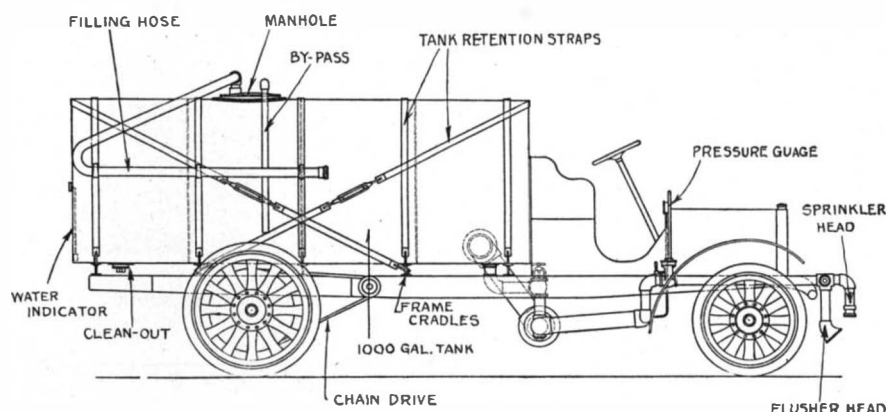
the method of street cleaning by flushing since this vehicle type has demonstrated that it is capable of doing the work satisfactorily. The tank, which is about 12 feet long is made of 3-16-inch boiler plate and is galvanized inside to prevent any rusting of the metal. The tank holds 1,000 gallons and a by-pass is fitted so that when the tank is filled it is not possible for the water to overflow through the filler opening.



Combined pneumatic and solid rubber tire



Cushioning solid rubber tires with resilient pads and blocks



Street cleaning machine combining sprinkling and flushing functions



Light rubber tired trailer for attachment to passenger cars

It will be apparent that this is an advantage of some moment because there are many parts of the chassis mechanism that would not be benefited by continual baths of water. An indicator is provided at the rear end of the tank to show the exact height of the water.

It will be observed that the tank tilts towards the rear of the chassis so that any foreign matter in the water will flow in that direction. The sediment may be easily removed through a cleaning plug provided

at the lower end. The top of the tank is provided with a manhole of standard size and baffle plates are fitted to prevent surging of the large mass of water as the truck moves. A strainer is provided in the outlet to insure that only clean water will reach the pump. The tank is round in section and is mounted on six metal cradles. These cradles or bed members are clamped to the frame of the chassis by U-bolts and the tank is held in place on these cradles by substantial straps of metal. The tank is also braced against fore and aft movement by strong bands and turnbuckles as indicated.

For flushing more pressure is needed than is available by utilizing the flow due to gravity. A centrifugal pump is used to obtain the desired water pressure. This is mounted concentrically with the main propeller shaft and is actuated by a positive jaw clutch from the propeller shaft itself. One of the clutch members is so mounted on the shaft that it can be easily actuated from the driver's seat so that the pump may be put into action, when desired. At normal engine speeds the pump has a capacity of from 250 to 350 gallons per minute at from 20 to 60 pounds pressure. A flushing head is located ahead of each front wheel and these heads are adjustable so that the water supply can be pointed to either side of the truck and the heads used in conjunction to either side or one pointing to one side while the other may be directed as desired. It is also possible to have the right hand nozzle point towards the left and vice versa as a cross stream is said to be the most effective cleanser under certain conditions. By working at high pressure it is found that considerable flushing may be done with a comparatively small amount of water.

The sprinkler heads are situated directly in front of the flushing nozzles and are on the end of a pipe pointing toward the ground. The amount of water delivered by the sprinkling heads can be varied from 10 to 80 gallons per minute. It is said that with both sprinkler heads in operation a street 80 feet wide may be sprinkled satisfactorily with one passage of the truck. All of the controls are placed convenient to the driver, who can open or close either the right or left hand supply pipes or both and can vary the supply of water and its pressure as he desires. The operation of the pump is controlled by a lever in the center of the chassis, near the driver and a small pressure gage on the dash shows the pressure of water supplied from the pump. This can be increased by either varying the speed of the motor or the speed of the truck.

Moving Structural Steel With Tractor

ANYONE who is familiar with the problems involved in moving heavy structural steel girders will appreciate the task accomplished by the tractor shown in the accompanying engraving. This illustrates one extreme of the great range of usefulness of the mechanical horse. The steel girder measured 60 feet in length, was nearly 5 feet wide and weighed over 31,000 pounds.



Utility of gasoline tractor in moving heavy structural steel girder

This formidable load was hauled a distance of over 3 miles to its destination in 18 minutes, and no trouble was experienced in stopping the heavy load when desired. This was due to the fact that the tractor was equipped with powerful hydraulic brakes acting on the rear wheels in addition to the large service brakes which are fitted to the jack shaft. It is stated that the load was brought to a complete stop in a third of its own length when running at its average speed of 10 miles per hour.

Light Trailers for Passenger Cars

THERE are numerous occasions when the owner of a passenger car could employ it to advantage in his business were it not for the fact that in many lines the carrying of goods mars the finish of the paint and upholstery and at the same time the average touring car or roadster is not very well adapted for carrying anything but the live freight for which it was designed. A plumber or carpenter, for instance has to handle bulky materials and use supplies in his work that are not of a nature to be easily handled in a pleasure car body. Numerous light trailers have been designed for attachment to the rear of passenger cars, these usually being of the form that will track with the two car wheels and swing around corners when desired. The outfit outlined is a practical one that is used by a grocer and it will be apparent that the bulkier goods, such as bags, barrels and boxes that could not be conveniently placed in the touring car tonneau can be carried without difficulty in the trailing vehicle. Such a trailer is well adapted for the use of contractors, plumbers, painters and others, as it can be left at the job with the supplies and the car used for visiting other operations. These trailers are built more substantially than horse-drawn vehicles and are usually provided with rubber tires and easy riding springs. Many occasions will suggest themselves where such a trailer would be an inexpensive and very useful auxiliary to a passenger car for pleasure purposes as well as the more utilitarian business service.

Motor Truck Queries

C. S. writes: Will you please discuss briefly the following: 1. Would a high tension magneto give a better spark on a two-cylinder tractor if it had a distributor so as not to spark in both cylinders at the same time? 2. What determines the length of piston stroke? 3. What does length of stroke have to do with power and economy of operation? 4. Does the best speed for a motor bear close relation to the length of stroke? 5. Why does the length of stroke vary so much in different engines? 6. Is a wide drum a good manner of tractor drive? How do they provide for turning?

Answer. 1. Yes. 2. The length of piston stroke is determined by various considerations of design, the most important being the desire not to exceed a safe piston speed. 3. It is said that a long stroke motor is a more efficient type than a short stroke of equal bore because it utilizes the expansive power of the exploded gas charge better. A long stroke engine is also a better "pulling" engine than a short stroke form as it will deliver more power at slow speed. 4. The accepted safe piston speed of a thousand feet per minute has been greatly exceeded in recent years without serious consequence. Some racing engines have two or two and a half times this piston speed. For traction engines and for heavy duty power plants it is probably well not to exceed a limit of 1,200 feet per minute. This would limit an engine having a 6-inch stroke to 1,200 r.p.m. 5. This is due to individual opinions of various engine designers. 6. Traction engines using a wide drum for driving purposes have given satisfactory service, it being said that this form distributes the load over a larger area and makes it possible for the tractor to work on soft ground. In some tractors, the drum is really composed of two of the same size, mounted together on a common axle but driven by independent driving gears. Some form of free wheel clutch can be used to drive only the drum

that is on the outside of the curve and declutching the inner drum. In other forms, turning is accomplished by the drums slipping.

The Reversion to Shields in Warfare of To-day

WITH the advent of firearms it was believed several centuries ago that the day of armor and shields was over for all time, for the powerful impact of projectiles discharged from even the early muskets rendered ineffective the light steel then worn. Prior to the present war, infantrymen were not provided with shields of any kind as a protection against the rifle fire of the opponent. It was rather in methods of concealment, such as uniforms whose colors tend to blend with the surrounding landscape, and scattered formation that protection had been sought.

The present great war has ridiculed so many generally accepted principles of what has heretofore been considered modern warfare that the reversion of the soldiers to shields and armor does not come as a surprise. At first, the shields were of small dimensions and used solely in trenches, in order better to resist the rifle fire of the enemy. Such shields in most instances were provided with a slot of just sufficient size to accommodate a rifle or machine gun.

Not content with employing steel shields in the trenches, the fighting forces have extended their use to infantry attacks, in order to lower the terrible toll collected by the rifles and machine guns. Most of the nations now fighting in Europe have provided a portion of their men with small, individual shields which can be conveniently carried and readily erected to afford a fair degree of protection to their user. Such shields are especially suited to the requirements of sappers, who must sometimes advance to the barbed wire entanglements of the enemy and cut them with a pair of pliers or other tool before the infantry can undertake a charge. Lying prone behind a small portable shield, the sapper is protected to no little extent against the fire of enemy sharpshooters as he goes about his work.

In some of the battles that determined the fate of Russian Poland and the great fortresses forming the western permanent bulwark of the Muscovite empire, the troops of the Czar employed steel shields mounted on wheels. One of these shields appears as the cover illustration of this issue, which has been painted from an actual photograph of the device. The Russian movable defenses, for such they are in reality, consist of heavy, slanting steel plates mounted on two large wheels, with small plates hinged at the bottom in such a manner as to protect the lower limbs of the marksmen and yet permit of the forward movement of the shield even over rough ground. A metal framework in the rear, provided with four small wheels, completes the miniature fort. From the photographs that have appeared, it is deduced that the Russians have given considerable thought to the design of the movable shields; in no wise can they be considered in the light of make-shifts hastily improvised by the soldiers themselves.

If the number of Russian movable shields captured by the Germans is to be accepted as a criterion of their military value, it must be admitted that they have proved a failure. And this seems quite logical; for, while a single marksman may be protected by a small shield against rifle and machine gun fire, a shield of the size used by the Russians invites accurate, concentrated artillery fire as well, because of the mark which it presents. While it is undoubtedly effective against light-arms fire of trench defenders, it cannot hope to withstand shell fire. As a further consideration, the very greatness of the Russian shield makes its rapid movement impossible, so that in the event of a powerful and successful counter-attack by the enemy, its defenders must needs leave it behind in their retreat. This is probably what has occurred in the majority of cases in which

they have been captured intact by the Germans, barring, of course, those found at the supply bases.

We may draw the conclusions that individual steel shields can be used to good advantage; but larger shields, because of their huge proportions, are not a success. Protection against light-arms and artillery fire during an attack in the open remains a matter of concealment or partial concealment, with each man taking advantage of such cover as he can find, rather than the providing of movable steel defenses.

The Current Supplement

A TIMELY article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2102, for April 16, is *Large Naval and Coast Defense Guns*, in which an authority on the subject tells how these monster weapons are built and tested. It is fully illustrated with photographs taken in the Government shops. A paper that will be found of general interest is *Economy in Study*. It is the first of a series of articles by a well known writer on the subject that will be of great value not only to every educator, but to every student as well, presenting as it does an intimate analysis with a view to economy of effort and the securing of the best results. *Animals With Many Eyes* tells of the curious and wonderful organs found in many of the lower orders of life. It is accompanied by a large number of illustrations. *The Paper Textile Industry* discusses many applications of paper as a substitute for other forms of fibers, with notes on methods of manufacture. *Oiling Earth Roads* discusses a feature in road making that will appeal to a large portion of the public, and it will be found of especial value to the engineer. *The Care of the Feet* will appeal to everyone, as it is intimately connected with our every-day comfort and efficiency. It is illustrated by a number of cuts. Radium has been employed very widely in the treatment of a number of diseases, but many who are using, or experimenting with it are oblivious to the serious dangers that are incident to its handling, and which are constantly present. To these *Injuries Due to Radium* will be of vital interest, as it discusses a number of actual typical cases. Other articles worth reading include *Indian Music*, *Detonating Submarine Mines by Electricity* and *Engineering in the Navy*.

Extensions of Time in Patent Cases

SINCE the commencement of hostilities in Europe, practically all the foreign countries have enacted remedial laws, which extend the time for the filing of papers and the payment of fees in connection with applications for patents, but in most cases citizens of the United States cannot take advantage of these new laws because of the failure of Congress to consider favorably the bills which have been introduced granting reciprocal rights.

American inventors have not felt disposed to abandon their rights to patents in Europe for terms of 14, 15, or more years, merely because business conditions might make it difficult to introduce their inventions commercially in Europe during the first year or two of the patent term. But the delays in delivering foreign mails, and sometimes the impossibility of having patent work attended to promptly in the countries at war, because many patent attorneys and clerks are at the front, have in many cases made it impossible to file applications and pay fees within the periods prescribed by the general laws. In such cases, petitions to file papers and to pay fees under the new, or war, provisions, have met with the reply that the request will be granted provided the United States will enact laws granting similar courtesies to citizens and subjects of foreign powers. It will, therefore, be seen that the new law, set forth in the bills now before Congress, should be enacted, not only in a spirit of justice to foreign inventors who, while at the front, are unable to attend promptly to their patent business, but also to enable American inventors to obtain necessary extensions for the protection of their rights.

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RECENTLY PATENTED INVENTIONS

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

Pertaining to Apparel

HEEL PLATE.—T. J. CARROLL and M. H. KANE. Address the former, Clifton, Ariz. Through the medium of a non-puncturable heel plate disposed and secured at the interior of the shoe, the heel of the wearer is protected by this invention from the frequently protruding nails of the ordinary boot or shoe, including oxfords. The invention also provides for the effective fastening of the covering or padding in the heel of the interior by means of the improved heel plate which overcomes the failure attending the use of adhesive material.

SPINE ARCH SUPPORT.—E. PACKER, care of M. Packer, 2134 Kent St., Los Angeles, Cal. This invention relates to a support for the arch of the spine, so as to support the human body from the small of the back to a point just above the waistline, and thereby give support to the curvature of the spine, whereby a person will stand erect with the greater ease, walk with more comfort, sit straight and breathe more deeply.

DETACHABLE BUTTON.—T. S. LEITH, 601 Bay St., St. Paul, Minn. More particularly the invention relates to a button having an arrangement of resilient shanks, and a form of co-acting button head, the parts being so formed and arranged that the turning of the button head through an angle relatively to the shanks will serve to bring engaging members of the shanks into position to be entered or withdrawn from the button head.

DRESS.—LENA KISELGOFF, 133 Mercer St., New York, N. Y. An object here is to provide a construction in which a plurality of pockets are provided without injuring the appearance of the garment. It provides a dress wherein the skirt portion is folded and connected together in such a manner as to provide one or more open pockets and a secret or hidden pocket.

Electrical Devices

BURGLAR ALARM.—J. CHANKIN, 1050 Hoe Ave., Bronx, New York, N. Y. The invention relates more particularly to the circuit-closing part of the alarm. It provides a device which may be easily and quickly secured to a window or door, and which will automatically close the electrical circuit if the window or door provided with the device is tampered with.

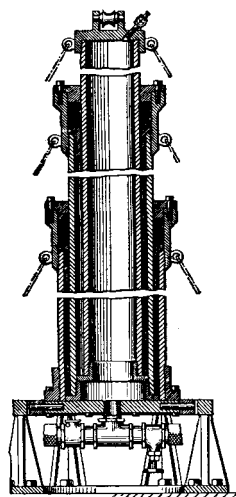
Of Interest to Farmers

THRESHING MACHINE.—E. D. RICHARDSON, Cawker City, Kan. An object here is to provide an improved straw rack associated with an arrangement of chaffer. Another object is to provide a threshing machine with means for increasing the beating action or agitation of the straw, hay, and the like during its passage through the machine.

BROODER.—P. SULLIVAN, care of C. F. WEMPLE, Waverly, Ill. This inventor provides a brooder arranged to permit convenient collapsing and storing during the winter, and when set up and used to insure the production of a uniform heat within the brooder for keeping the chicks warm; prevents the chicks from unduly crowding and smothering one another; provides a runway for the same; and prevents obnoxious gases from the lamp from reaching the chicks.

Of General Interest

TELESCOPIC TOWER.—F. E. WINN, care of Southern Brazil Lumber Co., Tres Barras, Parana, Brazil. This improvement relates to poles or towers which may be used for many different purposes, and the main object thereof is to provide a pole or tower constructed of a



TELESCOPIC TOWER.

plurality of sections telescoped one within the other in such manner as to provide a non-leakable joint therebetween in order that the tower may be extended to any desired height within its limits by means of water, steam, or other fluids and be certain of maintaining the same at the adjusted height.

FLUID FEEDING DEVICE.—H. A. SCHEU-PLEIN, 2nd St. and Montgomery Ave., Bayside,

L. I., N. Y. The primary object in this case is to provide means for effecting and regulating the discharge of a fluid from an inverted bottle or a receptacle having a bottom discharge orifice, in such a manner that fluid may be caused to drop or flow in the desired quantity or volume according to the various uses to which the device is put.

HORSESHOE.—D. S. ANTHONY, 413 5th Ave., Sioux City, Iowa. This invention relates to shoes of that type having removable calks, but more particularly to a horseshoe of that character in which the calks are carried by a plate or removable section which is fitted to and detachably fastened on the main or body portion of the shoe.

PHOTOGRAPHIC PRINTING FRAME.—F. B. YOUNG, 111 Maple Ave., Edgewood Park, Pa. This invention has reference to improvements in plate holders and particularly to what are known as printing frames, or printing photographic holders, and has for an object to provide an improved arrangement wherein one or any desired number of pictures may be exposed at a time.

BAG HOLDER.—G. C. SHELDRUP, Box 56, Maynard, Minn. This inventor provides a bag holder with pivoted clamps for pressing the neck of a bag against the sides of a spout, the clamps being operable by links connected by arms moving in guiding slots and held yieldingly at one set of ends by springs, these being radial rods, which are pivoted to the arms, which, with the springs, limit the movement of the arms.

STIRRUP.—C. A. H. GUNN, Grenada, Miss. An object here is to provide a stirrup body which is adapted to be joined to the strap therefor by means of a swivel connection, whereby to prevent twisting of said strap to permit of ready adjustment of said stirrup body to the movements of the rider's foot so that binding or other injury thereto will be prevented.

GLASS WELL MANTLE AND CLAMP THEREOF.—S. B. HENSHAW, care of Charleston Window Glass Co., Charleston, W. Va. The object of this invention is to form the glass well or drawing chamber by means of vertically disposed fire clay mantles having interengaging portions, and to provide in connection with the furnace buildings, clamps engageable with the series of fire clay mantles so disposed in order to hold the same firmly together and prevent accidental displacement.

PROCESS OF SUPPLYING MOISTURE TO COMMODITIES.—E. L. HENSON, 744 College St., Clarksville, Tenn. This invention relates to improvements in devices for supplying moisture to flour, meal, bran, shorts, etc. An object is to provide a process by means of which a substance, such as flour, may have moisture supplied, the amount of moisture being accurately regulated even to a fraction of one per cent.

Hardware and Tools

WIRE HOLDING STAND.—J. W. PETER, 241 E. South St., Fostoria, Ohio. One of the principal objects of the invention is to provide a stand whereby a plurality of rolls of screen or other species of wire may be kept in such a position as to be unrolled to any desired length without removal from the stand, for the purposes of dispensation.

SELF-PROPELLING HOSE NOZZLE.—J. T. BURNS, 60 39th St., Corona, Long Island, N. Y. This inventor provides a nozzle constructed to deliver a boring jet on a line substantially parallel with the axis of the nozzle; provides rearward openings, forming jets from said nozzle to propel the same by pressure against a volume of water in the rear thereof; and provides means for varying the effectiveness of rearwardly directed jets.

PLUMBER'S BENCH.—N. ROSENFELD, 280a Linwood St., Brooklyn, New York, N. Y. The invention provides a bench which may be folded to a diminished compass for storage or transportation; provides a bench adapted for attachment to the framework of a building under construction; provides means for bending pipes to obtain different curves thereof; provides a tool-box for storing one or more tools of greater length than the capacity of the box would normally afford; and provides means whereby various machines may be attached to said bench.

TIRE-BOLT WRENCH.—W. LARSON, R. 3 Box 10, Kingsburg, Cal. The invention relates to a device for tightening and loosening nuts upon bolts, particularly nuts upon tire-bolts. It provides a wrench whereby the nut and bolt can be simultaneously engaged therewith, so that the bolt is prevented from turning while the nut is unscrewed or screwed upon the bolt.

Heating and Lighting

FLASHLIGHT BATTERY CONTAINER.—H. M. KORETSKY, Bright Star Battery Co., 430 W. 14th St., New York, N. Y. This invention relates to flashlight batteries of that type in which a plurality of cells are arranged end to end so as to fit in a tubular or cylindrical flashlight casing, and the invention has to deal more particularly with the container for the cells. Mr. Koretsky has invented another flashlight battery container, which relates to a container for the cells that form the battery of a pocket flashlight. It overcomes the objections in containers by providing a container which is made from a single blank, which has

printed matter on its outer surface so as to take the place of a pasted label, and which when empty is folded flat to take up little space.

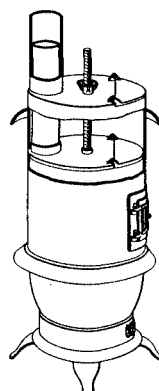
Household Utilities

BATH-TUB SEAT.—G. H. MULLEN, 20 Prospect Place, Far Rockaway, L. I., N. Y. This invention provides a bathtub seat which may be quickly applied to the bathtub at either end or either side. It provides a seat which may be folded to position against the side or end of the bathtub when not in use, whereby the same need not be removed during the ordinary use of the tub.

CLOTHES LINE SUPPORT.—A. P. FURMAN, 1337 Clay Ave., Bronx, N. Y., N. Y. This invention provides a device for apartment houses which is adapted to occupy various positions of adjustment with respect to the window frame, whereby the clothes line may project within the window for the purpose of applying or removing clothes, and in another position the line will be held on the outside of the window, the device including means for temporarily locking the movable parts of the device in either of said positions.

COOLER.—E. C. PURNELLE, P. O. Box 592, Douglas, Ariz. This invention provides a cooler comprising a safe provided with air-circulating and ventilating means; provides a manner of securing cloth to be moistened; provides for maintaining the cloth saturated; provides a door having a member to catch any drip from the cock of the water tank when the door is open; utilizes the said drip for saturating a cover provided on the door; and provides a drip pan to carry off the water dripping from the saturated covering.

STOVE.—E. E. TAYLOR, 1126 S. 4th St., St. Louis, Mo. This stove can be readily adjusted as to its heating capacity according to



HEATING STOVE

seasonal or diurnal changes in temperatures. The invention provides a device in the nature of a false top arranged within the upper portion of the stove and adjustable toward and from the fire in the fire-box so as to vary the capacity of the combustion chamber, the said false top having suitable means for adjustment, and also means for forming a continuation of the smoke flue for conducting off the smoke and gases.

Machines and Mechanical Devices

LETTER INDICATING MECHANISM.—W. E. GRAY, 816-817 Ideal Bldg., Denver, Colo. The subject of this patent is an indicating device to be employed on a copy-holder and arranged to be moved across the copy by a step-by-step movement to follow each letter and space of the copy as it is written upon the typewriting machine. At the end of a line when the typewriter carriage is returned to the right, the engaging member is automatically returned to the left of the copy-holder, and provision is made to give it movements in synchronism with the line spacing of the typewriting.

RAIN GAGE.—B. G. PATTERSON, 1605 N. Klein St., Oklahoma, Okla. This invention has reference generally to improvements in devices for the purpose of catching and measuring rainfall, commonly known as rain gages, and more especially to that class of rain gages employing a double compartment tilting or oscillating vessel for measuring the water.

MASSAGE APPARATUS.—J. SABATINO, 4757 Jerome Ave., Richmond Hill, L. I., N. Y. This invention refers to improvements in massage apparatus, and particularly to a holding device for the vibrator, and has for an object to provide an improved structure, whereby the hand of an operator may be properly connected with the vibrator so as to give an even firm vibration.

ATTACHMENT FOR ADDING MACHINES.—H. E. BROWN, Columbia, Mo. In this case the invention consists in providing means to indicate the appropriate numerical orders of the adding machine in which numbers should be registered, especially the numerical order of the adding machine in which the left hand digit should be registered.

MACHINE AND APPLIANCE FOR CUTTING OR FORMING SCREW THREADS.—G. H. ALEXANDER, Doe St., Birmingham, England. The present invention comprises the use of a screw threaded mill like rotating tool having a multiple start thread of the same pitch as that required on the work piece and rotating relatively to the work piece at a rate which is inversely proportional to the number of

starts on the mill. By "pitch" is meant the distance between any one ridge and the next.

DETACHABLE MAINSPRING FOR CLOCKS.—A. ASLESON, Redwood Falls, Minn. This improvement pertains to clocks and particularly to the springs thereof and means for holding the same in place, and the object is to provide an arrangement whereby the main spring of a clock may be removed without disturbing the remaining part of the works of the clock.

CONVEYER ATTACHMENT.—A. WINSKI. Address Henry D. Scott, Kooi, Wyo. This invention pertains to endless conveyers of the type employing plates extended between the corresponding links of two endless chains, such as used for conveying coal instead of by means of buckets. These plates are frequently bent by dumping the load thereon, thereby causing open spaces between adjacent plates through which the coal may fall. The present invention overcomes the defect.

CIGAR DUMMY MACHINE.—E. BELOT, 319 Rue de Charenton, Paris, France. In machinery where the interior of the cigar is molded in the form of dummies mechanically inserted in wooden molds having cells, the work is confined to rolling the dummy and putting the same into the molds. Afterward the mold provided with its lid is carried to a pressure device which is usually a screw press operated by hand. This invention provides an apparatus to apply such pressure automatically in the machine which has made the dummy so as not to stop the output of the machine.

PRINTING DEVICE.—A. G. OGDEN, 109 S. Charles St., Baltimore, Md. This invention relates to improvements in printing devices, especially those devices wherein a number of prints are to be made from a single negative. An object is to provide improvements whereby a multiplicity of prints may be made on a sensitized plate in a minimum of time.

HYDRANT.—G. N. FRAZER, care of Eugene Iron Works, Eugene, Ore. The invention provides an improvement in the drainage means of the hydrant, such improvement embodying a drainage plug normally closing a drain opening, the plug being provided with a drain valve automatically operable when the inlet valve is in closed position, to be opened for providing a continuous drainage from the hydrant casing.

METER ACTUATED CUT-OFF DEVICE.—N. ANDERSON, 11 Mesba Place, Duluth, Minn. The invention provides a device for use in connection with water meters, for automatically delivering fixed and predetermined quantities of water, and wherein the mechanism is so arranged that when it is set in operation, it will deliver a predetermined amount of water, after which the device will automatically shut off the water, and the mechanism is so arranged that the amount of water to be delivered may be varied.

GRAPPLE.—A. BRYANT, Route 2, No. 40, Moulton, Ala. The present invention provides a grapple which includes resilient elements held apart by a trip mechanism which, when contacted by an obstacle, permits said elements to return to normal positions whereupon the article is securely held therebetween.

PHOTOPRINT DEVELOPING MACHINE.—C. C. TOWNES, 2110 Main St., Baker, Ore. This improvement relates to the developing, fixing and washing of photographic positives in a purely mechanical manner and in large quantities, as for amateurs, and one of the main objects thereof is to provide an apparatus which accomplishes the above results automatically.

DEVICE FOR MEASURING WOVEN WIRE.—T. C. RUSH, Lexington, Ky. The invention, while capable of use for measuring sheet material generally, is more particularly constructed and arranged for measuring woven wire, and is adapted to be arranged in connection with a stand equipped with a plurality of trays or rests to receive rolls of the wire cloth of varying widths, and if necessary, of varying mesh.

Musical Instruments

REPEATER.—E. S. KEOGH, 122 Livingston St., Brooklyn, New York, N. Y. Among the principal objects which this invention has in view are: To provide means for automatically replaying a disk record; to diminish the time interval between the repetitions of the playing of said disk record; and to noiselessly suspend and inaugurate the playing of such record.

Prime Movers and Their Accessories

PISTON VALVE.—H. J. HICKEY, Fort Dodge, Iowa. The invention relates generally to piston valves for steam, gas, and other engines, and more particularly to piston valves for internal combustion engines. It provides a valve arrangement whereby to decrease the noise and increase power over the usual puppet valves of the same bore and stroke, and one which will effectively operate without the formation of compression.

LUBRICATING PUMP FOR ENGINES.—F. H. TREGO, care of Knox Motors Co., Springfield, Mass. This invention has for its general objects to provide a special form of pump that is mounted in the crank case of the engine, the pump being so designed as to be readily removable or assembled, of durable and substantial construction and requiring comparatively little power for its operation.

TWO-CYCLE COMBUSTION ENGINE.—C. W. ROESSLE and A. A. REENBERG. Address the (Concluded on page 410)

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.



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(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.

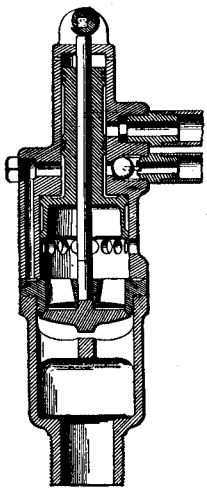
AIR STARTER FOR INTERNAL COMBUSTION ENGINES.—F. E. CLINE, San Diego, Cal. This invention relates to an air starter for internal combustion engines, the starter being arranged to compress air within a reservoir while the engine is running, and by means of suitable valves to subsequently utilize the stored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

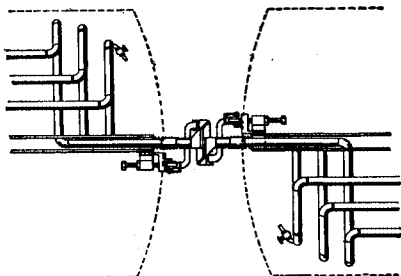
COMBINED DRIFTING AND RELIEF VALVE FOR LOCOMOTIVES.—J. F. MILLER, 743 14th St., Douglas, Ariz. This invention provides a drift valve associated with a relief valve of any preferred construction and automatically operated upon the actuation of said relief valve to admit a constant supply of saturated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

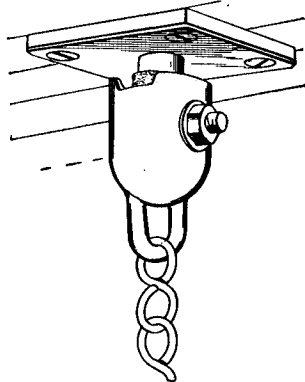
SLEEPING-CAR.—E. FLAGG, 109 Broad St., New York, N. Y. The invention relates to sleeping-cars of compartment and dormitory type. An object thereof is to provide a sleeping-car structure having a larger number of

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 sulphurous 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

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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.

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Raincoat and Sunshade for Your Car

These functions are combined in the automobile top. It must stand broiling sun and zero cold, rain and melting snow. It must stand folding and unfolding innumerable times. All the while it must have style and beauty to be a credit to the car it covers.

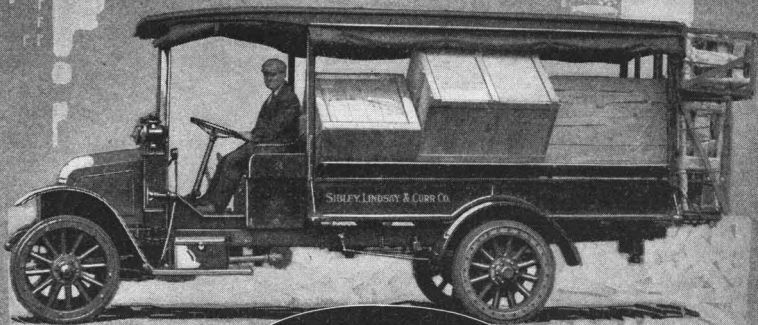
Neverleek is scientifically made to last the life of a healthy automobile. Its sturdiness begins with selection of materials and goes right through to the unmatched Neverleek beauty of finish.

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And I want to convey a distinct meaning when I say that the Lippard-Stewart is a truck for good business men.

It is today the safest truck money can buy: as an instrument of better business it is a wise and sound investment.

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It has never been confused with pleasure car manufacture: it is all truck—thoroughbred truck.

It pioneered many of those vital improvements that have forced the acceptance of the motor truck as a prime factor in modern business.

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President

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plan for improving the industrial preparedness of this city.

"Its directors have just approved a plan for an industrial development company to be known as the Cleveland Industrial Development Company, with a capitalization of \$500,000 of common stock, and \$100,000 in preferred stock. This is divided into shares of \$100 each, and the company will undertake the financing of such industrial organizations as may be deemed worthy of support and which desire to locate in Cleveland. The plan proposes a promoting company with sufficient paid up stock to permit of operation, to investigate and report upon industrial development for the benefit of its stockholders. The company will be independent of the Cleveland Chamber of Commerce, but will work in harmony with the Chamber at all times.

"The first board of directors will contain among others the members named by the board of directors as the committee on organization who have also been requested to act with others as the first board of directors of the new corporation. The fundamental idea underlying the proposed plan is similar to Lloyds Association of London, which, as is well known, is an association of merchants, ship owners, underwriters and insurance brokers grouped together for underwriting purposes. The Cleveland Industrial Development Company will operate largely in this same manner, as it is a promoting company organized for the purpose of securing and disseminating in concrete form detailed information concerning the industries to be promoted. These facts are to be placed before the members who become the underwriters of the promoted companies.

"To insure the success of this organization, the industrial development committee of the Chamber which has had the matter in charge, has insisted that there must be at its head a group of men of broad experience possessing the business acumen necessary to enable them to grasp to the fullest extent the opportunities that are offered and to realize the advantages accruing to industrial enterprise through changing local and world conditions.

"The Cleveland Chamber of Commerce is confident that the plan is a feasible one and that the company, when organized, will be admirably adapted for the work it is to do.

"In order to further carry out its plan of industrial preparedness, the Chamber Committee on Industrial Development is giving in the auditorium of the Chamber, at each Tuesday's noon-day gathering, an exhibition of the work of some industrial activity in the city.

"Cleveland is making rapid growth in the manufacture of automobile parts and accessories, and the Committee on Industrial Development is, at present, in communication with a number of firms relative to the erection of factories for the manufacture of automobile bodies and parts. A recent exhibition at the automobile show was a demonstration of a newly acquired industry for the manufacture of Standard Automobile Tires, and the success already attained by this company is regarded as an indication of the wonderful possibilities that Cleveland presents for industries of this character.

"Further than this, the Foreign Trade Department of the Cleveland Chamber of Commerce is aiding manufacturers in every possible way in extending their trade abroad.

"Specifically, the department is furnishing information in regard to foreign markets for different lines of goods, names of manufacturers, agents and dealers, trade extension methods to be used, etc.

"It maintains a coöperative branch office of the U. S. Bureau of Foreign and Domestic Commerce, and is therefore utilizing the Government's facilities for promoting American trade abroad.

"It is bringing to Cleveland business men from foreign countries who are purchasing goods, or who are making contracts to represent manufacturers. American consuls are brought to Cleveland whenever possible in order that manufac-



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In heat-resisting properties, Havoline led all competitors.

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Write for booklet "Havoline Oil Goes To College."

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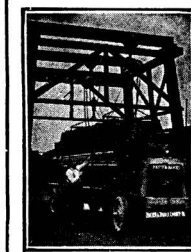


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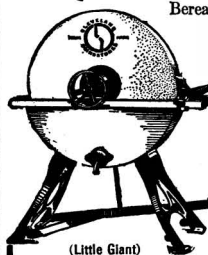
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Never given free, to men or cigarettes, and awarded only after a strenuous course in the school of experience.

Evidenced often in good taste—the acquired ability to choose what is right.

So it is a significant fact that the most highly developed men of the world take naturally to the decisive, unmistakable flavor of Rameses—because “The Aristocrat of Cigarettes” is out of the rut, unusual, vitally distinctive.

Remember—men are Rameses smokers generally after long experience with every other brand there is.

And nobody ever changes from Rameses.



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Do you have to bother with two pair of glasses—one for near, the other for far vision? Or are you compelled to peer over the top of your reading glasses, or remove them entirely, when looking at distant objects?

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KRYPTOKS keep you young-looking because they have no disfiguring line to reveal the fact that you wear double vision glasses.

The smooth, clear surface is entirely free from the seam and blur of old-fashioned bifocals. Yet the lower part gives you perfect vision for near objects and the upper part, perfect vision for far objects.

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turers may confer with them as to opportunities in the consuls' districts for the sale of certain lines of goods, and to get their advice as to the proper methods to use.

“The department is making investigations for manufacturers pertaining to foreign markets for their products, and no effort is spared to promote their foreign trade interest in every way.”

Increasing the Profits in Flax Mills

(Concluded from page 402)

after decomposition sets in. The water is usually turned on at dusk, as it takes all night for the tanks to fill.

In ordinary July and August weather four or five days is usually sufficient to effect the dissolution of the adhering gums, so that the fiber can be extracted. Extreme care and diligence are needed to determine the exact stage at which the operation is completed. That is why Fraleigh has cautiously stopped half way—at mixed retting. The 45-cent fiber, however, was obtained from straw that had practically completed retting in the tank.

At a point about halfway toward the completion of the retting operation the water is drained off and the flax removed. It is carefully transported to an adjoining meadow and spread evenly in rows, as for dew-retting. The time required on the grass varies according to the condition of the flax and the state of the weather.

Not only does the water process enhance the value of the fiber, but, as a substitute for dew-retting, it often means the actual saving of great quantities of flax. Let us see how dew-retting involves such losses:

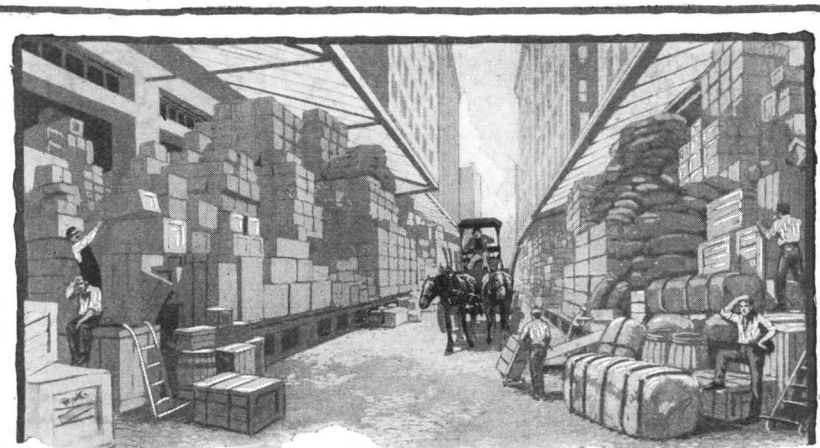
In the first place, because of the shortness of the season following threshing-time, great areas of straw are frequently spread before any is ready to lift. A prolonged wet spell occurring at such a point causes over-retting of a portion of this straw. In a word, the operator is at the mercy of the weather.

The tentative operations at water-retting at the Forest plant have been so encouraging that several more tanks are to be constructed this spring. At present there is no covering for the tanks. It is proposed to remedy this deficiency by the erection of a roofed structure with extended sides. This will enable men to work in all sorts of summer weather. All the work connected with handling the straw has so far been accomplished by hand. Consequently, there remains to be worked out, once the success of the process warrants it, some system of power-driven traveling cranes and carriers to effect the cheap transfer of the straw from wagon to tank, and vice versa. This is a minor point, quite outside the retting process proper, however.

Removing the Fiber

The third step in flax working is that of removing the fiber from the encumbering woody chive. In actual practice this operation has the most bearing on the final returns. For example, one Ontario mill bears a scutching bill at the rate of about two cents per pound of fiber. Another pays for inferior work at the rate of about five cents per pound. It is practically all in the quality of the labor. At the best mill in Canada the scutching force has been trained for efficiency over a period of years. Once initiated into this mill, whose atmosphere is cleaned by a suction fan and heated by steam pipes, a scutcher never migrates to another flax mill. There is an *esprit de corps* that is quite unprecedented in my records of American flax mills. From the proprietor down to the boy sheaf-handlers, the attitude is one of enthusiastic striving for more knowledge and greater efficiency. The very fault of the poorest mills is that know-all *laissez-faire* bearing which is incompatible with true progress.

Good scutching not only produces a clean, high quality of fiber, but a high percentage of such fiber. In the progressive flax mill the percentage of tow is usually about 10. In the misgoverned plant it may run as high as 30 per cent. How important these figures are may be judged by the comparative prices paid



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Nearly 30 per cent. were driven by women. The modern Automobile has been simplified and refined.

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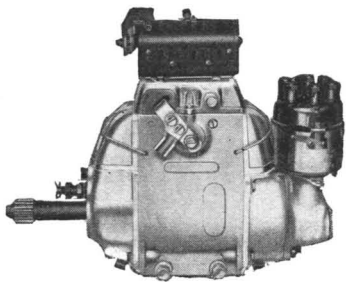
It was then that the first Delco Equipped Car appeared

It was then that Electricity first took the place of the cumbersome hand crank and that the three important functions of starting, lighting and ignition were first combined in one Compact Efficient System.

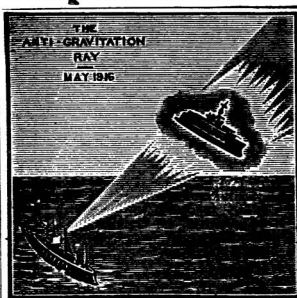
It is an important part that Delco has played in refining and broadening the scope of the motor car.

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for ordinary fiber and tow products of an Ontario mill:

Dressed fiber.....	20 cents per lb.
Fine tow.....	11 " "
Coarse tow.....	14 " "

The insignificance of the prices paid for tow demonstrates the importance of keeping the untangled fiber out of such bad company, and of distributing flaxes of various qualities in respective grades. This can be most effectively done, as already stated, when pains are taken from the time of harvesting. I have mentioned the assorting of flax in the field. These lots are kept separated throughout later operations. Furthermore, whatever differences in quality may be created during dew-retting are the basis of further sorting. For example, one field may have the advantage of favorable weather. Another may have been retted too little or too much. Different kinds of fiber will necessarily result from such fields. To mix the two kinds of straw would reduce the value of both to that of the less valuable.

Such preliminary examples of grading are consummated when the scutching and baling are done. Unequal scutching produces uneven flax, and dew-retting is unavoidably the cause of uneven fiber. This disadvantage can not be wholly overcome by the skill of the grader. To accomplish such a result every fiber would have to be examined, and that is obviously impracticable. Therein lies the essential weakness of the process of dew-retting.

The skillful grader at the Forest mill makes half a dozen lots, which are baled separately for shipment. The prices received vary according to quality. Grading increases the returns between 15 and 20 per cent.

NEW BOOKS, ETC.

WHITAKER'S PEERAGE, BARONETAGE, KNIGHTAGE, AND COMPANIONAGE. 1916. New York: J. Whitaker & Sons, Ltd., 1916. 8vo.; 905 pp. Price, \$2.

It is unlikely that any one needing to refer to some such work as Whitaker's "Peerage" would be ignorant of its existence and its scope; so that a long description is hardly called for. The contents comprise an obituary, which includes a roll of honor of those killed in action or dead from wounds; an indexed introduction describing the regalia and giving the details of accession, etc.; and concise information concerning the peerage and its degrees. This is followed by the Royal Family; by an alphabetical directory of the peerage in which precedence is ignored for the sake of easy reference; and by an index to seats and residences of persons cited in the work.

THE AMERICAN WHITAKER ALMANAC AND ENCYCLOPEDIA. 1916. New York: J. Whitaker & Sons, Ltd. 8vo.; 552 pp.; illustrated. Price, \$1.00.

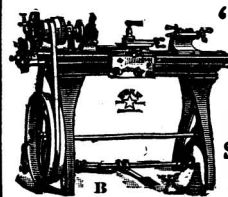
The Whitaker Almanac for 1916 presents an array of facts, some 9,000 in all, covering agriculture, finance, industry, sport, and all the more important activities of the world, with particular reference to America. Each State has its own section, carrying an outline map, and citing physical features, government, defense, education, finance, and production and industry. The main events of the year 1915 are chronicled, and a considerable division of the work is devoted to the great war, including the relations of the United States with the belligerent powers.

WAYS TO LASTING PEACE. By David Starr Jordan. Indianapolis: The Bobbs-Merrill Company, 1916. 8vo.; 255 pp. Price, \$1 net.

In all the leading nations a great deal of constructive thought—more, no doubt, than is generally realized—has been occupied since the outbreak of the war with devising means for settling international disputes without resort to arms. Dr. Jordan recognizes three kinds of peace: millennial contentment, the armed peace which he designates "balanced hatred," and the permanent peace of law. His book summarizes, analyzes and compares the various plans put forward by organizations and individuals with a view to permanent peace. The author has done humanity a service in collating the most promising of these proposals in a single volume, thus bringing their strong and weak points into sharp contrast. If he discloses any mistake in judgment, it is in his over-emphasis of the adequate organization for defense as a danger tending toward the precipitation of war. Defenselessness and militarism are the two extremes to be avoided; adequate preparedness is the happy medium. His arguments are, however, generally well-balanced, and cannot fail to bring the practical man and the idealist closer to a mutual understanding.

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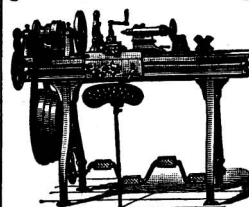
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Science vs. Guesswork

How "hit-or-miss" lubrication gave way
to the scientific use of oils



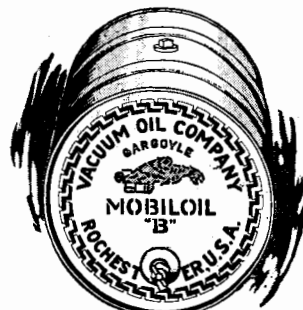
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It was found that petroleum oil would yield a lubricating oil which had many marked advantages, and would produce different types of lubricating oil.

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Unless the lubricating problems were properly met, mechanical development would fail in its aim. Only the properly lubricated engine or motor could yield the efficiency aimed at.

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In taking up automobile lubrication, the Vacuum Oil Company simply pursued its professional methods which were already well established in other fields of power-production and transmission.

The Chart of Automobile Recommendations on the right represents our professional advice.

In using the oil specified for your car, you will use oil whose correctness was determined by very thorough and careful engineering analysis of your motor. The oil specified combines *high quality with correct body*.

It makes for:

- (1) Increased power — noticeable particularly on the hills.
- (2) Reduced carbon deposit.
- (3) Reduced gasoline consumption.
- (4) Reduced oil consumption.
- (5) Freedom from unnecessary repairs.

If you use an oil which less correctly meets your motor conditions from a scientific standpoint, you are almost surely pouring trouble into your crank case.

If your car is not listed in the Chart at the right, a copy of our complete Lubricating Chart will be sent you on request.

Correct Automobile Lubrication

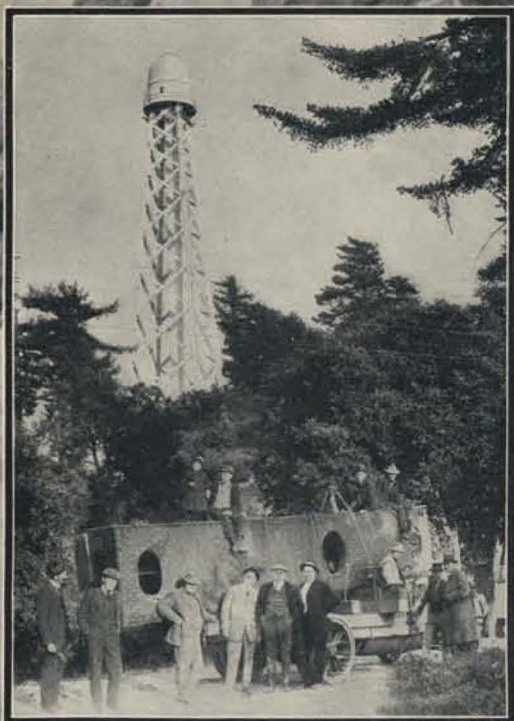
Explanation:—The four grades of Gargoyle Mobiloils, for gasoline motor lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

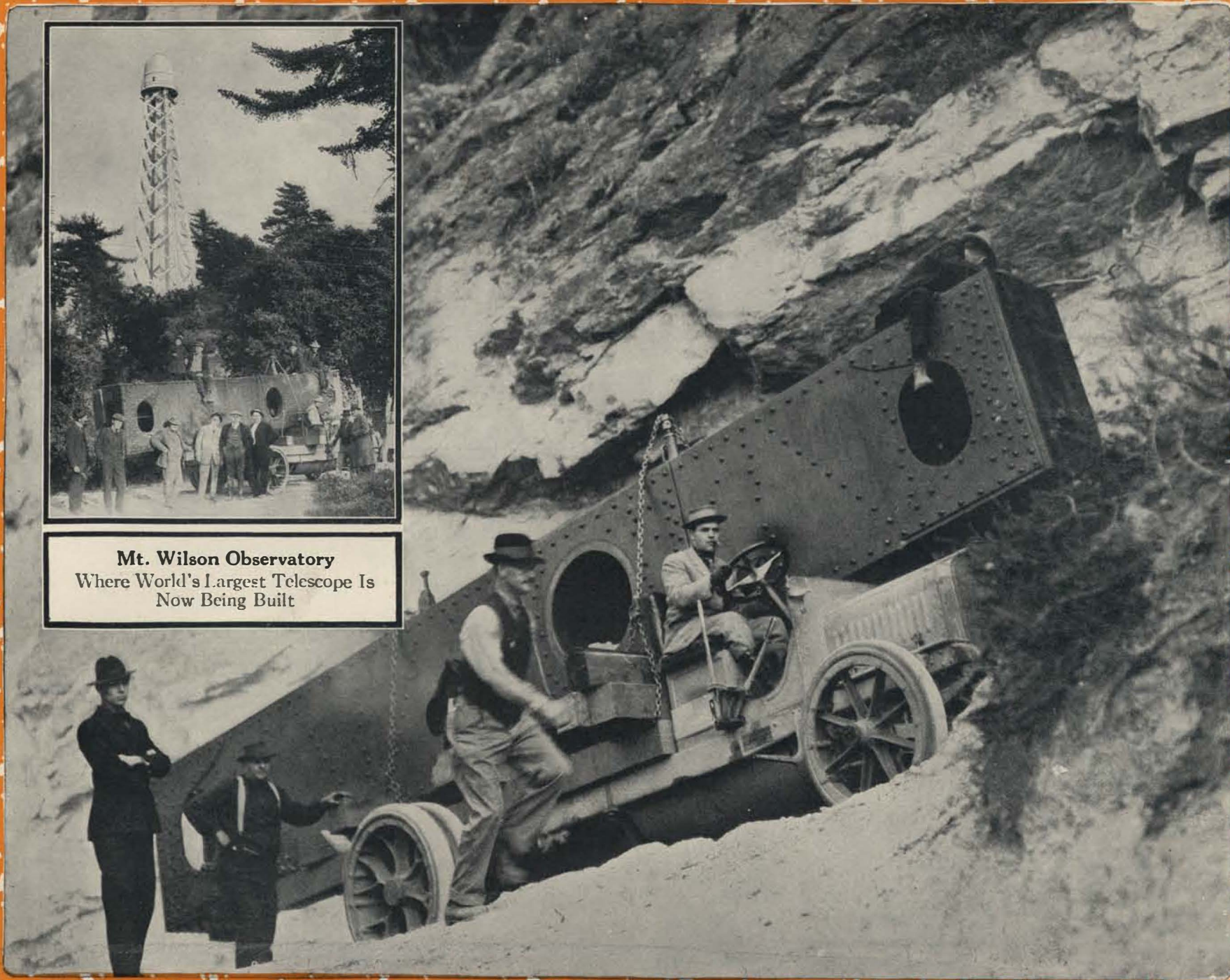
In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example, "A" means Gargoyle Mobiloil "A," "E" means Gargoyle Mobiloil "E," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF	1916	1915	1914	1913	1912
CARS	Summer	Winter	Summer	Winter	Summer
Abbott Detroit (8 cyl)	Arc	Arc	Arc	Arc	Arc
Apperson (8 cyl)	A	A	A	A	A
Auburn (4 cyl)	A	A	A	A	A
Auburn (6 cyl)	Arc	Arc	Arc	Arc	Arc
Autocar (8 cyl)	A	A	A	A	A
Avery (Mod 5 & C, 1 Ton)	Arc	Arc	Arc	Arc	Arc
Briscoe (8 cyl)	A	A	A	A	A
Buick (8 cyl)	Arc	Arc	Arc	Arc	Arc
Cadillac (8 cyl)	A	A	A	A	A
Cartercar Com'l	A	A	A	A	A
Case (Model 6-40)	Arc	Arc	Arc	Arc	Arc
Chalmers (Model 6-30)	A	A	A	A	A
Chandler Six	Arc	Arc	Arc	Arc	Arc
Chase (air)	B	B	B	B	B
Chevrolet (water, 4 cycle)	Arc	Arc	Arc	Arc	Arc
Cole (8 cyl)	A	A	A	A	A
Cummins (8 cyl)	A	A	A	A	A
Delaunay-Belleville	Arc	Arc	Arc	Arc	Arc
Detroit (8 cyl)	A	A	A	A	A
Dodge	A	A	A	A	A
Empire	Arc	Arc	Arc	Arc	Arc
Federal	Arc	Arc	Arc	Arc	Arc
Fiat	B	B	B	B	B
Ford	E	E	E	E	E
Franklin	A	A	A	A	A
Grant	Arc	Arc	Arc	Arc	Arc
Haynes (12 cyl)	A	A	A	A	A
Hudson	Arc	Arc	Arc	Arc	Arc
Hupmobile Super Six	A	A	A	A	A
Hupmobile (8 cyl)	Arc	Arc	Arc	Arc	Arc
I. H. C. (air)	B	B	B	B	B
Interstate (water, 4 cycle)	Arc	Arc	Arc	Arc	Arc
Jackman (8 cyl)	A	A	A	A	A
Jeffery (Chesterfield)	Arc	Arc	Arc	Arc	Arc
King (8 cyl)	A	A	A	A	A
Kline Kar. Com'l	Arc	Arc	Arc	Arc	Arc
Kline Kar. (Model 48)	A	A	A	A	A
Knox (Model 35)	B	B	B	B	B
Locomobile	E	E	E	E	E
Lozier	Arc	Arc	Arc	Arc	Arc
Marion	Arc	Arc	Arc	Arc	Arc
Marmont	A	A	A	A	A
Maxwell	Arc	Arc	Arc	Arc	Arc
Mercer (22-70)	Arc	Arc	Arc	Arc	Arc
Metz (22-72)	A	A	A	A	A
Mitchell (8 cyl)	A	A	A	A	A
Moline Knight	A	A	A	A	A
Moon (4 cyl)	Arc	Arc	Arc	Arc	Arc
National (6 cyl)	A	A	A	A	A
National (12 cyl)	A	A	A	A	A
Oakland (8 cyl)	A	A	A	A	A
Oldsmobile (8 cyl)	Arc	Arc	Arc	Arc	Arc
Overland	A	A	A	A	A
Packard (12 cyl)	A	A	A	A	A
Paige Com'l	A	A	A	A	A
Paige (6-46)	Arc	Arc	Arc	Arc	Arc
Pathfinder (6-36 & 38)	Arc	Arc	Arc	Arc	Arc
Peerless (12 cyl)	Arc	Arc	Arc	Arc	Arc
Pierce Arrow (8 cyl)	A	A	A	A	A
Premier Com'l	Arc	Arc	Arc	Arc	Arc
Pullman	Arc	Arc	Arc	Arc	Arc
Regal (8 cyl)	A	A	A	A	A
Renault	A	A	A	A	A
Reo	Arc	Arc	Arc	Arc	Arc
Richmond	Arc	Arc	Arc	Arc	Arc
S. G. V.	A	A	A	A	A
Saxon	E	E	E	E	E
Scripps Booth (air)	A	A	A	A	A
Seiden (8 cyl)	A	A	A	A	A
Simplex	A	A	A	A	A
Stearns Knight	B	B	B	B	B
Stevens Duryea	A	A	A	A	A
Studebaker	A	A	A	A	A
Stutz	A	A	A	A	A
Vette (4 cyl)	Arc	Arc	Arc	Arc	Arc
White (6 cyl)	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc
Willys Knight	B	B	B	B	B
Winton	Arc	Arc	Arc	Arc	Arc

Electric Vehicles:—For motor bearings and enclosed chains use Gargoyle Mobiloil "A" the year 'round. For open chains and differential, use Gargoyle Mobiloil "C" the year 'round. Exceptions—For *water lubrication* of pleasure cars use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.



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